IMPACT OF ALLUVIAL GOLD MINING ON SURFACE WATER QUALITY IN THE REVUÈ BASIN-MANICA DISTRICT, MOZAMBIQUE

by

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Submitted as the thesis component (which counts for 50% of the degree) in partial fulfilment of the requirements for the degree of Master of Science in the School of Geological and Computer Sciences, University of Natal, Durban South Africa

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I hereby declare that this study represents my own unaided work and has not otherwise been submitted in part or in whole for any degree or diploma to any other tertiary institution. Where use has been made of the work of others it is referenced or duly acknowledged in the text.

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ABSTRACT

The upper part of the Revuè basin in the Manica District, Mozambique is located in a mountainous area underlain by rocks of the Manica greenstone belt. This greenstone belt has alluvial gold deposits in the Revuè river and its tributaries Chua and Zambuzi. Alluvial gold in the Manica District has been mined by local people using artisanal mining methods (panning) and by small scale companies. The recovery process of gold involves washing of the auriferous gravel with large quantities of water and the surface water quality has been impaired in this process. The aim of this dissertation is to assess the impact of alluvial gold mining on surface water quality in the Revuè basin. Physical and chemical characteristics of the surface water were determined upstream of, within and downstream of the mining area and in the main tributaries immediately before flowing into the Revuè river. Upstream of the mining area the water is clear and the rock types of the Manica greenstone belt are likely to be the only source of metals dissolved in the water. Metal concentrations are generally low except Cd, Mo and Ni but the water in this area meets all World Health Organization (WHO) recommendations for drinking water. In contrast within the mining area there are signs of pollution. The water is cloudy and the highest concentrations of most metals are found in the lower part of this area where mining activity is very intense. Thus, the alluvial gold mining is responsible for elevated metal concentrations and constitutes the major point source of pollution in the Revuè basin. Water quality within the mining area has been affected and metals Ba, Pb and Mn have concentrations exceeding the WHO recommended values for drinking water. Downstream of the mining area the impounded water in the Chicamba Dam, which is the source of potable water for Chimoio City, reduces the water flow in the Revuè river and sedimentation of suspended sediments occurs, together with associated adsorption and precipitation processes. This result in general improvement of water quality with only Ba and Pb concentrations remaining above the WHO recommended values for drinking water. Increase in concentration of metals Al, Ba, K, Pb and Sr occurring in the Chicamba Dam is likely to be due to input to the dam of water from rivers which cross the Granite-gneiss Complex. Geochemical speciation modelling using MINTEQA2 program suggests that the behaviour of metals Cr, Al, Mn and Fe is controlled by redox and precipitation reactions while the behaviour of As, Cd, Zn, Cu, Ni, Pb, Ba and Ca is controlled by adsorption on the sediment surfaces. Changes in environmental conditions, such as pH and dissolved organic matter (DOM) could result in metals being released back into the water. Modelling the effect of a change in pH and variation in DOM indicate that adsorption and precipitation would decrease with decreasing pH values and with increasing DOM. The chemical form of dissolved metals, the type of interactive processes (adsorption and precipitation) and concentration of particulate matter gives the distribution of pollutants while the transport process affect the fate of pollutants in the Revuè river water.

PREFACE

The study described in this dissertation was carried out in the School of Geological and Computer Sciences, University of Natal, Durban from July 1997 to February 2000, under the supervision of Dr. Carol A. Marsh.

The dissertation is about the impact of alluvial gold mining on surface water quality in the Revuè basin, Manica District, Mozambique and is divided in seven chapters. The first, the introduction, defines the problem to be solved, describes the physical environment, the research aims and the methods of investigation used, including their limitations. Chapter two reviews the geology of the Manica alluvial gold deposits, their geologic setting and genesis, tectonism, size and mineralogy of the deposits. Chapter three describes the alluvial gold mining methods used in Manica, starting with brief historical notes and then the traditional gold mining methods used by the local people and ending with the mining methods used by small scale mining companies. Chapter four focuses on water quality in the Revuè basin and is organised to reflect the physical and chemical characteristics of surface waters in three areas: upstream of the mining area (natural background water quality), within the mining area and downstream of the mining area. Particular attention is given to the concentration of metals. Descriptions of each determinand behaviour and spatial distribution graphs down the Revuè river are presented. Chapter five examines the distribution and fate of pollutants by making use of the geochemical speciation computer model MINTEQA2. The chapter begins with a short review of aspects linked to the distribution and fate of pollutants, progresses through a review of the MINTEQA2 program and ends with Revuè water modelling procedure and results. In chapter six, the point sources and non-point sources of water pollution along the Revuè river are discussed as well as the water treatment strategies. Discussion and conclusions of the study are presented in the chapter seven.

> Durban, February 2000 Enoque Mendes Vicente

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CHAPTER ONE

1. INTRODUCTION

1.1 PROBLEM FRAMING

The upper part of the Revuè basin is located in a mountainous area underlain by rocks of the Manica greenstone belt. The Manica greenstone belt has alluvial gold deposits concentrated in the Revuè river and some of its tributaries, namely Chua and Zambuzi (Fig. 1.1).

Alluvial gold in the Manica District has been mined from pre-colonial times up to the present by small scale mining companies and by local people using traditional mining methods (panning). During this period, mining activity has played an important role in the economy of the region and to the survival of the indigenous people. These mining activities are not environmentally friendly and they have caused large alterations of the surface water quality in the Revuè basin as well as other physico-environmental degradation and disturbance namely pits, trenches, holes, tailings and river diversions. Because of the mining activities it is generally assumed that the water quality has been impaired.

Within and downstream of the mining area, the water is cloudy and is brown to reddish-brown in colour due to suspended clay and silt particles that enter the water during the mining process. The suspended sediment load of the Revuè river is deposited in the Chicamba Dam which is situated on the Revuè river approximately 62 km downstream from the mining area. The increased rate of sedimentation due to suspended sediments being carried from the mining area could affect the life expectance of the reservoir. Data from EDM (Electricidade de Moçambique), the company which manages the Chicamba Dam, indicate that the rate of sedimentation in the reservoir is approximately 5 mm/year. Such sediments can have both a direct effect on aquatic life through damage to organisms and their habitat (Walling & Webb, 1992) and an indirect effect through its influence on turbidity and light penetration. Furthermore,

suspended sediments have been demonstrated to be the main transport pathway of various trace metals (Lacerda & Salomons, 1991) due to their high sorptive capacity for many chemicals.

The turbidity of Revuè river water causes serious problems for the local people, as they can not use the river water directly. To obtain clear water the local people dig small holes in the riverbanks (1-2 m from the rivers). This water probably has the same chemical composition as the river water but is free of suspended sediments.

Since 1996 the Chicamba Dam has been the source of potable water for Chimoio City, located 35 km NE from the dam (Fig. 1.1). It was constructed for the potential generation of hydroelectric power. Impaired water quality could have implications for the health of people and for the corrosion of turbines.



Fig. 1.1 - Area map of the upper part of the Revuè hydrographic basin. Manica greenstone belt covers the part between Munene river and North border with Zimbabwe and the western part of Chimezi river.

1.2 THE PHYSICAL ENVIRONMENT

Manica District is situated in the west central part of Mozambique between the co-ordinates 19° 08' and 19° 20' latitude South and 33° 17' and 32° 41' longitude East, and is part of the Revuè hydrographic basin (Fig. 1.1), that covers an area of 8350 km². The Revuè river rises in the

Penhalonga mountains in Manica District, close to the border with the Republic of Zimbabwe, at an approximate altitude of 1750 m, and flows for 234 km before discharging into the Búzi river (Manzanares, 1957). It runs in a NW-SE direction and develops 60% of its total length between the altitude of 800 and 500 m. It has therefore characteristics of a tableland river (Manzanares, 1957). The main tributaries of the Revuè river in the study area are the Chua, Zambuzi, Inhamazonga, Messica, Nhamanguena and Zónue rivers. Alluvial gold mining occurs along the Chua and Zambuzi rivers.

Three zones are distinguished within the Revuè basin based on river gradient. Zone 1 is a mountain reach zone with altitudes between 1750 and 800 m and a gradient of 34.7. It is 6 km in length and contains the headwaters that flow to the Revuè river. This zone is characterised by steep, narrow and shallow channels. Presently the width of the channel varies between 3 to 4 m. The water is clear and turbulent. Zone 2, with an altitude between 800 and 150 m and gradient of 1.7, is a vast tableland where the river descends only 130 m in 100 km. As a result the river channel is flat, deep and wide. As the river approaches the Chicamba Dam the water velocity is reduced and the impounded water start to influence the channel which becomes larger and deeper. The mean width of the river channel increases from 10 m to more than 100 m close to Chicamba Dam. The change in gradient from zone 1 to 2 is not due to changes in lithology, because it occurs within the greenstone belt, but rather is due to the geomorphological change from mountainous to tableland terrain. The marked change in the lithology from the greenstone belt to granite gneiss complex which occurs within the zone 2 is not reflected in a gradient change. Zone 3 has an altitude of between 150 and 50 m and a gradient of less than 1.7% (Manzanares, 1957). The change in the gradient from zone 2 to 3 is a result of the change of lithology from igneous to flat lying sedimentary rocks. The river in this zone is more than 100m wide. The mean depth of the Revuè river is 50 cm in zone 1 but this increases downstream due to both the impounded water in the Chicamba Dam and the channel geomorphology.

The study area extends from the source of the Revuè river within the Manica greenstone belt (zone 1) to the Chicamba Dam (in zone 2), 84 km downstream and includes the downstream part of the main affluents. The discharge of the Revuè river is nowadays very small due to climatic changes which in the late 80's and in the early 90's have caused severe droughts in Southern Africa. The Revuè river is not a big river but is the most important in the region.

In the late 60's two dams, Chicamba and Mavúzi, were built for the potential generation of hydroelectric power for all cities along the Beira Corridor including Mutare City in the Republic

of Zimbabwe. Since 1996, the Chicamba Dam has been supplying potable water to Chimoio City located 35 km NE from the dam (Fig. 1.1).

The climate of Manica is temperate humid with dry winter, following the Köppen classification (Faria & Gonçalves, 1968) which takes into account two fundamentals climatic elements; the air temperature and the quantity of precipitation. The mean annual temperature of Manica is 21.1°C, the relative humidity ranges from 65 to 70 % and the mean annual precipitation is 1109.6 mm (FAO, 1980). During the severe droughts in the region in 1980 and 1991-92, the lowest mean annual precipitation of 110.9 mm (1980) and 367.2 mm (1991) were recorded. After the last drought period the normal precipitation has never return to previous levels and some rivers are still dry. There is a marked seasonal variation in rainfall. The rainy season has a duration of 5 months, from October to March, with January as the rainy month (230 mm). The driest month is July with 9 mm. The mean annual evaporation is 1290 mm, with 150 and 140 mm in October and November respectively, reducing to 58 mm during June.

Land in the upper part of the Revuè river basin is used for subsistence agriculture, pasture and mining activities. Many conflicts were reported in the area between mining companies and the local people, as the fertile land used for agriculture lies within the alluvial gold mining area. Compensation for loss of land use, paid to the local community has in most of the cases not been satisfactory (Local community, 1998, Interviews).

The occupations of the population of Manica are mainly rural farming in the rainy season and alluvial gold mining activity during the dry season. However, a large portion of the population at present engages only in the artisanal mining activity.

The soils of the Revuè basin are fertile and there is no reference to the use of any kind of fertilisers to increase the yield. The forests are characterised by dense indigenous vegetation and plantations of some exotic species, such as eucalyptus and pine-tree used for the production of wood.

1.3 RESEARCH AIMS

This research aims to assess the effect of alluvial gold mining in the Manica greenstone belt on surface water quality in the Revuè basin. The specific objectives of this study are:

- to determine the physical and chemical characteristics of surface water, upstream of, within and downstream of the alluvial gold mining area.

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- to characterise unpolluted upstream water quality background levels with reference to lithological type.

- to identify possible point sources of water pollution within the mining area.

- to identify any possible non-point sources of water pollution along the Revuè river.

- to examine the distribution and fate of pollutants using geochemical speciation computer models such as MINTEQA2.

- to suggest possible water treatment strategies to ameliorate any dissolved pollutant species in Chicamba Dam.

1.4 METHODS OF INVESTIGATION

To address the research aims listed above, several methods were used.

1.4.1 Sample Collection

Water samples were collected at several points within the study area for laboratory analysis. The distribution of sampling points is shown in Fig. 1.2. Generally sample points upstream of and within the mining area were approximately 2 km apart, while sample points downstream of the mining area were located approximately 5 km apart. Samples were also collected in Chicamba Dam and within the affluents before their confluence with the Revuè river.

In total 19 water samples were collected and care was taken to obtain a representative and homogeneous sample. The homogeneity of a stream at a cross section is determined by such physical factors as proximity of inflows and turbulence in the channel (Hem, 1985). The samples were taken as near as possible to the centre of the stream. Each sample was then filtered twice, first using filter paper (Whatmans n° 1) to remove coarse suspended particulate matter and then by Millipore membrane filter 0.45μ m to remove colloidal and possible biological fractions, which would influence analytical results. Colloidal material would sorb significant quantities of metals due to their large specific surface areas (Filella *et al.*, 1995). After filtering, the samples were placed in 100 ml polyethylene bottles and 0.5 ml (equivalent to 5 ml/l) of 1:1 HNO₃ were added to the sample to lower the pH to less than 2, thus keeping the metal ions in solution (Parr *et al.*, 1988). The low pH also reduces or inhibits the precipitation of trace elements as hydroxides or hydrated oxides and avoids any adsorption by the surface of polyethylene.



Fig. 1.2 – Geologic sketch of the Manica greenstone belt and sorroundings and water site analysis. Manica greenstone belt covers the North part of Munene river and the western part of Chimezi river.

1.4.2 Field Analysis

There are certain parameters of water quality that must be measured in the field, particularly those that define the carbonate system and oxygen regime. Thus, electrical conductivity, TDS (Total Dissolved Solids) and turbidity were measured at each sampling point (Fig. 1.2) using the HACH conductivity meter model CO150 and the portable turbidimeter model 2100P. The pH and temperature were measured by HACH EC10 portable pH/mV/Temperature meter model 50050 while alkalinity was obtained using a portable HACH Datalogging Spectrophotometer model DR/2010. This instrument is pre-programmed to perform tests for more than 120 parameters. For each parameter a portion of the water sample is inserted in the instrument together with the prescribed chemicals and the result is displayed on the screen. The field parameters were measured before sample preservation with HNO₃.

Field data and samples were collected during the dry season to avoid the rainfall that causes major seasonal changes in water quality. The rain can have a diluting effect or a concentrating effect, if erosion occurs. The salt load of water is dependent on discharge and concentration. Thus, in the dry season when discharge is low, high concentrations of elements or dissolved compounds are found. These data correspond to the worst case scenario situation that can be expected in the Revuè river water.

1.4.3 Laboratory Analysis

The collected water samples were analysed in the Department of Applied Chemistry, University of Natal, Durban to determine the concentration of major, minor and trace metals. The following elements were determined in the laboratory:

- major metals: Ca, Mg and Na.
- minor metals: Al, Fe, K and Sr.
- trace metals: As, Ba, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, and Zn.

The metals Na and K were determined by FES (Flame Emission Spectrometry) method which uses the chemical flame for bringing about atomic excitation and the analytical parameters measured are the emitted visible ultra-violet radiation.

The total concentrations of all other elements were analysed by ICP-AES (Inductively Coupled Plasma) method. The instrument used is the Jobin-Yvon JY 24 sequential ICP spectrometer for

multielement analysis, developed and manufactured by the JOBIN-YVON Division of INSTRUMENTS S.A.

1.4.4 Limitations

The selection of sampling and analytical methods used in this investigation took into account the sampling conditions, the sample preservation techniques and transport available to the author as well as the available laboratory techniques. However, the investigation methods used had their limitations both in analytical methods and in the field investigation.

The major limitation of the analytical methods was the impossibility of analysing for mercury that is presumed to be present at high concentrations in the Revuè water as it is used to recover alluvial gold. Mercury was excluded from the group of trace metals to be analysed because of water samples for the determination of mercury in the laboratory need to be cooled at temperatures of 4° C. This was not possible because of field conditions, the available preservation techniques and the distance between the sampling area and the laboratory.

The investigation method is limited by the fact that this study has been done with water analysis of only one season (the dry season). Thus comment on the behaviour of the river water quality during the rainy season can not be made. It is known that the rain causes major seasonal changes in the water quality. The data presented, thus, represents a snapshot of the water quality in the Revuè river during July 1998.

A further limitation is that no attempt was made to assess the total load of metals transported by the river. Calculations of total metals would require analysis of suspended sediment together with calculations of total dissolved salt load. Salt load requires knowledge of river discharge as well as concentration values. No river discharge values were available.

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CHAPTER TWO

2. GEOLOGY OF MANICA ALLUVIAL GOLD DEPOSITS

2.1 GEOLOGIC SETTING OF MANICA

The Manica greenstone belt is situated on the eastern margin of the Zimbabwe craton and covers the part between the Munene river and the North border with Zimbabwe and the Western part of the Chimezi river (Fig. 1.1, p. 2). It has a length of 35 km and width of 10-15 km. The Manica greenstone belt represents one synclinorium within a volcano-sedimentary formation and is one of many greenstones occurring in the Zimbabwe craton.

Lithostratigraphically the Manica greenstone belt is subdivided into three major units (Fig. 1.2, p. 6):

Lower Macequece Formation

The lower Macequece Formation is correlated with Bulawaian Formation of the Zimbabwe craton and is a unit of massive and generally grey-greenish greenstones. It consists of metamorphic rocks, intrusive, extrusive and sedimentary in origin, which crop out in the South and North of the Manica greenstone belt. Ultramafic volcano-sedimentary metamorphites that include massive serpentinite, talc schists, actinolite schists, komatiites and basalts have been transformed to amphibolites, chloritic schists, tremolitic schists and talc schists as a result of regional metamorphism of the ultramafic source rocks. These rocks are associated with peridotites, picritic basalts, epidiorites and chlorite schists (Oberholzer, 1964). Serpentinite with pillow lava structures, and rocks with spinifex texture formed as a result of fast crystallisation of ultramafic magma also occur.

Intercalated in the greenstone rocks are metasedimentary material which is irregularly distributed in lenticular lens and discontinous layers as striped quartzite and represents metamorphosed sandy deposits.

Upper M'beza/Vengo Formation

The upper M'beza/Vengo Formation is correlated with the Shamvaian Formation of the Zimbabwe craton. It is comprised of metasediments, which are divided into three units:

a) A lower Quartzitic unit composed of grey quartzites, sericitic quartzites, quartzites with epidote and zoizite and marble with magnetite and ferruginous quartzite (Manuel, 1992).

b) The middle M'beza unit is a metamorphosed sedimentary unit, which consists of a basal conglomerate followed by argillite, fine metagreywacke and arkoses. The greywackes are found as continuous irregular beds (Manuel, 1992). The basal conglomerates, located in Zambuzi valley are monomictic or polymictic (in the central part of the greenstone belt). They are composed of clasts of serpentinite, komatiite and ferruginous quartzite.

c) The upper Vengo unit is made up of conglomerates, meta sedimentary rocks, black schists argillaceous schists, sericiteous schists, chloritic schists, quartzitic schists, carbonaceous schists and ferruginous schists, argillaceous phyllite, argillite, conglomerate and breccia.

Intrusive Rocks

Later Precambrian intrusive rocks are composed of gneissic granites, granites and micro granite intrusions, quartz veins, gabbro and diabases. Dolerites dikes, oriented NW-SE, are widespread in the Manica greenstone belt.

The Manica greenstone belt is one large E-W synclinorium (Manuel, 1992). The area has been affected by seven deformation phases distributed in three main deformation categories: ductile, transitional and fragile or brittle (Matos, 1996). The earliest phase of deformation, ductile deformation category, is characterised by folding and formation of different types of foliation. This was followed by the transitional category, which is characterised by the appearance of kink folds. The last phase of deformation, the brittle category is marked by the appearance of different kinds of fractures such as strike slip faults, thrust faults and joints.

Folding accompanied by green-schist facies metamorphism together with the emplacement of granite stocks is believed to have played an important role in the subsequent remobilization of gold (Hutchison, 1983). The plutons acted as heat centres that drove large-scale circulation of brine through the volcano-sedimentary pile, depositing gold in fissures created during the folding of the greenstone belt.

2.2 GEOLOGY OF THE MANICA ALLUVIUM

Alluvial gold deposits in the Manica greenstone belt occur in the Revuè river and some of its tributaries. These rivers are part of the Revuè hydrographic basin, the headwaters of which arise in the Manica greenstone belt (Fig. 1.1, p. 2). As detailed in section 1.2, three zones are distinguished within the Revuè hydrographic basin based on river gradient. The alluvial gold deposits are found in the downstream part of Zone 1 and in the upper part of Zone 2. Gold accumulated in these zones as a result of changes in the river gradient.

Revuè basin alluvium can be divided into lower, middle, and upper terraces. The lower terrace is composed mainly of gravel that accumulated below the present average river height. The middle terrace is also composed of gravel and is found above the present average river height. The upper terrace is represented by soils.

The lower terrace of the Manica alluvium is the only gold bearing unit and is composed of four layers (Fig. 2.1). Vicente (1996) describes these layers as:

1 - an upper soil layer normally covered with vegetation. It is dark brown in colour and 15 to 85 cm thick.

2 - an interbeded clayey sand or sandy clay that is light brown in colour and 1.15 to 9.00 m thick.

3 - an auriferous gravel which is light brown yellowish in colour and 1 to 5 m thick.

4 - a basal layer of highly weathered bedrock derived from the Manica greenstone belt.

Thickness of the layers is variable as a function of the channel morphology and reflects the concentration and calibre of sediment moving down the channel.

The lower terrace shows an upward decrease in grain size and increasing clay content. Gold is only concentrated in gravels overlying bedrock. The distribution and thickness of Manica gold deposits are very irregular. These irregularities are associated with the geomorphologic conditions of the surface during the alluvial gold accumulation in Manica.

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Fig. 2.1 - Simple geologic profile of a lower terrace of the Manica alluvial deposits (Modified from Vicente, 1996).

2.2.1 Genesis

The source of gold in the Manica alluvium is the granite-greenstone rocks. The granite intrusions favoured the formation of syngenetic gold deposits (formed at the same time as the enclosing rock). It includes volcanogenic stratabound massive sulphides, volcanogenic-stratiform subaqueous exhalative, plutonic stocks and sills (Fig. 2.2) (Hutchison, 1983). Epigenetic deposits containing high grade gold formed after its host rocks. These epigenetic deposits are due to gold mobilisation during the metamorphism of the rocks of Manica greenstone belt (Manuel, 1992). The gold mobilisation occurred along fractures (Afonso & Marques, 1993) formed by folding of the greenstone belt.

Rivers eroded the granite-greenstone source rocks and the gravel was deposited along the Revuè hydrographic basin within the Manica greenstone belt. In the Revuè river gold can be found from 4.5 km to 22 km from its source (Fig. 1.2, p. 6). Mineralization coincides with a marked decrease in river gradient allowing alluvial gold accumulation.

In the Chua river (tributary of the Revuè river) the main gold deposit was recovered from a feature interpreted as a pothole. A pothole is a circular deep hole in the bed of a river formed by abrasion and grinding effect on the bed rock of pebbles whirled round by eddies (Monkhouse, 1970).



Fig. 2.2 - Schematics diagram of an Archaean Vulcan-sedimentary greenstone belt basin showing the possible relation of mineralization to the volcanic-exhalative activity (From Hutchison, 1983).

The potholes are dominated by centrifugal action of the water ejecting particles and produced in conditions of turbulent flow. This theory is used by Bache (1989) to suggest that gold can not accumulate in a pothole. However, the ridge of mountains (Vengo with 1767 m height) exists next to the pothole may have hindered the normal flow of water carrying gold. The reduction of turbulent flow favoured the accumulation of gold.

2.2.2 Tectonic Setting

The geomorphologic evolution of the Manica greenstone belt contributes towards understanding modern alluvial gold deposits.

The deformation phases refered to in section 2.1. (Folding and faulting), played an important role in the tectonic setting of Manica. As a result of tectonic movements mountainous regions formed. These mountains have altitudes varying from 1500 to 1920 m, and contain the Revuè river and its tributaries.

The Revuè river rises at an approximate altitude of 1750 m. The first 6 km of the river has strong declives (within the mountainous relief). Both the formations of mountains and very strong declives from there could have facilitated the erosion of beds containing gold.

2.2.3 Size and Mineralogy

The Manica greenstone belt is very small in areal extent reducing the possibility of forming a large alluvial gold deposit. The present alluvial gold production is very low and the remaining gold grades are also low.

Gold in Manica is found as particles of 0.1-2.5 mm in size and seldom as nuggets. Its size distribution follows sediment size distribution, with coarser particles being formed in the upstream sections. Gold in Manica alluvial gold deposits is accompanied by heavy minerals such as magnetite, titano-magnetite, ilmenite, calcopyrite and copper.

CHAPTER THREE

3. ALLUVIAL GOLD MINING METHODS

3.1 HISTORICAL NOTES

Alluvial gold mining in Manica is undertaken by mining companies using small scale methods, and by indigenous people using several traditional mining methods (panning). The mining of alluvial gold deposits in Manica started centuries ago, probably in the time of the State of Zimbabwe (1250-1450) and of the Empire of Monomotapa (1325-1600). Rounded pits (50-75 cm in diameter and 3-7 m deep) were excavated in the lower terrace of Revuè river (Galiläer *et al.*, 1980).

In the XVI century the Portuguese temporarily occupied the Manica mining area and is estimated that up till that time 500 kg of gold had been produced. In the XVII and XVIII centuries the Portuguese transported large and non-specified quantities of gold to Lisbon. With the development of the mining industry in the world in later XIX century, the demand of gold increased and in 1889 the "Comissariado de Minas" was created in Manica (Manuel, 1986). At this time 23 mining companies were registered and another 140 companies asked for concessions (Galiläer *et al.*, 1980), and started the scientific exploration by the English and Portuguese. There are records of 30 companies that mined quartz veins and 7 that mined deposits in ferruginous quartzites and quartzitic veins (Sheeran, 1987).

In this century, dredge mining in the lower terrace of the Revuè and Chua rivers was started by several companies. Between 1914 and 1949 about 6456 kg of gold were produced by dredge method but production declined in the following 3 decades with only a few kilograms of gold extracted per year. In 1990 a new phase of gold mining in Manica was started by ALMA (Aluviões de Manica) and small scale mining companies. In 1994 it was estimated that about 11000 kg of gold has been produced in Manica from all known sources (MIREM, 1990-1994).

3.2 TRADITIONAL GOLD MINING

Gold panning is a very old tradition in Manica District. It has been used from pre-colonial times up to the present. In the late 80's and early 90's, due to drought and civil war in Mozambique, panning was used extensively and represented a survival activity to a large part of the local people who had no other source of income.

This traditional gold mining activity is not controlled by the state. In a small plot of land, hundreds of people can be found working the deposit.

Traditional gold mining in Manica is undertaken by local people using low technology mining methods. The mining methods used differ depending upon both the morphological and geological conditions of the mining site and the kind of auriferous material. If the gold-rich layer is located at depth, pits are opened, even on river beds, or else material is taken from the tailings.

Pits ranging from 3 to 10 m in depth are opened to expose the auriferous gravel layer at the base of the lower terrace. Most of these pits are opened in the form of benches and large quantities of overburden are removed to expose only a small area of auriferous gravel. The auriferous gravel is brought to the surface with buckets fastened to ropes and is then washed directly in the river water to produce gold-rich gravitic concentrate. In some situations, the auriferous layer is followed horizontally producing small galleries of 2-10 m length and approximately 1 m diameter. Due to the low technology of the mining method many cases of pit collapse causing injuries and deaths have been reported. The pits are normally abandoned without any rehabilitation resulting in changes to the topography of the area and reducing the beauty and the security of the landscape.

In other cases the river is diverted so that the river bed can be excavated to remove auriferous material. Rerouting also occurs where the pits to the auriferous layer are located far from the river bank and the river is diverted so that water can be directed to gold washing points. This river rerouting changes only small portions of the basin causing local variations in erosion, transport and sedimentation processes.

Dredge mining used by mining companies between 1914 and 1949 resulted in low recovery of gold. Significant quantities of gold remain dispersed in tailings. The local miners remine this tailing material and wash it again to recover the remaining particles of gold. In the tailings the gold is distributed randomly within the detritical sediments of fine and medium size.

Regardless of the method used, the final stage is washing of the gold with the river water (Fig. 3.1). The gold rich material is submitted to the panning process to produce a gold-rich gravitic concentrate. A rounded pan, 50 cm in diameter and 10 cm in height is commonly used, or if not available metal or plastic basins are substituted. A small quantity of gold-rich material is placed in the pan, and alternatively immersed and removed form the river water. This is accompanied by rotation of the pan. In this way light material is washed out which increases the turbidity in the Revuè river water and, due to its high density, the gold and other heavy minerals which also occur in the alluvial gold deposits are retained within the pan and form a gold-rich gravitic concentrate.

The large gold grains in the concentrate are selected by hand. The remaining fine fraction of gold is put in rounded pans and a few grams of liquid mercury and a small quantity of water are added. The pan is stirred to facilitate the adherence of gold to the mercury. The mercury-gold amalgam is squeezed in a piece of tissue to remove excess mercury which is recycled to the next batch. The amalgamation process takes place in open air, thus releasing part of the mercury content of the amalgam directly to the atmosphere.

The tools commonly used in the traditional mining are hoes, shovels, sacks, buckets, pans, wheelbarrow, motor water pump and ropes. These tools are used to remove the overburden layer, draining the water, extraction of the auriferous material and the panning process.



Fig. 3.1 – Local people processing gold in the river water.

3.3 SMALL SCALE GOLD MINING

The alluvial gold mining methods used by small scale mining companies consists of several steps. The first step consists of removal of the topsoil and storing it in a safe place. In the Manica alluvium the topsoil is about 15 to 85 cm thick. The intention is to reuse the top soil to rehabilitate the landscape so that the adverse effects of mining on the environment are eliminated or reduced. However, in most cases this does not happen.

Following the removal of the top soil, the interbeded clayey sand and sandy clay which comprises the overburden to the auriferous gravel is removed. This material is light brown in colour and 1.15 to 9.0 m thick. Small pebbles are distributed randomly. This material is deposited as tailings.

Once the auriferous gravel layer is reached it is sent to the processing plant. There it is fed through a grizzly. The oversize material is discarded and the fine material is fed to a scrubber. In the scrubber the gravel is washed and sorted by running water. This results in density separation and the light fraction is dumped in the river margins.

The water used in the auriferous gravel washing process is deposited in a small settling pond intended to allow sediment precipitation, but because of the high volume throughput, sedimentation is limited and the water which is returned to the river has a high sediment load.

The denser material from the scrubber passes to the gig plant. Here the material is separated into three categories accordingly to grain size. Particles with diameter of more than 0.5 cm are retained by the primary gig. Particles with diameter between 0.2 and 0.5 cm are retained by the secondary gig. Particles with diameter less than 0.2 cm are retained by the tertiary gig.

Any nuggets of gold retained in the primary gig are selected by hand and the remaining material is dumped. In the secondary gig, small grains of gold are collected and the remaining material is mixed with that retained in the tertiary gig.

The mixture of material from the secondary and tertiary gigs is taken to the "Gemine table" (vibration table) where the heavy minerals including gold are collected. This concentrate is moved to the amalgamation cylinder. After a gravimetric preconcentration step of the heavy fraction of the auriferous gold-containing material, liquid mercury is added to the cylinder. The amalgamation cylinder is rotated and the gold particles form an amalgam with the mercury. The remaining material is discarded. The mercury-gold amalgam is then squeezed to remove excess

mercury and then taken to a retort for roasting. The amalgamation process is done in the laboratory, thus the risk of releasing mercury to the atmosphere is reduced.

The gold particles recovered are liquefied at 1000° C temperature to produce gold bars with approximately 98% gold and 2% of impurities.

CHAPTER FOUR

4. WATER QUALITY IN THE REVUÈ BASIN

To assess the water quality of the Revuè basin several physical and chemical parameters were determined in the field as well as in the laboratory. For the chemical parameters total soluble concentrations were determined. However, total concentration provides no information concerning the particular behaviour of an element in terms of its interaction with sediments, its ability to cross biological membranes (bioavailibility), or its resultant toxicity (Christie, 1995). Förstner (1990) started that the particular behaviour of trace metals is determined by their specific form rather than by their total concentration. Therefore, any changes in speciation may dramatically affect the toxicity of a metal. The chemical speciation of the elements in the Revuè river water is the main subject of Chapter 5. Table 4.1 shows the water quality data measured in the Revuè river. The distribution of each determinand along the Revuè river is described below and graphs are drawn for each determinand to show its spatial change down the river. These changes are related to proximity to inputs of affluents, sites and intensity of mining activity and lithology. As there are no geochemical data available on the rocks of the Manica greenstone belt, references to lithology are based on the typical concentrations of heavy metals in the earth's crust and in major types of igneous and sedimentary rocks (Table 4.2).

In order to determine the impact of the alluvial gold mining on surface water quality, the study area was divided in three parts; upstream of, within and downstream of the mining area. The water quality data from these areas were compared to see the evolution of water quality down the Revuè river. The analytical data of water collected in site 1 in the Revuè river were used as a background reference value because this site is in a pristine area far from the influence of mining activity.

The Chicamba Dam situated downstream of the mining area is the source of potable water for Chimoio city. In order to quantify the impact of mining on the quality of water entering the dam, water quality data were compared to the 1996 WHO (World Health Organisation) recommended values for drinking water.

Determinands Upstream of the			Mining area					Downstream of the mining area									
	mining	g area													Min	Max	1996 WHO
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Value	Value	standards
Temp (° C)	18.9	20.8	21.7	17.9	17.6	21.6	21.5	19	17.3	19.2	17.8	18	19	19.2	17.3	21.7	25
TDS (mg/l)	74.34	79.65	90.27	95.58	106.2	106.2	116.82	191.16	138.06	143.37	148.68	111.51	116.82	106.2	74.34	191.16	
Condutivity (µS/cm)	155.3	164.0	179.9	199.3	219.2	220.2	236.59	308.65	285.6	291.8	298.9	222.3	235.6	218.2	155.3	308.65	
Turbidity (NTU)	7.28	14.4	16.9	10.9	8.41	23.6	14.7	59.1	142	92.2	84	10.4	1.56	1.42	1.42	142	< 5
Alkalinity (mg/l) *	32.4	32.8	47.6	24.8	50.8	41.2	43.6	52	61.6	58.4	56.2	42	39.8	32.2	24.8	61.6	NS
рН	7.3	7.3	7.7	7.6	7.8	7.5	7.1	7.6	7.5	7.3	7.5	7.4	7.5	7.6	7.1	7.8	6.5 - 8.5
Ca (mg/l)	3.8	4.1	4.3	4.9	5.3	5.5	5.8	6.9	7.2	7	7.1	5.6	5.2	5.2	3.8	7.2	< 200
Mg (mg/l)	3.1	3.2	4.5	4.9	5.6	5.7	6.4	7.5	7.6	7.6	7.7	3.9	3.5	3.5	3.1	7.7	< 150
Na (mg/l)	4.1	4	3.3	3.4	3.45	3.3	3.3	4.75	5.2	3.8	5.85	5	5.3	4.8	3.3	5.85	< 120
K (mg/l)	0.3957	0.3867	0.5036	0.4856	0.4676	0.7014	0.4766	0.6745	0.7644	1.0612	1.0432	2.5899	2.5629	2.5989	0.3867	2.5989	< 10
Al (mg/l)	0.04	0.03	0.1	0.07	0.08	0.06	0.11	0.06	0.06	0.08	0.02	0.09	0.14	0.13	0.02	0.14	< 0.2
Fe (mg/l)	0.02	0.02	0.05	0.09	0.26	0.27	0.18	0.07	0.05	0.06	0.06	0.05	0	0.03	0	0.27	< 0.3
Mn (mg/l)	0.024	0.026	0.044	0.094	0.13	0.132	0.14	0.18	0.2	0.18	0.11	0.0042	0	0	0	0.2	< 0.02
Sr (mg/l)	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.04	0.04	0.04	0.05	0.05	0.05	0.02	0.05	NS
As (mg/l)	0.011	0	0.012	0.007	0.0095	0.0058	0.025	0.0084	0.004	0.015	0.03	0.0047	0.042	0	0	0.042	< 0.05
Ba (mg/l)	0.09	0.08	0.08	0.1	0.1	0.1	0.1	0.14	0.17	0.17	0.16	0.18	0.19	0.19	0.08	0.19	< 0.1
Ni (mg/l)	0.0018	0.0069	0.00061	0.0004	0.0015	0	0.00042	0.00058	0	0.0023	0	0	0	0.0011	0	0.0069	< 0.02
Co (mg/l)	0.0024	0	0.011	0.0073	0.0059	0	0.0056	0.0039	0.024	0.023	0.0098	0.006	0.0051	0.0038	0	0.024	NS
Cu (mg/l)	0	0.01	0	0	0.05	0	0.01	0	0	0	0.02	0.03	0	0.02	0	0.05	< 1-2
Cr (mg/l)	0.0064	0.0069	0.0051	0.0076	0.0084	0.0072	0.0068	0.0077	0.0047	0.0062	0.0048	0.0032	0.0015	0.0024	0.0015	0.0084	< 0.05
Cd (mg/l)	0.0027	0.0016	0.0021	0.00045	0.0017	0.00023	0.002	0.00001	0.00032	0.0018	0.0014	0.0022	0	0.00053	0	0.0027	< 0.005
Mo (mg/l)	0.0065	0.0018	0.00096	0.0061	0.006	0.00081	0.005	0.0025	0.0055	0.0081	0.0054	0.0033	0.0013	0	0	0.0081	< 0.05
Pb (mg/l)	0.0096	0.01	0.0088	0.019	0.0055	0.005	0.025	0.053	0.027	0.026	0.028	0.017	0.025	0.037	0.005	0.053	< 0.01
Zn (mg/l)	0	0	0	0	0	0	0	0.01	0	0	0	0	0	0.02	0	0.02	< 3

Table 4.1 - Water quality data measured along the Revuè river water and the 1996 WHO recommended values for drinking water.

* Alkalinity as CaCO₃

Elements	Earth's	Igr	ieous rocks		Sedimentary rocks			
	crust	Ultramafic	Mafic	Granitic	Limestone	Sandstone	Shales/clays	
Ag	0.07	0.06	0.01	0.04	0.12	0.25	0.07	
As	1.5	1	1.5	1.5	1	1	13	
Au	0.004	0.003	0.003	0.002	0.002	0.003	0.0025	
Ba			330	600	10	193	580	
Cd	0.1	0.12	0.13	0.09	0.028	0.05	0.22	
Со	20	110	35	1	0.1	0.3	19	
Cr	100	2980	200	4	11	35	39	
Cu	50	42	90	13	5.5	30	39	
Hg	0.005	0.004	0.01	0.08	0.16	0.29	0.18	
Mn	950	1040	1500	400	620	460	850	
Mo	1.5	0.3	1	2	0.16	0.2	2.6	
Ni	80	2000	150	0.5	7	9	68	
Pb	14	14	3	24	5.7	10	23	
Sb	0.2	0.1	0.2	0.2	0.3	0.05	1.5	
Se	0.05	0.13	0.05	0.05	0.03	0.01	0.5	
Sn	2.2	0.5	1.5	3.5	0.5	0.5	6	
Ti	0.6	0.0005	0.08	1.1	0.14	0.36	1.2	
U	2.4	0.03	0.43	4.4	2.2	0.45	3.7	
V	160	40	250	72	45	20	130	
W	1	0.1	0.36	1.5	0.56	1.6	1.9	
Zn	75	58	100	52	20	30	120	

Table 4.2 - Typical concentrations of heavy metals in the earth's crust and major types of igneous and sedimentary rocks in ppm (from Alloway & Ayres, 1993; Drever, 1997).

4.1 NATURAL BACKGROUND WATER QUALITY

In the catchment area of the Revuè basin, the water crosses a variety of rocks of the Manica greenstone belt. Epidiorite, metagabbro, anorthosite, dolerite, quartz porphyry schist, actinolite chlorite schist, metafelsite, and komatiite metabasalt has been described by Passela (1996). These rocks are composed of minerals such as plagioclase, augite, epidote, clinozoisite, quartz, chlorite, feldspar, biotite, muscovite, magnetite, and actinolite. Dissolution of these minerals results in metals such as Ca, Al, Fe, Si, Na, Mg and K being present in the Revuè basin water. The presence of these metals in the chemical composition of water cannot be considered evidence of pollution in the strict sense of definition. A widely used definition of pollution is "the change in the physical, chemical, radiological or biological quality of the resource (air, land or water) caused by man or due to man's activities that is liable to cause hazards to human health, harm to ecological systems, damage to structures or amenity and is injurious to existing, intended or potential uses of the resource" (Holdgate, 1979; Novotny, 1995).

To characterise the natural background water quality in the Revuè basin, the analytical data of water collected at site 1 in the Revuè river was selected (Fig. 1.2, p. 6). This site is in a pristine area far from the influence of the mining activity and represents the water quality upstream of the mining area. Water quality at this site can be used as base level against which the impact of mining can be judged.

The electrical conductivity of water in this site is 155.3 μ S/cm, TDS 74.34 mg/l, alkalinity 32.4 mg/l and turbidity 7.28 NTU (Table 4.1). The suspended sediment concentration in this site is very low as reflected in the clearness of the water.

Trace metals present in the minerals will also be dissolved in the Revuè river water. The content of metals and other determinands in the water upstream of the mining area is generally small, except Cd and Ni, when compared with other two parts of the study area (Figures 4.1 to 4.21 and Table 4.1). Table 4.1 includes the 1996 WHO recommended values for drinking water. In this upstream area, the concentrations of all metals are lower than the WHO standards for drinking water. In the case of Ba, Pb and Mn the concentrations are close to the recommended limit while Al, As, Ca, Cd, Co, Cr, Cu Fe, K, Mg, Mo, Na, Ni, Sr and Zn are markedly lower. Water quality problems are not cause of concern upstream of the alluvial gold mining area in the Revuè basin. This water is therefore of suitable quality to be used as potable water.

4.2 WATER QUALITY PARAMETERS

4.2.1 Physical Parameters

i) TDS and Electrical Conductivity

Electrical conductivity (EC) is the capacity of a substance to conduct electricity. Chemically pure water has very low electrical conductivity. Small quantities of dissolved ions are enough to increase the electrical conductivity of water. The more ions present in the water, the higher the electrical conductivity will be. Therefore, electrical conductivity is proportional to the Total Dissolved Solids (TDS). In the Revuè river the electrical conductivity ranges from 155.3 to 308.65μ S/cm while the concentration of total dissolved solids ranges from 74.34 to 191.16 mg/l. The lowest values of these two determinands are observed upstream of the mining area. Values rise gradually until site 8 where there is a marked increase in the both TDS and electrical conductivity values (Fig. 4.1). At this locality, mining activity by a considerable number of artisanal miners is very intense and large quantities of substances enter the river water from the gold washing process. This results in the highest electrical conductivity and TDS along the river being recorded at this locality. Similar high values are recorded at sites 9, 10 and 11. From site 12 to site 14 there is a decrease in both TDS and electrical conductivity, reflecting a reduction of metal concentrations in the dam water.

High TDS in potable water may lead to salt overload in sensitive individuals, e.g. those with impaired renal function or those with immature kidneys (Sherman, 1998).



Fig. 4.1 – Spatial distribution of TDS and Electrical Conductivity down the Revuè river. I – Upstream of the mining area; II – Within the mining area; III – Downstream of the mining area.

ii) Turbidity

Turbidity is the state, condition or quality of opaqueness or reduced clarity of a fluid, due to the presence of suspended matter (Jackson, 1997). Water turbidity is a normal function of nature but can be influenced by human activities. Turbid water contains particles that are too small to be seen without magnification, but the particles produce effects that can be detected with the human eye because they scatter light. The particles that cause turbidity are those that are about the same size as wavelengths of visible light (or smaller), described as colloidal size. Colloids are so small that they never settle, even gravity doesn't affect them (Everpure, 1999). Clay and silt particles can also be maintained in suspension for a long time in a turbulent flux due to their small size and also contribute to turbidity. Turbidity is measured in Nephelometric Turbidity Units (NTU).

The maximum value of turbidity allowed in drinking water by the WHO is 5 NTU. In the Revuè river water turbidity values of between 1.42 and 142 NTU were measured (Fig. 4.2). Turbidity starts to increase immediately after the first mining site (site 3) and reaches a maximum at site 9. This is due to washing the auriferous gravel directly in the river water (Chapter 3). Clay and silt particles are held in suspension in the water which becomes brown to reddish-brown in colour. Turbidity values are influenced by the intensity of mining activities as the more mining sites that are crossed by the river water, the higher the turbidity will be. For example, mining activity is intense between site 8 and 9 and this is reflected in high turbidity value of 142 NTU measured at site 9. Furthermore, the number of local miners at a site will also influences the turbidity as there is a direct relationship between the number of miners and the volume of material removed and washed. Along the Revuè river and the Chua and the Zambuzi affluents (Fig. 1.1, p. 2) there are areas where more than one hundred artisanal miners can be found in a small site. Within the mining area, all sample sites have turbidity values that exceed the WHO recommended values set at 5 NTU.

Downstream of the mining area the turbity drops to values of 1.42 NTU and 1.56 NTU in the Chicamba Dam. This reflects settling of clay and silt particles in the impounded water and consequently the turbidity drops.

The water turbidity in the Revuè river basin causes different negative effects:

- transportation and accumulation of clay and silt particles accelerates the reduction in depth of the Chicamba Dam.
- water quality for domestic use is impaired.
- the high level of water turbidity prevents animals from drinking river water.
- aquatic flora and fauna habitats are disturbed.
- the reduction of light penetration in the water can affect the photosynthesis of aquatic plants.
- suspended particles causing turbidity adsorb other dissolved water contaminants and carry them through the system.



Fig. 4.2 – Spatial distribution Turbidity down the Revuè river. I - Upstream of the mining area; II – Within the mining area; III - Downstream of the mining area; RV - Reference Value (Site 1).

4.2.2 Chemical Parameters

i) pH

pH expresses the concentration of free hydrogen ions in water. The relative concentration of hydrogen ion in water indicates whether it will act as weak acid or as an alkaline solution. In most natural waters the pH is controlled by reactions involving the carbonate system. These reactions produce H^+ and influence the pH of the solution. The equilibrium reactions are:

$$CO_2 (aq) + H_2O (l) = H_2CO_3 (aq)$$

 $H_2CO_3 (aq) = H^+ + HCO_3^-$
 $HCO_3^- = H^+ + CO_3^{2-}$

River water in areas not influenced by pollution generally has a pH in the range 6.5 to 8.5. The pH of natural water is useful index of status of equilibrium reactions in which the water participates. In low pH water (acidic), metals generally tend to be more soluble.

In the Revuè river water, pH values of between 7.1 to 7.9 were measured, i.e. within the normal values for natural waters.

ii) Alkalinity

The alkalinity of a solution is defined as the capacity for solutes it contained to react with and neutralize acid. The property of alkalinity must be determined by titration with a strong acid,
and the end point of the titration is the pH at which virtually all solutes contributing to alkalinity have reacted (Hem, 1980). The alkalinity titration is an important analytical procedure in natural water chemistry. The titration curve also provides insights into pH stability and buffering.

Alkalinity is caused by different types of solutes and in almost all natural water the alkalinity is produced by dissolved carbon dioxide species, bicarbonate and carbonate. The important non-carbonate contributors to alkalinity include hydroxide, silicate, borate and organic ligands, especially acetate and propionate (Hem, 1980). The principal source of carbon dioxide species that produce alkalinity in surface or ground water is the CO₂ gas fraction of the atmosphere or the atmospheric gases present in the soil.

In the Revuè river the alkalinity concentrations measured are between 24.8 and 61.6 mg/l as CaCO₃. In a general manner the alkalinity values rises gradually from upstream of the mining area with some small oscillations. Fig. 4.3 shows that the highest alkalinity is observed within the mining area at site 9 with 61.6 mg/l as CaCO₃. This site is underlain by carbonate rocks. Downstream of the mining area the alkalinity starts to drop gradually until the Chicamba Dam at site 14. Chemical precipitation of Ca and Mg carbonates which occurs in the water column to form particles and colloids can be the cause of the reduction (Fillela *et al.*, 1995).





Fig. 4.3 – Spatial distribution of Alkalinity down the Revuè river. I - Upstream of the mining area; II – Within the mining area; III - Downstream of the mining area; RV - Reference Value (Site 1).

4.2.2.1 Major metals

i) Calcium

Calcium is the most abundant of the alkaline-earth metals and is a major component of the solutes in most natural waters. The sources of calcium are the sedimentary rocks where Ca is found as carbonates and as calcareous cement between particles. In igneous rocks plagioclase feldspars are a major source of calcium but calcium is also present in pyroxenes, amphiboles and in other silicate minerals produced by metamorphism.

Calcium has only one oxidation state, Ca^{2+} , and generally it is a predominant cation in river water. The behaviour of calcium in natural aqueous systems is generally governed by the availability of the more soluble calcium-containing solids and by solution and gas-phase equilibria that involve carbon dioxide species (Hem, 1980).

In the Revuè river the calcium concentrations range between 3.8 and 7.2 mg/l. The lowest values are found at site 1. Here the possible sources of calcium are the pyroxinites and amphibolites. The highest concentrations of Calcium are observed, at the site 9, within the mining area, where the river crosses carbonate rocks as marble which is found within the Manica greenstone belt.

Downstream of the mining area at sites 12 to 14 the calcium concentration drops gradually until the Chicamba Dam (Fig. 4.4). When river water is impounded in a storage reservoir, changes may occur in calcium content as a result of calcium carbonate precipitation (Hem 1980). The increased pH near the water surface, caused by algae and plankton, may bring about supersaturation, and precipitation can occur on solid surfaces around the edges of the water.

All sites sampled in the Revuè river are well below 200 mg/l, the recommended maximum calcium concentration for drinking water.

ii) Magnesium

Magnesium is an alkaline-earth metal together with calcium ions contributes to the property of water hardness. Magnesium is derived from different sources. In igneous rocks, magnesium is typically a major constituent of ferromagnesian minerals such as olivine, pyroxenes, amphiboles and biotite. In metamorphic rocks magnesian mineral species such as chlorite and serpentine occur. In sedimentary rocks it is found in magnesite and hydromagnesite, the hydroxide brucite, limestone and dolomite (Hem, 1980).



Fig. 4.4 – Spatial distribution of Calcium concentration down the Revuè river. I - Upstream of the mining area; II – Within the mining area; III - Downstream of the mining area; RV - Reference Value (Site 1).

Magnesium has only one oxidation state of significance in water chemistry, Mg^{2+} . The magnesium ion, Mg^{2+} , will normally be the predominant form of magnesium in solution in natural water. Other magnesium forms in solution are the ion complexes $MgOH^+$ formed at pH >10 and the neutral ion pair $MgSO_{4 (aq)}$ (Hem, 1980).

The concentrations of magnesium measured in the Revuè river range between 3.1 and 7.7 mg/l. The distribution of magnesium down the Revuè river is similar to that reported for calcium. The smallest concentrations are found upstream the mining area (Fig. 4.5). The magnesium concentration rises within the mining area reaching a peak at sites 8 and 9. This coincides with the change in lithology to carbonates rocks (marble). Similar concentrations are found at sites 10 and 11. Downstream of the mining area the magnesium concentration drops until the Chicamba Dam. This may be due to the chemical precipitation of calcium and magnesium carbonates in the water column to form particles and colloids (Fillela *et al.*, 1995) or to dilution by other river waters flowing in the Chicamba Dam. In this area the water is quiescent which would aid settlement of suspended material.

Magnesium is a common element and is essential to plant and animal nutrition. The maximum recommended concentration in drinking water is 150 mg/l which is higher than the observed concentrations in the Revuè river.



Fig. 4.5 - Spatial distribution of Magnesium concentration down the Revuè river. I - Upstream of the mining area; II - Within the mining area; III - Downstream of the mining area; RV - Reference Value (Site 1).

iii) Sodium

Sodium is economically the most important and abundant member of the alkali metal group of the periodic table. It occurs in igneous, sedimentary and evaporite rocks. Sodium is found in plagioclase minerals ranging in composition from albite (NaAlSi₃O₈) to anorthite (CaAlSi₂O₈). These plagioclases are susceptible to weathering and form clay minerals (kaolinite, illite or montmorillonite). The sodium occurs in the Na⁺ oxidation state and does not participate in redox processes (Hem, 1980). When it is in solution, it tends to remain as sodium ions and does not readily participate in precipitation reactions.

The sodium ion Na⁺ predominates in waters with TDS below 1000 mg/l. In more concentrated solutions the complex ions and ion pairs NaCO₃⁻, NaHCO_{3 (aq)} and NaSO₄⁻ are possible.

Natural water can have a very wide range of sodium concentration from less than 1 mg/l in rain water and dilute stream runoff to more than 100 g/l in brines associated with evaporites. In the Revuè river water concentrations of 3.3 to 5.85 mg/l of sodium were measured (Fig. 4.6).

There is a close correlation between sodium concentration and lithology, for example, sites 1 and 2 situated on basalts, komatiites, talschists and chloritic schists have similar sodium concentrations. Likewise, sites 3 to 7 situated on peridotites, serpentinites and amphibolites, also have similar sodium concentrations. Generally the highest sodium concentrations in the Revuè river are associated with granitic lithologies.

Minor variation in concentration along the river, may possibly be attributed to adsorption by clay minerals, as at site 10 or dissolution of igneous rocks, as at site 11.

High sodium concentrations can be of concern in infants as the infant kidney is less effective than the adult at sodium elimination. If sodium is present in excess in drinking water given to infants hypernatraemia may result. However, the concentrations along the river are well bellow recommended WHO value of 120 mg/l.



Fig. 4.6 - Spatial distribution of Sodium concentration down the Revuè river. I - Upstream of the mining area; II - Within the mining area; III - Downstream of the mining area; RV - Reference Value (Site 1).

4.2.2.2 Minor metals

i) Aluminium

Aluminium is the third most common element in the earth's crust. It rarely occurs in solution in natural water in concentrations greater than few tenths or hundredths of a milligram per liter (Hem, 1980). Aluminium is considered to be non-essential element for human health and development, as no substantiating evidence has been found to indicate that it fulfils any vital biological function.

Aluminium is a major compound in a large number of silicate igneous rock minerals like feldspars, feldspathoids, micas and amphiboles, and in clays. At neutral pH the aqueous concentration of aluminium is low in subsoil water, lakes, rivers and seawater, due to the formation of secondary hydroxo phases (Hem, 1980). At high and low pH levels the solubility increases substantially.

Aluminium is trivalent and the cation Al^{3+} predominates in many solutions in which the pH is less than 4.0. Above neutral pH, the predominant dissolved form of aluminium is the anion $Al(OH)_4$. In the presence of few tenths of a milligram per liter to a few milligrams per liter of fluoride the ions AlF^{2+} and AlF^+_2 appear to be most likely in natural water. The sulfate complex $AlSO^+_4$ may predominate in acid solutions in which much sulfate is present (Hem, 1980).

The median concentration of aluminium in rivers range from 0.01 to 40 mg/kg (Frech & Cedergren, 1992). The aluminium values measured in the Revuè river are of 0.02 to 0.14 mg/l. In a general manner the aluminium concentration rises gradually from upstream to downstream of the mining area with some small oscillations (Fig. 4.7). The presence of granitic rocks at sites 13 and 14 coincides with the highest Al^{3+} concentrations found in the area.

Possible toxic effects due to high aluminium concentration in water are the development of neurological diseases such as Alzheimer's senile and pre-senile dementia, amyotropic lateral sclerosis, and Parkinson's dementia as well as dialysis encephalopathy (Frech & Cedergren, 1992; Packham, 1993).

The maximum recommended aluminium value for drinking water is 0.2 mg/l. This value is above those observed in the Revuè river.



Fig. 4.7 – Spatial distribution of Aluminium concentration down the Revuè river. I - Upstream of the mining area; II – Within the mining area; III - Downstream of the mining area; RV - Reference Value (Site 1).

ii) Iron

Iron, the most important of all metals, is also one of the most abundant in the earth's crust, being second only to aluminium. The most important ores are hematite, Fe_2O_3 , magnetite, Fe_3O_4 , and siderite, $FeCO_3$. Pyroxenes, amphiboles, biotite and olivine also have relatively high iron contents. Iron in these minerals is in ferrous, Fe^{2+} , oxidation state whereas in magnetite is in the ferric, Fe^{3+} state.

Iron concentrations in water generally are small. Its chemical behaviour and solubility in water depends strongly on the oxidation potential of the system in which it occurs. The iron in aqueous systems can be found as ferrous or ferric ions, anions, monohydroxides and solid ferric oxyhydroxide. Ferric oxyhydroxide surfaces have a substantial adsorption capacity, which may affect the concentration of minor constituents of water associated with such material. Redox co-precipitation process may occur that can control solubilities of other metal ions under some conditions (Hem, 1980).

Water in rivers that is fully aerated should not contain more than a few micrograms per liter of uncomplexed dissolved ferrous iron at equilibrium in the pH range of about 6.5 to 8.5 (Hem, 1980). In the Revuè river concentrations of 0 to 0.27 mg/l were measured. Fig. 4.8 shows that the highest concentrations of iron occur within the mining area. At sites 3 to 7 both the mining activity and lithology have a combined effect in raising the iron concentration. These sites are underlain by the same rock types (peridotites, amphibolites, serpentinites) and the gold washing process increases the releasing of iron to the water. The reduction of iron concentration observed at sites 8 and 9 is possibly due to precipitation of iron as a carbonate as the river flows over marble in the region. Downstream of the mining area the iron concentration continues to drop as the river runs over acid rocks such as granites, gneissic granites and cratonic granitoids. It is believed that the impoundment of water in the Chicamba Dam has also effect on the iron concentration because dilution can occur as well as settling of metal-contaminated solids.

Iron is an essential element in the metabolism of humans, animals and plants. If present in water in excessive amounts it forms red oxyhydroxide precipitates that stain laundry and plumbing fixtures and, therefore, is an objectionable impurity in domestic and industrial water supplies (Hem, 1980). The maximum iron concentration allowed in drinking water is 0.3 mg/l. This value was not recorded in the Revuè river.

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Fig. 4.8 – Spatial distribution of Iron concentration down the Revuè river. I – Upstream of the mining area; II – Within the mining area; III - Downstream of the mining area; RV - Reference Value (Site 1).

iii) Potassium

Potassium is the sixth most common element in the earth's crust. Although potassium is an abundant element and its salts are highly soluble, it seldom occurs in high concentrations in natural water. It is slightly less common than sodium in igneous rock but more abundant in all sedimentary rocks (Hem, 1980). Potassium is liberated with greater difficulty from silicate minerals and exhibits a strong tendency to be reincorporated into solid weathering products, especially certain clay minerals (Hem, 1980).

The sources of potassium in silicate rocks are the feldspars orthoclase and microcline $(KAlSi_3O_8)$, the micas, and the feldspathoid leucite $(KAlSi_2O_6)$. In sediments it is present in unaltered feldspar or mica particles or in illite or other clay minerals.

In dilute natural waters in which the sum of sodium and potassium is less than 10 mg/l, it is not unusual for the potassium concentration to equal or even exceed the sodium concentration (Hem, 1980). This is not the situation observed in the Revuè river where the potassium concentrations of 0.387 to 2.599 mg/l were recorded. There is a little variations in potassium concentration along the river with values below or close to 1 mg/l until site 12 where there is a marked increase in concentration (Fig. 4.9). This increase can be attributed to the granitic lithologies found in the area.

Limits for potassium in drinking water are based on its effect in disturbance of the electrolyte balance of the body (Sherman, 1998). A desirable limit for potassium is 10 mg/l, which is higher than the values observed in the Revuè river.



Fig. 4.9 – Spatial distribution of Potassium concentration down the Revuè river. I - Upstream of the mining area; II – Within the mining area; III – Downstream of the mining area; RV - Reference Value (Site 1).

iv) Strontium

Strontium is a fairly common element, replacing calcium or potassium in igneous-rock minerals in minor amounts, although apparently favouring those species that are typical of granitic and syenitic rocks rather than ultrabasic rocks (Hem, 1980). Other sources of strontium are strontianite (SrCO₃) and celesite (SrSO₄) which are common in sediments.

The oxidation state of strontium is +2 and its chemistry is similar to that of calcium. The strontium concentration in most natural waters does not approach the solubility limit of either strontianite or celestite (Hem, 1980). In the Revuè river concentrations of 0.02 to 0.05 mg/l were measured (Fig. 4.10). At site 8, the increase in concentration coincides with the changes in lithology from mafic and ultramafic rocks to metasedimentary and carbonate rocks (quartzites and marble), the latter having higher strontium concentrations than the former. A further increase in strontium concentration occurs at site 12 where the river flows over granitic rocks which have high strontium concentration.

No value was recommended as maximum concentration of strontium in drinking water.



4.10 - Spatial distribution of Strontium concentration down the Revuè river. I - Upstream of the mining area; II - Mining area; III - Downstream of the mining area; RV - Reference Value (Site 1).

4.2.2.3 Trace metals

i) Arsenic

Arsenic compounds have been known, at least in impure form, for several millenia. It occurs in the earth's crust at an average of 2-5 ppm (Manahan, 1990). Historical events make it understandable that it is perceived as a life threatening poison (Irgolic, 1992). Arsenic may form metal arsenides in which its oxidation state is negative. Arsenic may also form sulfides and can be present as an accessory element in sulfide ore deposits. Arsenite and arsenate are the most common arsenic compounds in the environment. Arsenite is formed as the weathering product of arsenic-containing sulfide ores and is considered the most toxic among arsenic compounds. Arsenite also occurs with phosphate minerals. In solution in aerobic waters arsenate (As⁵⁺) or Arsenite (As³⁺) oxyanions are the thermodynamically stable forms of inorganic arsenic (Hem, 1980).

The dissolution of the above mentioned sources and the combustion of fossil fuels, particularly coal, introduces large quantities of arsenic into the environment, much of it reaching natural waters (Manahan, 1990). The arsenic concentration values measured in the Revuè river water range from 0 to 0.042 mg/l with the highest value (0.042 mg/l) recorded at site 13 (Fig. 4.11). Examination of Table 4.2 indicates that apart from shales and clays, typical arsenic concentrations in major rock types varies from 1 to 1.5 ppm. Concentrations of arsenic in natural waters can be expected to be lower than the average concentration found in rocks but will be independent of lithology. Within the mining area variations in concentrations may be

the result of adsorption of arsenic by hydrous iron oxide, or co-precipitation, or combination with sulfide in the bottom sediments (Hem, 1980).

Because small amounts of arsenic can be toxic to humans, it is considered a highly undesirable impurity in water supplies. Although, arsenic compounds can have beneficial influences on human and animal life. The recommended arsenic concentration for drinking water set by the WHO in 1996 is less than 0.05 mg/l. This concentration is above the values measured in the Revuè river water.



Fig. 4.11 – Spatial distribution of Arsenic concentration down the Revuè river. I - Upstream of the mining area; II – Within the mining area; III - Downstream of the mining area; RV - Reference Value (Site 1).

ii) Barium

Barium is somewhat more abundant in acid igneous rocks than in basic and ultrabasic. It occurs principally as the mineral barite (BaSO₄), which is fairly common mineral. The concentration of barium in natural waters is likely controlled by the solubility of this mineral. This reduces the range between the upper and lower extreme values of barium to be expected in natural waters. Another factor that seems likely to influence the concentration of barium in natural water is adsorption by metal oxides or hydroxides (Hem, 1980).

Barium oxidation state is 2+ and a median concentration of 0.045 mg/l is observed in rivers (Hem, 1980). In Manica barium concentrations of 0.08 to 0.19 mg/l were recorded. The lowest barium concentrations are observed upstream of the mining area (Fig. 4.12). Within the mining area sites 3 to 7 have fairly constant barium concentrations. These sites have similar lithologies of peridotites, serpentinites and amphibolites. The Zambuzi river (also with mining activity),

which flow into the Revuè river between sites 7 and 8 brings high barium content (0.27 mg/l) that increases the barium concentration at site 8. At site 8, the country rocks are carbonatic and metasedimentary (marble, quartzites, metagreywakes). These rock types are likely to contain higher barium concentrations than mafic rocks and also contribute to the higher concentrations at site 8 and 9. The release of barium can be accelerated by the intense mining activity in these sites.

Downstream of the mining area the barium concentration remains fairly constant. The Chicamba Dam (site 14) receives water from other rivers flowing over the granitic gneiss complex and has the highest concentration of barium (0.19 mg/l).

From site 8 downstream to the Chicamba Dam, barium concentrations are higher than the recommended WHO standard for drinking water (0.1 mg/l). Because of the toxicity of barium, it is considered an undesirable impurity in drinking water. Water from Chicamba Dam is pumped to Chimoio City and used as potable water. Apart from desinfection with chlorine, no water treatment is undertaken.



Fig. 4.12 – Spatial distribution of Barium concentration down the Revuè river. I - Upstream of the mining area; II – Within the mining area; III - Downstream of the mining area; RV - Reference Value (Site 1).

iii) Nickel

Nickel is widely distributed in the environment and is the twenty-fourth most abundant element in the earth's crust. It may substitute for iron in ferromagnesian igneous-rock minerals. The source of nickel are ferrous sulfides in which nickel is substituted for part of the iron, and nickel-bearing laterites developed on ultramafic bedrock terranes (Hem, 1980). Nickel oxidation states are +1, +2 and +3 and the aqueous chemistry is primarily concerned with the Ni²⁺ oxidation state. Important compounds are nickel oxide, nickel hydroxide, nickel sulphate, nickel chloride and nickel subsulfide (Stoeppler & Ostapczuk, 1992).

The median concentration of nickel in river water and probably in most other natural freshwater is somewhat less than 1 to 60 μ g/l. In the Revuè river water values between 0 and 0.0069 mg/l (6,9 μ g/l) were measured (Fig. 4.13). The highest concentrations were observed in sites underlain by ultramafic and mafic rocks, which have the highest typical concentrations of nickel (Table 4.2, p. 23). The concentrations of nickel in the Revuè river may be a reflection of its natural abundance. Nickel tend to be coprecipitated with iron oxides and especially with manganese oxides (Hem, 1985).

The maximum recommended nickel concentration for drinking water is 0.02 mg/l. Therefore, the concentrations in Revuè water are below the recommended value. Divalent nickel compounds are non-toxic for animals, plants and man at prevalent concentrations in natural waters. In humans beings adverse effects (dermatitis) from inorganic, water-soluble nickel compounds frequently occur following skin contact.



Fig. 4.13 – Spatial distribution of Nickel concentration down the Revuè river. I - Upstream of the mining area; II – Within the mining area; III - Downstream of the mining area; RV - Reference Value (Site 1)

iii) Cobalt

Cobalt is comparatively rare than nickel and is the thirty-second most abundant element in the earth's crust. It can substitute for part of the iron in ferromagnesian rock minerals (Hem, 1985).

Cobalt oxidation states are +2 and +3. Important cobalt compounds are cobalt oxide, cobalt tetraoxide, cobalt chloride, cobalt sulfide and cobalt sulfate (Stoeppler & Ostapczuk, 1992). With the possible exception of certain complex ions, aqueous species of Co^{3+} are not thermodynamically stable under Eh and pH conditions that commonly occur in natural water. (Hem, 1985).

The median concentration of cobalt in river water is between 0.4 to 4 μ g/l. In the Revuè river water values between 0 and 0.024 mg/l (24 μ g/l) were measured (Fig. 4.14). The first change in the Cobalt concentration is observed at site 3 with the change in lithology from schists to peridotites and serpentinites. The highest concentration is observed in the lower part of the mining area at site 9 which is underlain by metasedimentary and carbonate rocks. The high concentration here may be due to remobilization of the sediments during mining activity. A similar value at site 10, underlain by peridotites and serpentinites, may be a consequence of rock type (Table 4.2, p. 23). Downstream of the mining area the Cobalt concentration drops and returns to values close to those observed upstream of the mining area.

The maximum acceptable concentration of cobalt in drinking water has not been established. Cobalt is a constituent of vitamin B12 and in this form is essential for mammals (i.e. also for human beings) especially for ruminant animals. Extremely low contents in food may lead to deficiency syndromes, which has been especially observed in ruminants. Although, because of its industrial use, cobalt also poses a potential danger in occupational exposure primarily for metal workers (Stoeppler & Ostapczuk, 1992). Exposure to cobalt-containing dust and fumes can cause adverse effects to lungs, heart and skin.



Fig. 4.14 – Spatial distribution of Cobalt concentration down the Revuè river. I - Upstream of the mining area; II – Within the mining area; III - Downstream of the mining area; RV - Reference Value (Site 1).

iv) Manganese

Manganese is the tenth most abundant element in the earth's crust. Manganese occurs as a minor constituent in igneous and metamorphic minerals. It is not an essential constituent of the more common silicate rock minerals, but it can substitute for iron, magnesium or calcium in silicate structures (Hem, 1985). Manganese is a significant constituent of basalt and many olivines and of pyroxene and amphibole. It is also present in small amounts in dolomites and limestones substituting for calcium.

The chemistry of manganese is somewhat like that of iron, but manganese has three oxidation states, +2, +3 and +4, and can form a wide variety of mixed-valence oxides. The +3 species are unstable. When divalent manganese is released to the aqueous environment during weathering, it is more stable toward oxidation than is ferrous iron (Hem, 1985). Manganese co-precipitates with iron, and other metal ions such as cobalt, lead, zinc, copper, nickel and barium (Alloway & Ayres, 1993). Under conditions in natural waters systems, any dissolved manganese will be in the +2 oxidation state. The ion Mn^{2+} will predominate in most situations. It forms hydroxides, complex ions and ion pairs.

The presence of manganese in a stream water depends on the pH. Acidic streams can have more than 1 mg/l of manganese. In the Revuè river concentrations of 0 to 0.2 mg/l were measured with the highest concentration recorded in the lower part of the mining area (Fig. 4.15). The concentration of manganese increases throughout the mining area, reaching a maximum at site 9 which is underlain by metasedimentary rocks. As high concentrations of manganese are normally associated with mafic rocks, the peak concentration can be attributed to alluvial gold mining activity. Furthermore, between sites 8 and 9 the Revuè river receives water from the Inhamazonga river, a small affluent, which brings water with high manganese concentration (0.33 mg/l). This water also helps to raise the manganese concentration in the Revuè river. Downstream of the mining area manganese concentration drops until zero in the Chicamba Dam as the river runs over acid rocks such as granites, gneissic granites and cratonic granitoids which give a very small input of Mn to the water due to their low Mn concentration. It is believed that the impoundment of water in the Chicamba Dam has also effect on the manganese concentration because dilution can occur as well as settling of metal-contaminated solids. Hem (1985) suggests that manganese takes long time to disappear from solution.

A recommended upper limit for manganese in drinking water is 0.02 mg/l. Fig. 4.15 shows that from site 3 to site 11 Mn exceeds this value. Manganese is an undesirable impurity in water supplies, mainly owing to a tendency to deposit black oxide stains.



Fig. 4.15 – Spatial distribution of Manganese concentration down the Revuè river. I - Upstream of the mining area; II – Within the mining area; III - Downstream of the mining area; RV - Reference Value (Site 1).

v) Copper

Copper is by a considerable margin the most noble of the first transition series metals, and it may occur in the earth's crust, as native copper or in Cu^+ or Cu^{2+} minerals. Copper forms stable sulfide minerals. Common ores are chalcopyrite or copper pyrite, CuFeS₂, malachite, $Cu_2(OH)_2(CO_3)$, atacamite, $Cu_2(OH)_3Cl$, and cuprite, Cu_2O (Sharpe, 1986).

Copper may occur in solution in either Cu^{2+} or Cu^+ oxidation states, but the redox conditions in oxygenated water favour the more oxidised form (Hem, 1985). The species formed in solution are $Cu(OH)_3^-$ (above neutral pH) and $CuCO_3(aq)$ in aerated natural water containing dissolved CO_2 species.

Levels of copper near 10 μ g/l can be commonly expected in river water. In the Revuè river water 0 to 0.05 mg/l (50 μ g/l) of copper were measured. The highest concentration is observed at site 5, within the mining area (Fig. 4.16). There is no clear apparent reason for Cu behaviour along the river.

As with other metals, the copper concentration in river water is also controlled by adsorption on mineral surfaces and co-precipitation with ferric oxyhydroxides. The upper copper limit in drinking water is 1-2 mg/l, well above the concentrations measured in the Revuè river.



Fig. 4.16 – Spatial distribution of Copper concentration down the Revuè river. I - Upstream of the mining area; II – Within the mining area; III - Downstream of the mining area; RV - Reference Value (Site 1).

vii) Chromium

Chromium occurs naturally in the environment and is the twenty-first most abundant element in the earth's crust with an average concentration of 100 $\mu g/g$ (Miller-Ihli, 1992). Its principal ore is chromite, FeCr₂O₄, and elemental chromium is rarely found in nature. Chromium occurs in oxidation states ranging from Cr²⁺ to Cr⁶⁺. In minerals the predominant oxidation state is Cr³⁺. Dissolved chromium, however, may be present as trivalent cations or as anions in which the oxidation state is Cr⁶⁺ (Hem, 1985).

Concentrations of chromium in natural waters that have not been affected by waste disposal are commonly less than 10 μ g/l. Naturally occurring chromium concentrations in water arise from mineral weathering processes, the dissolution of chromium bearing soluble organic species, and adsorption from clays. Chromite, the principal ore of chromium, may be concentrated in lateritic residue overlying ultramafic igneous rocks. These rocks are found in the Manica greenstone belt upstream of and within the mining area and constitute the source of chromium in the Revuè river water. In the Revuè river the chromium concentration ranges from 0.0015 to 0.0084 mg/l (Fig. 4.17). The ultramafic igneous rocks are higher in chromium concentration than other rock types (Table 4.2, p. 23). Downstream of the mining area the concentration of chromium drops gradually until the Chicamba Dam. The chromium concentration in water is largely controlled by precipitation and co-precipitation reactions and by adsorption or co-precipitation with hydrous oxides of iron and manganese (Miller-Ihli, 1992).

Chromium is an element that has several roles in our daily lives. At low concentrations it is an essential micronutrient in human and animal nutrition and at high concentrations it is a known carcinogen when present as chromate. Drinking water recommended value have been set at 0.05 mg/l total chromium because of the toxic effects of Cr (VI) and the possibility of oxidation of Cr (III) to Cr (VI). In the Revuè water the chromium concentrations are lower than this value.



Fig. 4.17 – Spatial distribution of Chromium concentration down the Revuè river. I - Upstream of the mining area; II – Within the mining area; III - Downstream of the mining area; RV - Reference Value (Site 1).

viii) Zinc

Zinc has about the same abundance in crustal rocks as copper or nickel and is fairly common. It is usually recovered from sphalerite, ZnS. Zinc shows a much more restricted range of oxidation state than the other elements, and the chemistry of zinc is confined to that of Zn^{2+} except in so far Zn_2^+ ion has been identified (Sharp, 1986). It tends to be substantially more soluble in most types of natural water than are the other two metals (Hem, 1985).

Zinc concentrations in river water range from 5 to 45 μ g/l. The probability of interaction with pre-existing mineral surfaces, through simple adsorption, ion exchange, or co-precipitation processes may inhibit zinc concentration in the river water (Hem, 1985). In the Revuè river, zinc was detected at only two sites; site 8 (0.01 mg/l) and site 14 (0.02 mg/l) (Fig. 4.18).

Zinc is an important element biologically for plants and animals, and occurs in a wide variety of enzymes involved in carbohydrate, lipid and protein metabolism, but is an undesirable contaminant for some species of aquatic life at much lower concentrations (Hem, 1980; Sharpe, 1986). The upper limit recommended in drinking water set by the WHO is of 3 mg/l because above that limit a significant number of people can detect zinc by taste.



Fig. 4.18 – Spatial distribution of Zinc concentration down the Revuè river. I - Upstream of the mining area; II – Within the mining area; III - Downstream of the mining area; RV - Reference Value (Site 1).

ix) Cadmium

Cadmium is the sixty-seventh most abundant element in the earth's crust. Generally, cadmium is present in zinc ore minerals such as sphalerite and is recovered from some copper ores during smelting and refining (Hem, 1985). Chemically, cadmium is very similar to zinc, and these metals undergo geochemical processes together. Both metals are found in water in the +2 oxidation state (Manahan, 1990)

The equilibrium solubility of cadmium carbonate was suggested by Hem (1985) as a possible limit for concentrations in natural water. The typical prevalent content for cadmium in river waters, dissolved and particulate bound, is $<0.05 - 0.2 \mu g/l$. In the Revuè river water the concentrations of cadmium range from 0 to $0.0027 \text{ mg/l} (2.7 \mu g/l)$ (Fig. 4.19). The distribution of Cadmium appears to be unrelated to mining activity as the highest recorded value occurs at site 1 which was chosen as a background reference value to the pristine nature of the site. Cadmium may be co-precipitated with manganese oxide or adsorbed on mineral surfaces (Stoeppler, 1992) such as calcite (Drever, 1997).

The cadmium recommended value for drinking water set by WHO is 0.005 mg/l. In the Revuè

river cadmium is not a cause of concern. According to present knowledge cadmium is not essential for plants, animals and man. Higher doses of cadmium from ingestion and inhalation can cause toxic effects for humans. Acute effects include high blood pressure, destruction of testicular tissue, destruction of red blood cells and the respiratory and digestive tracts. Cadmium accumulates predominantly in the kidneys with a biological half-life of between ten to twenty years.



Fig. 4.19 – Spatial distribution of Cadmium concentration down the Revuè river. I - Upstream of the mining area; II – Within the mining area; III - Downstream of the mining area; RV - Reference Value (Site 1).

x) Molybdenum

Molybdenum is a rather rare element. Its source is sulfide molybdenite, MoS_2 and is an accessory element in many metal ores. Soluble molybdates may be produced in oxidized sectors of these deposits and may appear in detectable concentrations in stream water, sediments, ground water and vegetation at considerable distances from their source. Molybdenum occurs in oxidation states ranging from Mo^{3+} to Mo^{6+} , but the most common solid and aqueous species contain Mo^{4+} and Mo^{6+} (Hem, 1985). In oxidising conditions the predominant oxidation state is Mo^{6+} , which forms molybdate anions in water. Other molybdate species found in water of different pH conditions are H_2MoO_4 (aq) (pH 2), $HMoO_4^-$ (pH 2 to pH 5) and MoO_4^{2-} (above pH 5) (Hem, 1985).

Molybdenum has a relatively high geochemical mobility, i.e., a tendency to enter into solution in water under normal Earth-surface conditions. River water from areas not affected by pollution sources generally have less than 1 μ g/l molybdenum (Hem, 1985). In the Revuè river

concentrations of 0 to 0.0081 mg/l were measured. Like cadmium, the distribution of molybdenum appears unrelated to any mining activity as only one site (site 10) exceeds the background reference value. The higher concentration at site 10 is also unrelated to lithology as generally the highest molybdenum values are associated with granitic rocks (Table 4.2) and site 10 is underline by carbonate rocks. The reduction in concentration downstream of site 10 could be related to precipitation and adsorption. Hem (1985) stated that solubility control of molybdenum concentration could include precipitation with common metals as metals molybdates and referenced other authors saying that the downstream attenuation of molybdenum in water and sediment is attributed to adsorption by amorphous ferric oxyhydroxide. Furthermore, Alloway & Ayres (1993) state that molybdenum can be adsorbed and co-precipitated with hydrous oxides of iron in both sediments and soils.

The upper molybdenum concentration limit for drinking water is 0.05 mg/l. Values measured in the Revuè river never exceeded this value.



Fig. 4.20 – Spatial distribution of Molybdenum concentration down the Revuè river. I - Upstream of the mining area; II – Within the mining area; III - Downstream of the mining area; RV - Reference Value (Site 1).

vii) Lead

Although lead rarely occurs naturally in its elemental state, man throughout history has used it. One reason for this is that its principal ore, lead (II) sulphide known as galena, is easily recognised (Hill, 1992). Lead is comparable in abundance to cobalt and is rather widely dispersed in sedimentary and granitic rocks. Its natural mobility is low, however, owing to the low solubility of lead hydroxy carbonates (Hem, 1985).

The principal dissolved inorganic forms of lead are the free ion Pb²⁺, hydroxide complexes, and, probably, the carbonate and sulphate ion pairs. Lead from leaded gasoline is a major source of atmospheric and terretial lead and much of this lead eventually enters natural water systems. The dissolved lead concentrations of surface waters depend on the dry fallout and rainout of particulate lead especially in areas of heavy automobile traffic (Hem, 1980; Manahan, 1990). This is not the situation of Manica, therefore the lead concentration in the water comes from the rocks.

The lead values measured in the Revuè river water are between 0.005 and 0.053 mg/l. The lowest concentrations are found upstream of the mining area underlain by ultramafic rocks which have low lead concentrations (Fig. 4.21). At site 8, where the river water crosses metasedimentary rocks, the highest concentration of lead was measured. At this site the most intense artisanal gold mining occurs leading to the disturbance of sediments and releasing clay and silt particles to the water. This can facilitate the dissolution of the metal in the water. Downstream of site 8, the concentration of lead drops slightly as the river flows over basic and ultrabasic rocks. This decrease may be due to co-precipitation of lead with manganese oxide dissolved from the basic and ultrabasic rocks. The lead concentration rises again in the Chicamba Dam. The Chicamba Dam receives water from the Messica, Zonuè and Nhamanguena rivers which run over granitic rocks. As granitic rocks contain relatively high concentrations of lead, dissolution of granite may account for the increase in lead concentration in the dam.

The recommended lead concentration for drinking water set by the WHO in 1996 is of less than 0.01 mg/l. Within and downstream of the mining area the lead concentrations are higher than this value. This water is used as potable water in Chimoio City. Exposure to low concentrations of lead in drinking water leads to detectable increase in blood lead levels. It causes severe dysfunction in the kidneys, reproductive system, liver, and the brain and central nervous system. Possible neurophysiological effects influencing learning ability (mental retardation) and general behaviour in children can occur (Manahan, 1990; Packham, 1993).

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Fig. 4.21 – Spatial distribution of Lead concentration down the Revuè river. I - Upstream of the mining area; II – Within the mining area; III - Downstream of the mining area; RV - Reference Value (Site 1).

4.2 ASSESSMENT OF WATER QUALITY

4.3.1 Water Quality Within the Mining Area

The data collected during this study show that generally the highest concentration of all determinands are found in the lower part of the mining area, i.e., between sites 7 and 9 (Fig. 1.2, p. 6). Figures 4.1 to 4.21 illustrate the spatial changes of the study parameters down the Revuè river and clearly show the sites where the highest inputs, increases and reductions occur.

The highest concentration of TDS and electrical conductivity occur at site 8 with values of 191.16 mg/l and 308,65 μ S/cm respectively. Alkalinity is highest at site 9 (61.6 mg/l) reflecting the carbonate nature of rocks at this site. The highest turbidity also occurs at site 9 (142 NTU) (Table 4.1, p. 21). This represents 28 times more the recommended turbidity in the standards for potable water, which is 5 NTU.

The small variations in the total metal concentrations within the mining area can be attributed to sediment loads from the mining sites and the dilution by Revuè river water and affluents and by the adsorption and precipitation capacity of the sediments. According to Bourg (1995) there are three processes that influence metal concentration in rivers:

1 - Dilution. The variations in dissolved metal concentration are given by loads from both diffuse and point sources, and dilution with river water.

2 - Dilution plus sediment transport. The exchange of contaminant sediments due to scour and desorption influences total metal concentration (dissolved+adsorbed) in the water column.

3 - Dilution plus adsorption/desorption equilibria. The application of the previous two approaches is justified if the degradation rate of the metals is negligible and metal concentration are the same in the water and sediment bed and there are no adsorption or desorption.

Between sites 8 and 9 the Revuè river receive water from the Inhamazonga river (Fig. 1.2, p. 6) (Table 4.3), a tributary on which there is no mining activity and which has very clear water. This water has a dilution effect in the Revuè river which is seen in some water parameters, e.g., there is a reduction of conductivity (from 308,65 to 285,6 μ S/cm), in TDS (from 191,16 to 138,06 mg/l) and in some metals concentrations (Cr, As, Fe, Ni, Pb and Zn). This breaks the general trend within the mining area of increasing concentrations downstream.

Site	15	16	17	18	19
Al (mg/l)	0,03	0,08	0,04	0,04	0,04
As (mg/l)	0	0,013	0,019	0,028	0,0021
Ba (mg/l)	0,06	0,09	0,12	0,27	0,14
Ca (mg/l)	3,9	5,6	5	9,4	7,7
Cd (mg/l)	0,0022	0,00029	0,0041	0,00076	0,00096
Co (mg/l)	0	0	0,0029	0,023	0,026
Cr (mg/l)	0,0068	0,0094	0,0063	0,0068	0,0078
Cu (mg/l)	0	0,04	0	0,01	0,01
Fe (mg/l)	0,06	0,07	0,11	0,07	0,2
Mg (mg/l)	2,7	5,7	4,6	9,8	7,8
Mn (mg/l)	0,016	0,022	0,21	0,17	0,33
Mo (mg/l)	0,006	0,004	0,0046	0,0031	0
Ni (mg/l)	0,00003	0,0094	0,00032	0	0,0025
Pb (mg/l)	0	0	0,015	0,0099	0,0034
Sr (mg/l)	0,01	0,02	0,02	0,07	0,03
Zn (mg/l)	0	0	0	0	0

Table 4.3 – Concentration of metals in the main Revuè river affluents immediately before flowing into the Revuè river.

Site 15 – Nhamatsambe river; Site 16 – Nhahombwè river; Site 17 – Chua river; Site 18 – Zambuzi river; Site 19 – Inhamazonga river.

In contrast, when the Chua and Zambuzi rivers, both of which have mining activities along their banks, enter the Revuè river, between sites 6 and 8, there is an increase in turbidity (14.7 at site 7 to 59.1 NTU at site 8), in alkalinity (from 43,6 to 52 mg/l), in conductivity (from 236,59 to 308.65 μ S/cm), in TDS (from 116,82 to 191,16 mg/l) and in metal concentrations such as Ba, Ca, Cr, K, Mg, Mn, Na, Ni, Pb, Sr and Zn.

Overall it is apparent from Figs. 4.4 to 4.21 that, with the exception of Cd, Ni and Mo, total concentration of all metals are higher within the mining area, than the natural background water quality in the Revuè river (water upstream of the mining area). While changes of lithology along the river and the inputs from affluents may increase the concentration of some elements (Ba, Ca, Cr, Co, As, Cu, Fe, Al, K, Mg, Mn, Na, Pb, Sr and Zn), it is likely that the increase in total metal concentration can be largely attributed to the alluvial gold mining activity. The washing of auriferous gravel can facilitate the dissolution of metals in the water. Table 4.4 shows the percentage difference in metal concentrations at site 9 compared to site 1, site 9 being considered the site most affected by mining. Percentage increases range from 26.8 % for sodium to 900% for cobalt. Within the mining area, the metals are being mobilized at rates greatly exceeding those of natural geologic processes.

Metals	Upstream (I)	Within (II)	Downstream (III)	Variation rate (%)		
	Site 1 (mg/l)	Site 9 (mg/l)	Site 14 (mg/l)	From I to II	From II to III	
Al	0,04	0,06	0,13	50	116.67	
As	0,011	0,004	0	-63.64	-100	
Ba	0,09	0,17	0,19	88.89	11.76	
Ca	3,8	7,2	5,2	89.47	-27.78	
Cd	0,0027	0,00032	0,00053	-88.15	65.63	
Co	0,0024	0,024	0,0038	900	-84.17	
Cr	0,0064	0,0047	0,0024	-26.56	-48.94	
Cu	0	0	0,02	0	100	
Fe	0,02	0,05	0,03	150	-40	
K	0,3957	0,7644	2,5989	93.18	239.99	
Mg	3,1	7,6	3,5	145.16	-53.95	
Mn	0,024	0,2	0	733.33	-100	
Mo	0,0065	0,0055	0	-15.38	-100	
Na	4,1	5,2	4,8	26.83	-7.69	
Ni	0,0018	0	0,0011	-100	100	
Pb	0,0096	0,027	0,037	181.25	37.04	
Sr	0,02	0,04	0,05	100	25	
Zn	0	0	0,02	0	100	

Table 4.4 – Comparison of metals concentrations between the reference sites of the three areas of the Revuè river.

Negative signal (-) symbolize the reduction of the concentration.

The alluvial gold mining increases the amount of clay and silt suspended particles in the river water which becomes cloudy. The suspended solid surfaces (particles and colloids) in water have been demonstrated by Lacerda & Salomons (1991) as the main transport pathway of various trace elements and by Filella *et al.*, (1995) as playing a prominent role in controlling the concentration of dissolved trace elements. Suspended clays and silt are, thus, important

components of aquatic systems because they influence the water composition. That is possible because they have a high sorptive capacity for many chemicals.

Cd, As, Cr, Ni and Mo show a percentage decrease at site 9 compared to site 1. The percentage decrease for Cr is misleading as the highest Cr concentrations are found within the mining area. The decrease metals concentration at site 9 could be due to either removal of these elements from the water by precipitation reactions or by adsorption by clay and silt particles. Chemical equilibrium modelling predicts that As and Ni would be removed by adsorption while Cr would be removed by precipitation processes. This will be discussed more fully in Chapter 5. The percentage decrease for Ni and Cd is real, as the highest values of these elements are found upstream of the mining area.

Table 4.4 also shows the percentage difference in total metal concentrations at site 14 (Chicamba Dam) compared to site 9. This will be discussed in Section 4.3.2. Al, Ba, Cd, Cu, K, Ni, Pb, Sr and Zn show a percentage increase compared to the water in the mining area. Most of these increases can be attributed to the acid nature of granite and granitoid rock at site 14. As, Ca, Co, Cr, Fe, Mg, Mn, Mo and Na all show a percentage decrease compared to the water in the mining area.

In the mining area the concentrations of Al, As, Ca, Cd, Cr, Cu, Fe, K, Mg, Mo, Na, Ni, and Zn are lower than the WHO standards for drinking water while Ba, Mn and Pb are higher (Table 4.1, p. 21). The water within the mining area is thus not recommended to be used as potable water, without prior treatment (Chapter 6).

4.3.2 Water Quality Downstream of the Mining Area

Site 14, in the Chicamba Dam was selected as being typical of water quality downstream of the mining area (Figure 1.2, p. 6). Presently this water is used as potable water in Chimoio city. This dam is located 42 km downstream from the mining area and receives large amount of clay and silt sediments released to the water during the gold mining activities. Water from other rivers, such as the Messica, Zónuè and Nhamanguena (Figure 1.2, p. 6) which have no any mining activity along their courses and which run over the Granite-gneiss Complex also enter the dam. The chemical composition of the water in these rivers will differ from the rivers underlain by rocks of the Manica greenstone belt and will influence the water chemistry in the dam.

The impounded water in the Chicamba Dam influences the water flow in the Revuè river, beginning at its confluence with the Messica river. The water flux becomes slow. From this

confluence to the Chicamba Dam the quiescent of water allows the sedimentation of suspended clay and silt particles which is reflected directly in the reduction of turbidity. The sedimentation of suspended material causes accelerated silting and depth reduction of the Chicamba Dam. This has implications for the life expectance of the reservoir (Cook & Doornkamp, 1990). The sediments bury organisms of small dimensions in the river banks and in the Chicamba Dam, eliminating some species, and causing reduction in the biodiversity.

The turbidity of water in the Chicamba Dam, at site 14 is 1.42 NTU, the concentration of TDS is 106.2 mg/l and the electric conductivity is 218.20 μ S/cm (Table 4.1, p. 21).

The impoundment of water will also have an effect on metals concentrations. Dilution can occur in the dam and settling of metal-contaminated solids has a much higher likelihood of occurring in the dams than along the river channel itself, both during high flow and low flow periods, as turbulence effects are smaller (Novotny, 1995). Inspection of Figs. 4.4 to 4.21 and Table 4.4 show that the concentration of Ca, As, Co, Cr, Fe, Mg, Mn, Mo and Na drop significantly from site 9 to site 14 in the Chicamba Dam. The percentage decrease for As is misleading as the highest concentrations of As in the area do occur downstream of the mining area (Fig. 4.11). Cd, Ni and Cu show a percentage increase at site 14 compared to site 9. This is also misleading as the highest values of Ni and Cd occur upstream of the mining area (Figs. 4.13). The spatial distribution of copper along the river is erratic (Fig. 4.16).

This reduction in the concentrations of Co, Cr, Cu, Fe, Mn, Mo, Na and Ni may be a result of precipitation and/or adsorption and coprecipitation with hydrous oxides of iron and manganese into sediments. The relative importance of precipitation and adsorption is discussed in Chapter 5. Adsorption occurs when a dissolved ion or molecule becomes attached to the surface of a pre-existing solid substrate generally by complexation with the surface sites. Coprecipitation occurs when a dissolved specie is incorporated as a minor component in a solid phase which itself is being precipitated (Drever, 1997). The extent to which metals are adsorbed depends on the properties of the metal concerned (valency, radius, degree of hydratation and coordination with oxygen), the physico-chemical environment (pH and redox status), the nature of the adsorbent (permanent and pH dependent charge, complex forming ligands), other metals present and their concentrations and the presence of soluble ligands in the surrounding fluids (Alloway & Ayres, 1993).

Alloway & Ayres (1993) report that V, Mn, Ni, Ca, Zn and Mo are believed to co-precipitate with hydrous Fe oxides while Fe, Ca, Ni, Zn and Pb are believed to co-precipitate with Mn oxides. The reductions in metal concentrations in the Chicamba Dam are also consistent with

the work of Rose *et al.* (1979) where it is shown that at pH values of between 6.5 and 8, values found in the Revuè river, large quantities of Ba, Ca, Co, Cu, Mg, Mn, Ni, Sr and Zn can be adsorbed (Fig. 4.22). The reduction of Ca and Mg may be due to chemical precipitation of Ca and Mg carbonates in the water column to form particles and colloids (Filella *et al.*, 1995) while the reduction of Cd may be due to the adsorption by calcite surfaces (Drever, 1997). In this way the elements are removed by sedimentation after incorporation on to or into particles. Particles deposited in this way into water, either react with the constituents of the water or settle to the bottom where they react with sediments (Alloway & Ayres, 1993). The Chicamba Dam therefore acts as a sink for metals, as the particles surfaces deposited in the dam are important scavengers for heavy metal ions in natural water systems because of their ability to compete with soluble complexing agents for metal ions (Bourg, 1988).



Fig. 4.22 – Adsorption of divalent cations on MnO as a function of pH. (A) alkaline earth; (B) transition metals. Cation concentration = 10^{-3} (From Rose *et al.*; 1979).

The concentrations of Al, Ba, K, Pb and Sr at site 14 (Chicamba Dam) show an increase compared to site 9 within the mining area (Table 4.4). The highest As concentrations of are also found downstream of the mining area but not at site 14. The Chicamba Dam receive water from Messica, Zónuè and Nhamanguena rivers that cross the Granite-gneiss Complex (igneous acid rocks). The increase in concentration of these metals may therefore be a result of the input of water that has crossed these acid rocks. Acid rocks are relatively enriched in these elements compared to basic and ultrabasic rocks which predominantly compose the Manica greenstone belt (Table 4.2, p. 23).

The concentration of Al, As, Ca, Cd, Cu, Cr, Fe, K, Mg, Mo, Mn, Ni, and Zn are lower than the WHO standards for drinking water but Ba and Pb have concentrations higher than these standards (Table 4.1, p. 21). Thus, the water in the Chicamba Dam is not recommended for use as potable water without prior treatment.

CHAPTER FIVE

5. DISTRIBUTION AND FATE OF POLLUTANTS

Natural waters are extremely complex environments. They contain not only most elements in the periodic table, but also dissolved organic matter of largely unknown composition, and colloidal and particulate material, both inanimate and living (Turner, 1993).

The trace metals in the aquatic environment are present in a number of different chemical forms as a result of the interactions between metal ions and other species in solution such as complexing anions and the acidity or redox properties of the system. Some trace metals may be presented in more than one oxidation stage dependent on the redoxpotential. Most trace metals are able to form complexes, which may either be labile or inlabile. Furthermore, the trace metals may be adsorbed to suspended matter and colloids and can form precipitates (Fig. 5.1).



Fig. 5.1 – Geochemical speciation of heavy metals (All of these processes are prone to concurrent reactions with other cations, including H⁺) (From Bourg, 1995).

The chemical or physical form in which an element is present is called its speciation (Howard, 1998) which is used in a vague manner both for the operational procedure for determining typical species in environmental samples and for describing the distribution and transformation of such species in various media (Förstner, 1990). Species has been defined as the molecular representation of a specific form of an element. The importance of understanding the speciation

of an element is that the environmental pathway, mobility and toxicity of an element are strongly dependent upon the speciation of the element concerned. The differences in speciation can arise from a number of different causes. An element's speciation is governed by the environment in which it is present. However, any pollutant metal discharged to the aquatic environment enters a complex biogeochemical cycle, and predicting its fate requires multidisciplinary modelling of that biogeochemical cycle and its constituent physical, chemical and biological processes (Turner, 1993). The aim of this chapter is to examine the distribution and fate of pollutants using a geochemical speciation computer model. If all possible physical, chemical and biological processes of trace metal in the aquatic environment should be considered in the development of a model, it would be a very complex model. Jørgensen (1990) suggests that heavy metal pollution may be described by use of 5 submodels: a distribution model, a model of metal speciation, a model for release of metal from sediment, a model related to the metal concentration in biota and an effect model. For this study the metal geochemical speciation computer model MINTEQA2 was used to examine the distribution and fate of pollutants. MINTEQA2 incorporates 3 of the submodels of Jørgensen, namely a distribution model, a model of metal speciation and a model for release of metal from sediment.

5.1 MINTEQA2

MINTEQA2 is a geochemical speciation model based on equilibrium thermodynamics which can calculate the equilibrium composition of dilute aqueous system amongst soluble, solid, adsorbed and gas phases. It was developed by the United States Environmental Protection Agency (USEPA). Calculations can be performed to take into account varied environmental conditions such as pH, ionic strength, temperature and redox conditions. The program also includes an extensive thermodynamic database, for soluble complexes, mineral solubilities, gas solubilities and redox couples. In addition the program contains a database of metal surface complexation constants for the diffuse-double-layer model (DDLM) and also complexation constants for a humic distribution model for metal complexation with dissolved organic matter (DOM). For input of problems the input files can be created interactively with the program PRODEFA2. All the database information can be edited by the user (Lumsdon & Evans, 1995).

To describe the input problem the program uses the concepts of components and species defining the equilibrium problem namely the mass action equations, mass balance equations, the concept of chemical components, the equilibrium problem matrix and the proton balance and electrical neutrality. MINTEQA2 uses a list of current components but the user, however, can also define new components and reaction stoichiometries and change the thermodynamic data. The input of the problem requires total analytical concentrations of the selected components.

Total concentrations of elements (components) from chemical analysis such as ICP and atomic absorption are preferable to methods that only measure some fraction of the total such as selective colorimetric or electrochemical methods. The user defines how the activity coefficients are to be computed (Davis equation or the extended Debye-Huckel), the temperature of the system and whether pH, Eh and ionic strength are to imposed or calculated. Once the total concentrations of the selected components are defined, all possible soluble complexes are automatically selected from the database. At this stage the thermodynamic equilibrium constants supplied with the model may be edited or certain species excluded from the calculation (e.g. species that have slow reaction kinetics). In addition, it is possible for the user to supply constants for specific reactions not included in the database, but care must be taken to make sure the formation equation for the newly defined species is written in such a way as to be compatible with the chemical components used by the rest of the program (Lumsdon & Evans, 1995).

Another useful feature of MINTEQA2 is the range of adsorption models available. These include adsorption isotherm approaches, cation exchange equilibria and three surface complexation models. The surface complexation models are the constant capacitance model (CCM), diffuse-double-layer model (DDLM) and the triple-layer model (TLM).

The results from a MINTEQA2 calculation are read to an output file which can be viewed by a text editor. The format of this file can be preselected to vary the amount of detail given. Multiple output files can be created in which one of the inputs files is systematically varied by selecting the use of the "sweep" option (Lumsdon & Evans, 1995).

5.2 REVUÈ WATER MODELLING PROCEDURE

In order to describe the water quality in the Revuè basin, the study area was divided in three parts; upstream of, within and downstream of the mining area. The same sub divisions have been used to model water quality. Site 1 was selected to represent the water quality upstream of the mining area; site 9 to represent water quality within the mining area; and site 14 located in the Chicamba Dam to represent water quality downstream of the mining area. The composition of the water at these sites is shown in the Table 4.1 (p. 21).

In order to model the water quality was necessary to make some simplifying assumptions:

1 - A chemical equilibrium model is a suitable approximation. The simplest process that might regulate the concentration of a trace element in solution is equilibrium with respect to a solid phase containing the element as a major component (Drever, 1997).

2 - The river water will be in equilibrium with the atmospheric oxygen and carbon dioxide. The turbulence of water facilitates the oxygen dissolution in the water.

3 - The oxidising environment and the introduction of redox pair can lead to precipitation of some trace metals.

4 – For the adsorption, the iron and manganese oxyhydroxides are the adsorbing phases and the FEO-DLM.DBS database will be used as contains surface complexation reactions applicable to diffuse layer model.

The mobility of trace metal pollutants depends on a more or less complex network of interactions between aqueous and heterogeneous chemical reactions as well as particle coagulation and flocculation phenomena. Hydrolysis and dissolved complexation tend to increase the solubility of trace metals while precipitation and adsorption will delay metal availability and transport (Fig. 5.1, p. 61). The distribution of a metal between its various possible species is a result of a series of heterogeneous and dissolved chemical reactions.

For each site four modelling runs were undertaken to allow the program to run without a phase rule violation.

In the first run MINTEQA2 was used as a speciation-saturation program only, with the total concentrations of the water quality variables as the input. This has two purposes: (1) to see which phases are supersaturated and hence are likely to precipitate, and (2) to convert the alkalinity input into total concentration of carbonate species and the concentration of the component H⁺ (Drever, 1997). In this initial run the oxidation state of the Fe, Mn and Cr in the analysis was also decided upon. These elements were entered into the program as Fe²⁺, Mn²⁺ and Cr(OH)₂ (reduced species) which are probably their actual form despite that in air saturated fresh waters, all trace elements should be in their maximum oxidation states, because the redox potential of the O_2/H_2O complex is higher than that of any other complex (Lumsdon & Evans, 1995). This water should be in equilibrium with atmospheric oxygen and contain close to the maximum dissolved oxygen possible due to the turbulent flow. The reason for entering these elements in their reduced form was that the water samples were filtered using 0.45 µm Millipore membrane filter. Thus, any oxides or oxyhydroxides of these elements which could have been present in the water as colloidals or suspended solids have been removed. After filtering the samples were also acidified, thus any dissolved Fe, Mg and Cr reported in the chemical analysis are likely to be in reduced state. No post precipitation was noted in the sample bottles. In the initial run the water was specified to be in equilibrium with CO2 gas phase at partial pressure of 3.10^{-4} atm and O₂ at fixed partial pressure of 0,21 atm.

In the second run the components of the first run were called as a seed file and the total carbonate concentration obtained in the output file of the first run was entered as a component. Saturated solids were allowed to precipitate as it is known that the precipitation limits metal solubility.

In the third run, the redox pairs for Fe and Mn were imposed on the model. With fixed redox ratio imposed, MINTEQA2 calculates the concentration of species present in the reduced and in the oxidised state.

In many aqueous environments the distribution of metals, particularly the trace metals, is regulated by adsorption/desorption reactions occurring at the interface between the aqueous solution and particulate matter such as mineral particles, organic matter or living cells (Fig. 5.2). Thus, in the fourth run the effect of solid surface adsorption was considered, assuming that for natural water systems the binding capacity of sediments is controlled largely by a surface layer of amorphous ferric hydroxide which forms a coating on inorganic support particles (Luoma & Davies, 1983; Kerr 1994)).

Adsorption by iron and manganese oxyhydroxides in particular, is probably the most important process in maintaining the concentrations of trace elements at levels far below those predicted by equilibrium solubility calculations. They have extremely high adsorption capacities and high adsorption affinities for many metals. MINTEQA2 provides a separate database file, FEO-DLM.DBS, which contains surface complexation reactions that are applicable to the diffuse layer model for adsorption of some metals and ligands onto the iron oxide surface (Kerr, 1994).

The properties of the iron hydroxide layer for which the FEO-DLM.DBS database can be attached to the diffuse layer adsorption model are:

Solids concentration of 3,422 g/l and with an amorphous iron concentration of 0,721 mg/g. Specific surface area = 600 m^2 /g. High energy site density = 1,922. 10^{-4} moles/l. Low energy site density = 7,690. 10^{-3} moles/l.

Distribution and fate of pollutants



Fig. 5.2 – Schematic representation of internal processes that influence the concentrations of trace elements in a water system (From Tessier *et al.*, 1994).

5.3 REVUÈ WATER MODELLING RESULTS

From the modelling process were obtained large output files. Part of the output files from Run 1 is shown in Table 5.1. As all components are 100 % dissolved in the water in all sites, only the output file of site 14 (Chicamba Dam) is presented as an example. The complete output files of all sites are presented in the Appendix I.

Table :	5.1– Output f	ile from th	e MINTEQA2	for the Sit	e 14 after	Run 1(solids not	allowed t	o precipitate).
]	he output file	e has been	condensed for	this table.	Extended	output	files are i	n the App	pendix I.

-							
			PART 5 c	f OUTPUT FI	LE		
		EQUILI	BRATED MA	ASS DISTRIBU	JTION		
IDX	NAME	DISSOLVED		SORBE	D	PRECIPITATED	
		MOL/KG	PERCENT	MOL/KG	PERCENT	MOL/KG	PERCENT
800	Sr+2	5.707E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
950	Zn+2	3.060E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
30	A1+3	4.818E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
100	Ba+2	1.383E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	1.297E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
160	Cd+2	4,715E-09	100.0	0.000E-01	0.0	0.000E-01	0.0
211	Cr(OH)2+	2.790E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
231	Cu+2	3.147E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
280	Fe+2	5.372E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	6.647E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	1.440E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	2.088E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
540	Ni+2	1.874E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
600	Pb+2	1.786E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
1	E-1	0.000E-01	0.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	2.144E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	2.067E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
2	H20	1.765E-05	100.0	0.000E-01	0.0	0.000E-01	0.0

Parts of the output files from Run 2 are shown in Tables 5.2, 5.3 and 5.4. In all sites MINTEQA2 predicts that the metal Cr should be 100 % precipitated; Al 99,9 % precipitated and Mn more than 95,5 % precipitated. The percentage of Fe predicted to precipitate varies from 2,6 % in the sample from site 14 to 10,4 % in the sample from site 1. The remaining metals are all predicted to be present as dissolved species.

Table 5.2 – Output file from the MINTEQA2 for the Site 1 after Run 2 (solids allowed to precipitate). The output file has been condensed for this table. Extended output is in the Appendix I.

	all and the second second second second						
			PART 5 c	of OUTPUT FI	LE		
		EQUILI	BRATED MA	ASS DISTRIBU	JTION		
IDX	NAME	NAME DISSOLVED		SORBE	D	PRECIPITATED	
		MOL/KG	PERCENT	MOL/KG	PERCENT	MOL/KG	PERCENT
800	Sr+2	2.283E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
540	Ni+2	3.066E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
60	H3AsO3	8.734E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
100	Ba+2	6.553E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	9.481E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
160	Cd+2	2.402E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
211	Cr(OH)2+	6.520E-12	0.0	0.000E-01	0.0	7.436E-08	100.0
600	Pb+2	4.634E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	1.012E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	1.275E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	1.783E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
470	Mn+2	1.947E-08	4.5	0.000E-01	0.0	4.174E-07	95.5
30	A1+3	2.623E-09	0.2	0.000E-01	0.0	1.480E-06	99.8
1	E-1	-8.655E-11	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	1.130E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
280	Fe+2	3.209E-07	89.6	0.000E-01	0.0	3.718E-08	10.4
2	H2O	1.474E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	1.233E-04	100.0	0.000E-01	0.0	0.000E-01	0.0

Table 5.3 – Output file from the MINTEQA2 for the Site 9 after Run 2 (solids allowed to precipitate). The output file has been condensed for this table. Extended output is in the Appendix I.

			PART 5 c	of OUTPUT FI	LE		
		EQUILI	BRATED MA	ASS DISTRIBU	JTION		
IDX	NAME	DISSOL	VED	SORBE	D	PRECIPITATED	
		MOL/KG	PERCENT	MOL/KG	PERCENT	MOL/KG	PERCENT
800	Sr+2	4.565E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	2.262E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
60	H3AsO3	3.176E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
100	Ba+2	1.238E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	1.796E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
160	Cd+2	2.847E-09	100.0	0.000E-01	0.0	0.000E-01	0.0
211	Cr(OH)2+	2.441E-12	0.0	0.000E-01	0.0	5.464E-08	100.0
600	Pb+2	1.303E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	1.955E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	3.126E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
470	Mn+2	8.473E-09	0.2	0.000E-01	0.0	3.632E-06	99.8
30	A1+3	3.333E-09	0.1	0.000E-01	0.0	2.220E-06	99.9
1	E-1	-1.324E-10	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	1.809E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
280	Fe+2	8.680E-07	96.9	0.000E-01	0.0	2.732E-08	3.1
2	H2O	2.207E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	1.911E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
			PART 5 0	f OUTPUT FI	LE		
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		EQUILI	BRATED MA	ASS DISTRIBU	JTION		
IDX	NAME	DISSOL	DISSOLVED		D	PRECIPI	TATED
		MOL/KG	PERCENT	MOL/KG	PERCENT	MOL/KG	PERCENT
950	Zn+2	3.060E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
600	Pb+2	1.786E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
100	Ba+2	1.383E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	1.297E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
160	Cd+2	4.715E-09	100.0	0.000E-01	0.0	0.000E-01	0.0
211	Cr(OH)2+	1.988E-12	0.0	0.000E-01	0.0	2.790E-08	100.0
231	Cu+2	3.147E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
800	Sr+2	5.707E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	6.647E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	1.440E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	2.088E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
540	Ni+2	1.874E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
30	A1+3	3.331E-09	0.1	0.000E-01	0.0	4.815E-06	99.9
1	E-1	0.000E-01	0.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	2.144E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
280	Fe+2	5.232E-07	97.4	0.000E-01	0.0	1.395E-08	2.6
2	H20	8.982E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	2.235E-04	100.0	0.000E-01	0.0	0.000E-01	0.0

Table 5.4 – Output file from the MINTEQA2 for the Site 14 after Run 2 (solids allowed to precipitate). The output file has been condensed for this table. Extended output is in the Appendix I.

The effect of imposing redox pairs on the model is shown in Tables 5.5, 5.6 and 5.7 which represent part of the output files of Run 3. MINTEQA2 predicts that all Iron would be in a ferric state and thus be precipitated. Some Manganese, Mn^{2+} would be converted to Mn^{3+} and be precipitated. Although the concentrations of Manganese in the water is extremely low and unlikely to exert any great control on the water chemistry, they have been included so as to indicate what the likely fate of Manganese would be if Manganese concentrations increase in the future. Chromium is predicted to be between 91,2 to 95,8 % precipitated and Aluminium to be between 99,8 to 99.9 % precipitated. Other metals remain dissolved in the water.

MINTEQA2 predicts that iron would be precipitated as hematite. The kinetics of this reaction are likely to be slow and it is more probable that iron is removed from the water as ferric hydroxide or particularly at site 9 as a carbonate as carbonate rocks are present at this site.

			PART 5 c	f OUTPUT FI	LE		
		EQUILI	BRATED MA	ASS DISTRIBU	JTION		
IDX	NAME	DISSOL	VED	SORBE	D	PRECIPI	TATED
		MOL/KG	PERCENT	MOL/KG	PERCENT	MOL/KG	PERCENT
540	Ni+2	3.066E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	1.783E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
60	H3AsO3	8.734E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
100	Ba+2	6.553E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	9.481E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
160	Cd+2	2.402E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
800	Sr+2	2.283E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
600	Pb+2	4.634E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	1.012E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	1.275E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
211	Cr(OH)2+	3.157E-09	4.2	0.000E-01	0.0	7.125E-08	95.8
470	Mn+2	4.205E-16	100.0	0.000E-01	0.0	0.000E-01	0.0
30	A1+3	2.623E-09	0.2	0.000E-01	0.0	1.480E-06	99.8
140	CO3-2	1.129E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
471	Mn+3	2.468E-27	0.0	0.000E-01	0.0	4.369E-07	100.0
280	Fe+2	5.543E-25	100.0	0.000E-01	0.0	0.000E-01	0.0
281	Fe+3	2.396E-15	0.0	0.000E-01	0.0	3.581E-07	100.0
1	E-1	-1.869E-18	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	1.233E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
2	H20	1.479E-07	100.0	0.000E-01	0.0	0.000E-01	0.0

Table 5.5 - Output file from the MINTEQA2 for the Site 1 after Run 3 (Fe and Mn redox pairs included).The output file has been condensed for this table.Extended output is in the Appendix I.

Table 5.6 – Output file from the MINTEQA2 for the Site 9 after Run 3 (Fe and Mn redox pairs included). The output file has been condensed for this table. Extended output is in the Appendix I.

			PART 5 c	f OUTPUT FI	LE		
		EQUILI	BRATED MA	ASS DISTRIBU	JTION		
IDX	NAME	DISSOL	VED	SORBE	PRECIPITATED		
		MOL/KG	PERCENT	MOL/KG	PERCENT	MOL/KG	PERCENT
500	Na+1	2.262E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
800	Sr+2	4.565E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
60	H3AsO3	3.176E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
100	Ba+2	1.238E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	1.796E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
160	Cd+2	2.847E-09	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	3.126E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
600	Pb+2	1.303E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	1.955E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
211	Cr(OH)2+	2.835E-09	5.2	0.000E-01	0.0	5.181E-08	94.8
470	Mn+2	9.604E-17	100.0	0.000E-01	0.0	0.000E-01	0.0
30	A1+3	3.333E-09	0.1	0.000E-01	0.0	2.220E-06	99.9
140	C03-2	1.809E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
471	Mn+3	6.572E-28	0.0	0.000E-01	0.0	3.641E-06	100.0
280	Fe+2	2.139E-25	100.0	0.000E-01	0.0	0.000E-01	0.0
281	Fe+3	2.047E-15	0.0	0.000E-01	0.0	8.953E-07	100.0
1	E-1	-1.501E-18	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	1.911E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
2	H20	2.183E-07	100.0	0.000E-01	0.0	0.000E-01	0.0

				E OUTDUM ET	TE		
			PART 5 0	I OUTPUT FI	.LE		
		EQUILI	BRATED MA	ASS DISTRIBU	JTION		
IDX	NAME	DISSOL	VED	SORBE	D	PRECIPI	TATED
		MOL/KG	PERCENT	MOL/KG	PERCENT	MOL/KG	PERCENT
800	Sr+2	5.707E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
600	Pb+2	1.786E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
100	Ba+2	1.383E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	1.297E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
160	Cd+2	4.715E-09	100.0	0.000E-01	0.0	0.000E-01	0.0
540	Ni+2	1.874E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
231	Cu+2	3.147E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
950	Zn+2	3.060E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	6.647E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	1.440E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	2.088E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
211	Cr(OH)2+	2.464E-09	8.8	0.000E-01	0.0	2.544E-08	91.2
280	Fe+2	1.448E-25	100.0	0.000E-01	0.0	0.000E-01	0.0
30	A1+3	3.331E-09	0.1	0.000E-01	0.0	4.815E-06	99.9
140	CO3-2	2.144E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
1	E-1	0.000E-01	0.0	0.000E-01	0.0	0.000E-01	0.0
281	Fe+3	1.495E-15	0.0	0.000E-01	0.0	5.372E-07	100.0
330	H+1	2.235E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
2	H2O	8.961E-07	100.0	0.000E-01	0.0	0.000E-01	0.0

Table 5.7 – Output file from the MINTEQA2 for the Site 14 after Run 3 (Fe redox pair included). The output file has been condensed for this table. Extended output is in the Appendix I.

The effect of adsorption on the water chemistry is shown in Tables 5.8, 5.9 and 5.10 which are part of the output files of Run 4. Cd, Zn, Cu, Pb, Ni and As are predicted to be almost totally removed from the water as adsorbed phases (Fig. 5.3a).

Table 5.8 – Output file from the MINTEQA2 for the Site 1 after Run 4 (adsorption included). The output file has been condensed for this table. Extended output in the Appendix I.

			PART 5 c	f OUTPUT FI	LE		
		EQUILI	BRATED MA	ASS DISTRIBU	JTION		
IDX	NAME	DISSOL	VED	SORBE	D	PRECIPITATED	
		MOL/KG	PERCENT	MOL/KG	PERCENT	MOL/KG	PERCENT
800	Sr+2	2.283E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
60	H3AsO3	5.682E-11	0.1	8.729E-08	99.9	0.000E-01	0.0
100	Ba+2	3.561E-07	54.3	2.992E-07	45.7	0.000E-01	0.0
150	Ca+2	7.321E-05	77.2	2.160E-05	22.8	0.000E-01	0.0
160	Cd+2	2.421E-11	0.1	2.400E-08	99.9	0.000E-01	0.0
600	Pb+2	6.537E-15	0.0	4.634E-08	100.0	0.000E-01	0.0
410	K+1	1.012E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	1.275E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	1.783E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
540	Ni+2	8.239E-11	0.3	3.058E-08	99.7	0.000E-01	0.0
211	Cr(OH)2+	3.156E-09	4.2	0.000E-01	0.0	7.125E-08	95.8
470	Mn+2	4.188E-16	100.0	0.000E-01	0.0	0.000E-01	0.0
30	Al+3	2.622E-09	0.2	0.000E-01	0.0	1.480E-06	99.8
140	CO3-2	1.128E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
280	Fe+2	5.521E-25	100.0	0.000E-01	0.0	0.000E-01	0.0
1	E-1	-1.867E-18	100.0	0.000E-01	0.0	0.000E-01	0.0
281	Fe+3	2.394E-15	0.0	0.000E-01	0.0	3.581E-07	100.0
471	Mn+3	2.446E-27	0.0	0.000E-01	0.0	4.369E-07	100.0
330	H+1	1.232E-04	86.7	1.887E-05	13.3	0.000E-01	0.0
2	H20	1.414E-07	91.2	1.362E-08	8.8	0.000E-01	0.0

			PART 5	of OUTPUT FI	LE		
		EQUILI	BRATED M	ASS DISTRIBU	JTION		
IDX	NAME	DISSOL	VED	SORBE	D	PRECIPI	TATED
		MOL/KG	PERCENT	MOL/KG	PERCENT	MOL/KG	PERCENT
800	Sr+2	4.565E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
60	H3AsO3	2.087E-11	0.1	3.174E-08	99.9	0.000E-01	0.0
100	Ba+2	5.010E-07	40.5	7.368E-07	59.5	0.000E-01	0.0
150	Ca+2	1.175E-04	65.4	6.217E-05	34.6	0.000E-01	0.0
160	Cd+2	1.612E-12	0.1	2.845E-09	99.9	0.000E-01	0.0
600	Pb+2	1.759E-14	0.0	1.303E-07	100.0	0.000E-01	0.0
410	K+1	1.955E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	3.126E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	2.262E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
211	Cr(OH)2+	2.833E-09	5.2	0.000E-01	0.0	5.181E-08	94.8
1	E-1	-1.498E-18	100.0	0.000E-01	0.0	0.000E-01	0.0
280	Fe+2	2.122E-25	100.0	0.000E-01	0.0	0.000E-01	0.0
470	Mn+2	9.528E-17	100.0	0.000E-01	0.0	0.000E-01	0.0
30	A1+3	3.331E-09	0.1	0.000E-01	0.0	2.220E-06	99.9
140	C03-2	1.804E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
281	Fe+3	2.044E-15	0.0	0.000E-01	0.0	8.953E-07	100.0
471	Mn+3	6.455E-28	0.0	0.000E-01	0.0	3.641E-06	100.0
330	H+1	1.907E-04	147.8	-6.168E-05	-47.8	0.000E-01	0.0
2	H20	2.020E-07	66.6	1.014E-07	33.4	0.000E-01	0.0

Table 5.9 – Output file from the MINTEQA2 for the Site 9 after Run 4 (adsorption included). The output file has been condensed for this table. Extended output in the Appendix I.

Table 5.10 – Output file from the MINTEQA2 for the Site 14 after Run 4 (adsorption included). The output file has been condensed for this table. Extended output in the Appendix I.

			PART 5	of OUTPUT FI	LE		
		EQUILI	PART 5 of OUTPUT FILE DISSOLVED SORBED PRECIPITATED MOL/KG PERCENT MOL/KG PERCENT MOL/KG PERCENT MOL/KG PERCENT .101E-07 29.6 9.734E-07 70.4 0.000E-01 0.0 .999E-05 53.9 5.975E-05 46.1 0.000E-01 0.0 .133E-11 0.0 3.059E-07 100.0 0.000E-01 0.0 .930E-12 0.0 3.147E-07 100.0 0.000E-01 0.0 .647E-05 100.0 0.000E-01 0.0 0.0 0.00E-01 0.0 .6440E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 .647E-05 100.0 0.000E-01 0.0 0.000E-01 0.0 .6440E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 .645E-11 0.2 1.870E-08 9.8 0.000E-01 0.0 .65E-11 0.2 1.870E-07 100.0 0.000E-01 0.0				
TDX	NAME	NAME DI SSOLVED		SORBE	D	DDECIDIWAWED	
1 Dir		MOL/KG	PERCENT	MOL/KG	PERCENT	MOL/KG	PERCENT
100	Ba+2	4.101E-07	29.6	9.734E-07	70.4	0.000E-01	0.0
150	Ca+2	6.999E-05	53.9	5.975E-05	46.1	0.000E-01	0.0
160	Cd+2	1.689E-12	0.0	4.714E-09	100.0	0.000E-01	0.0
950	Zn+2	3.133E-11	0.0	3.059E-07	100.0	0.000E-01	0.0
231	Cu+2	9.930E-12	0.0	3.147E-07	100.0	0.000E-01	0.0
410	K+1	6.647E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	1.440E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	2.088E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
540	Ni+2	3.365E-11	0.2	1.870E-08	99.8	0.000E-01	0.0
600	Pb+2	2.153E-14	0.0	1.786E-07	100.0	0.000E-01	0.0
800	Sr+2	5.707E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
211	Cr(OH)2+	2.463E-09	8.8	0.000E-01	0.0	2.544E-08	91.2
30	A1+3	3.327E-09	0.1	0.000E-01	0.0	4.815E-06	99.9
140	CO3-2	2.136E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
280	Fe+2	1.434E-25	100.0	0.000E-01	0.0	0.000E-01	0.0
1	E-1	0.000E-01	0.0	0.000E-01	0.0	0.000E-01	0.0
281	Fe+3	1.493E-15	0.0	0.000E-01	0.0	5.372E-07	100.0
330	H+1	2.235E-04	156.9	-8.101E-05	-56.9	0.000E-01	0.0
2	H20	2.845E-07	25.7	8.227E-07	74.3	0.000E-01	0.0

The concentrations of Ba and Ca in the water are predicted to be reduced (Fig. 5.3b) with the percentage Ba adsorbed ranging from 45,7 % at site 1 (Table 5.8) to 70,4 % at site 14 (Table 5.10) in the dam and the percentage Ca adsorbed ranging from 22,8 % at site 1 (Table 5.8) to 46,1 % at site 14 (Table 5.10).

Fe, Al, Cr and Mn concentrations are not affected by adsorption modelling and their concentration in the water remains controlled by precipitation processes rather than adsorption (Fig. 5.3c) as indicated by the fact that the percentage of these elements remaining in the water is zero after Run 2 (precipitation only) and/or Run 3 (precipitation and redox).



Fig. 5.3 – Elements with same behaviour in the modelling process of water of the site 14 (Chicamba Dam). (a) Predicted reduction in percentage of Cd, Cu, Ni, Pb and Zn dissolved in Chicamba Dam as a result of adsorption. (b) Predicted reduction in percentage of Ba and Ca dissolved in Chicamba Dam as a result of adsorption. (c) Predicted reduction of Al, Fe and Cr concentrations. As the percentage dissolved is zero after Run 2 and 3 the removal of these elements is controlled by precipitation rather than adsorption processes.

Adsorption processes therefore could have a great influence on the chemical composition of water in the Revuè river and have the potential to be responsible for removal of most trace elements from the water.

Comparison of predicted water quality (assuming control on the water chemistry by adsorption processes) and actual water composition (Table 5.11) suggests that adsorption may not be as effective process as predicted. This is particularly true for Ba and Pb, the two elements that are in excess of WHO recommended limits for drinking water. Concentration of other trace metals are negligible and below WHO recommendations.

Metals	Predicte	d Water	Actual water		
	Mol/kg	mg/l	Mol/kg	mg/l	
Ba	4.10E-07	5.60E-02	1.38E-06	1.90E-01	
Pb	2.15E-14	4.53E-09	1.78E-07	3.70E-02	
Cd	1.69E-12	1.93E-07	4.68E-09	5.30E-04	
Zn	3.13E-11	2.07E-06	3.09E-07	2.00E-02	
Cu	9.93E-12	6.47E-07	3.16E-07	2.00E-02	
Ni	3.37E-11	2.02E-06	1.86E-08	1.10E-03	

 Table 5.11 – Comparison of predicted water quality by MINTEQA2 with actual water quality in the Chicamba Dam (Site 14).

Förstner (1990) suggests that they are many factors affecting the distribution of trace metals between solution and particulate material in aquatic systems:

- chemical form of dissolved metal input both from natural and antropogenic sources.

- the type of interactive processes, i.e. either sorption/desorption or precipitation/dissolution controlled mechanism. Modelling Runs 2 and 3 indicate that neither Ba nor Pb takes part in precipitation processes.

- concentration and composition of particulate matter, mainly with respect to surface-active phases and grain size distribution. In the case of Ba and Pb the characteristics of the sediment in the Chicamba Dam may not be suitable to Ba and Pb adsorption or differ significantly from the sediments characteristics used by MINTEQA2.

Adsorption of trace metals onto inorganic solid surfaces is often only a temporary condition (Hownslow, 1995). Fluxes of trace elements across the solid-water interface occur in response to changing environmental conditions as they progress toward equilibrium. The remobilization of elements from solid phases (i.e. solubility, mobility desorption and bioavailability) would occur by four majors factors in aquatic environments (Förstner, 1990):

- 1 Lowering of pH.
- 2 An increase in complexation
- 3 Changing redox conditions
- 4 Increasing salinity

To investigate the effect of lower pH on the amount of metal predicted to be either adsorbed or precipitated, a series of modelling runs at different pH values were undertaken for the water in the Chicamba Dam (site 14). The output files of the modelling process are in the Appendix II. Table 5.12 and Fig. 5.4 show that at pH 6.5, which is the minimum pH value within the range recommended for drinking water, the adsorbed concentrations of Ba would drop from 70.4 to 2.7 %, Ca from 46.1 to 1.0 % and Ni from 99.8 to 94.4 %, increasing the dissolved metal concentrations. Pb and Cu would remain 100 % adsorbed while Cd and Zn would drop to 96.8 and 99.1 % respectively.

pH	6	6.5	7	7.6	8	8.5
Ni	65.1	94.4	99.3	99.8	99.8	99.8
Pb	100	100	100	100	100	100
Cu	99.9	100	100	100	100	100
Zn	92.2	99.1	99.9	100	100	100
Ba	0.3	2.7	19.2	70.4	90.8	98.6
Ca	0.1	1	7.6	46.1	78.7	96.5
Cd	76.9	96.8	99.6	100	100	100

Table 5.12 – Variations in metals percentage adsorbed with pH changes in the Chicamba Dam water (site 14) as predicted by MINTEQA2.



Fig. 5.4 – Variation of Ca, Ba and Ni concentrations adsorbed with changes in pH in the Chicamba Dam (site 14) as predicted by MINTEQA2.

For the metals whose concentrations is controlled by precipitation, i.e., Fe, Al and Cr, MINTEQA2 predicts that only Cr would be strongly influenced by the reduction of pH. Table 5.13 and Fig. 5.5 show that the concentration predicted to precipitate would drop from 91.6 (at pH 7.6) to 60.7 % (at pH 6.5).

pH	6	6.5	7	7.6	8	8.5
Fe	100	100	100	100	100	100
Cr	0	60.7	84	91.2	92.6	93.1
Al	99.9	100	100	99.9	99.9	99.7





Fig. 5.5 – Influence of different pH values in Cr precipitated concentrations in water for the Chicamba Dam (site 14) as predicted by MINTEQA2.

The redox conditions of any body of water are a function of the amount of dissolved oxygen. This in turn is dependent on the amount of organic matter in the water. The decay of organic matter will place a biological oxygen demand (BOD) on the water and lead to a decrease in dissolved oxygen (Hem, 1985).

The amount of organic matter in the Revuè basin is known to vary with season and therefore the dissolved oxygen content of the water will also vary with season. A decrease in dissolved oxygen could lead to the redistribution of iron and manganese and possibly the release of heavy metals formerly adsorbed on the hydroxides. To simulate the possible effects of changing redox conditions on the predicted percentage adsorbed or precipitated a number of modelling runs were undertaken at increasing dissolved organic matter concentrations. The output files of the modelling process are in the Appendix III. Table 5.14 and Fig. 5.6 show that the more dissolved organic matter present in the water, the lower the adsorbed metal concentrations will be. This is particularly true for Ba and Ca. Table 5.14 and Fig. 5.6 show that the percentage of Ba adsorbed would decrease from 24.5 to 3.6 % while the percentage of Ca adsorbed would decrease from 14.5 to 2 % if dissolved organic matter concentrations increased from 0.001 to 0.005 mol/l.

DOM (mol/l)	0.001	0.002	0.003	0.004	0.005
Cd	99.6	99	98.2	97.3	96.3
Ni	99.2	98.1	96.7	95.2	93.6
Pb	100	100	100	100	100
Cu	100	99.9	99.8	99.7	99.5
Zn	99.8	99.5	99.2	98.8	98.3
Ba	24.5	11.6	6.9	4.8	3.6
Ca	14.5	6.6	3.9	2.7	2

Table 5.14 - Variations in metals percentage adsorbed with changes in dissolved organic matter (DOM) in the Chicamba Dam (site 14) as predicted by MINTEQA2.



Fig. 5.6 – Influence of DOM changes in Ba and Ca adsorbed concentrations in the Chicamba Dam (site14) as predicted by MINTEQA2.

MINTEQA2 also predicts that the Pb concentration would not be affect by increasing concentrations of dissolved organic matter, and that Pb would remain fully adsorbed. Other metals adsorbed would only show small variations in the adsorbed concentrations. Table 5.15 shows that for metals controlled by precipitation, only Cr would be affected by an increase in dissolved organic matter.

Table 5.15 - Variation of Fe, Cr and Al percentage precipitated with changes in dissolved organic matter (DOM) in the Chicamba Dam (site 14) as predicted by MINTEQA2.

DOM (mol/l)	0.001	0.002	0.003	0.004	0.005
Fe	100	100	100	100	100
Al	99.9	99.9	99.9	99.9	99.9
Cr	91.9	91	90.9	90.8	90.8

Increased inorganic salt concentrations could occur during the dry season, when an increase in the number of local people involved in alluvial gold mining occurs. As samples in this study were collected during the dry season, it is likely that the total dissolved salt concentration was at a maximum and so further modelling to investigate the effect of increasing salinity on adsorption and precipitation was not attempted. Likewise no modelling was undertaken to investigate the effect of an increase in complexation as the dry season samples are likely to represent the maximum opportunity for complexation.

The main objective of the modelling undertaken in the water quality of the Revuè basin was to know what would be the final behaviour of trace metals in relation to adsorption and precipitation which are some of the factors controlling the distribution of pollutants in natural waters. Novotny (1995) classified the processes affecting the fate of pollutants in the aquatic environment in four main categories:

- 1 transport processes (advection, sedimentation and precipitation-dissolution)
- 2 transformation processes (biomodification by microbial metabolism)
- 3 speciation processes (acid-base equilibria and sorption of inorganic compounds)
- 4 bioacumulation (intrusion of nondegradable, nonassimilable compounds in the food chain.

Since metals do not degrade, volatilize or decay by photolysis, their fate in natural waters is mainly controlled by transport processes.

Furthermore, upstream of and within the mining area conditions are not conducive to sedimentation. The influence of precipitation and adsorption factors will not be felt upstream of and within the mining areas due to transport of pollutants by the turbulent flow of water and due to the mining activity which release pollutants to the Revuè river. In contrast, the slow water flow in the impounded water of the Chicamba Dam favours sedimentation. Evidence that the adsorption and precipitation processes occur in the dam is given by the reduction of Ca, Co, Cr, Fe, Mg, Mn, Mo, Na, Cu, Cd and Ni concentrations in the dam water. Where increased metal concentrations were found they can be attributed to lithology (Section 4.3.2).

A summary of the geochemical modelling is given in Table 5.16 which shows the percentage dissolved concentrations as the modelling scenario was made more realistic. The table demonstrates that the dissolved concentration of Al, Fe, Cr and Mn are controlled by precipitation processes while the dissolved concentrations of As, Ba, Ca, Cd, Pb, Ni, Cu and Zn are controlled by adsorption processes. Metals such as Na, Mg, K and Sr, are not predicted to take part in these processes. Co and Mo were not included in the modelling because the program do not contains a database of surface complexation constants for these metals.

					No. of Concession, Name				and the second se	the second s		
Metals		Site 1				Site 9				Site 14		
	Run 1	Run 2	Run 3	Run 4	Run 1	Run 2	Run 3	Run 4	Run 1	Run 2	Run 3	Run 4
Al	100	0,2	0,2	0,2	100	0,1	0,1	0,1	100	0,1	0,1	0,1
Fe	100	89,6	0	0	100	96,6	0	0	100	97,4	0	0
Cr	100	0	4,2	4,2	100	0	5,2	5,2	100	0	8,8	8,8
Mn	100	4,5	0	0	100	0,2	0	0				
As	100	100	100	0,2	100	100	100	0,1				
Ba	100	100	100	54,3	100	100	100	40,5	100	100	100	29,6
Ca	100	100	100	77,2	100	100	100	65,1	100	100	100	53,9
Cd	100	100	100	0,1	100	100	100	0,1	100	100	100	0
Cu									100	100	100	0
Ni	100	100	100	0,3					100	100	100	0,2
Pb	100	100	100	0	100	100	100	0	100	100	100	0
Zn									100	100	100	0

Table 5.16 – Comparison of the dissolved percentage of elements in the Revuè river water after each run of the modelling process.

Run 1: PCO₂, PO₂, fixed pH, solids not allowed to precipitate.

Run 2: Same as Run 1 but solids allowed to precipitate and CO3⁻ as a component.

Run 3: Same as Run 2 and Fe redox pair, Mn redox pair.

Run 4: Same as Run 3 and adsorption.

(...)The total concentration of the metal in the input file is Zero.

CHAPTER SIX

6. SOURCES OF WATER POLLUTION AND WATER TREATMENT

Water, through natural weathering and leaching processes and by dissolving and reacting with rocks, mobilises and incorporates trace elements in its chemical composition (Ward, 1995). The *in situ* chemical and thermodynamic conditions and the factors that control the solubility determine the extent to which these metals are dissolved. The presence of metals incorporated in this way into the chemical composition of water ultimately relates to the lithology occurring in any region.

Following the definition of pollution given by Holgate (1979) and Novotny (1995), the presence of metals, even in high concentrations, can not be considered evidence of pollution in its strict sense. The term pollution of the environment refers to an increase of a element relative to the natural occurrence of that element. In this order to determine the sources of trace element pollution, it is necessary to establish the natural elemental levels and chemical forms of the earth's environment. This situation can be applied to the water upstream of the mining area in the Revuè river where there is no influence of mining activity yet where high concentrations of Ni, Cd and Mo are found. In spite of this, the water in this area meets all WHO recommendations for drinking water.

The mining exploration methods and gold washing process used in the area accelerate the entrance of pollutants in the Revuè river water. These processes have accelerated the dissolution of metals and their entry into the river water causing an increase in concentration above that of the natural background. This is especially true between sites 7 and 9 where the mining activity is very intense. Thus, the mining activity in Manica is the principal point source of pollution in the upper part of the Revuè river basin. Water quality in the mining area has been impaired and Ba, Pb and Mn have concentrations higher than WHO recommended values for drinking water.

Within the impounded water of Chicamba Dam, sedimentation of suspended sediments occurs, together with associated adsorption and precipitation processes. This results in general improvement of water quality with only Ba and Pb exceeding WHO recommended values for potable water.

The upper part of the Revuè river basin is a remote area with no industrial development. There is no production and no emissions of sulphur and nitrogen oxides to the atmosphere. The type of agriculture in the area is subsistence farming. The soils are very fertile and there is no reference to the use of nitrogen-containing fertilisers to increase the yield, which could bring a marked increase in the nitrate content of surface waters. The same can be said to the use of pesticides. Thus the contribution of diffuse sources to the total pollution load is negligible.

By this manner, the common characteristics of this pollution event are identified. Following Alloway & Ayres (1993) all cases of pollution have certain characteristics in common: these involve (i) the pollutant, (ii) the source of pollutant, (iii) the transport medium and (iv) the target or receptor. The pollutants identified are the heavy metals dissolved in the water; the source of the pollutants is the alluvial gold mining activity; the transport medium of pollutants is the Revuè river water and the target are the humans, plants, animals and probably the turbines in the Chicamba Dam.

The water in the Chicamba Dam is used as source of potable water for Chimoio City. The only treatment practiced is disinfection prior to distribution. Because of the toxicity of free Ba and Pb ions this situation is undesirable.

An long accepted method of metal removal from water is addition of lime $(Ca(OH)_2)$ to remove metals as hydroxides. Manahan (1990) indicated that Pb can be removed by lime addition followed by activated carbon filtration. This has a reported efficiency of 99.4 %. A drawback of this method is the expense of activated carbon.

Examination of solubility products of Ba and Pb carbonate and sulphates (Table 6.1) show that there are rather insoluble compared to other common carbonates and sulphates.

Salts	K _{sp}
BaCO ₃	10 ^{-8.3}
BaSO ₄	10 ^{-9.96}
PbCO ₃	10 ^{-13.1}

Table 6.1 – Solubility	products o	f some	carbonates
and	sulphates.		

This suggests that there is a scope for removal of Ba and Pb by precipitation either as a carbonate or sulphate. Possible sources of carbonate would be limestone, soda ash or CO_2 gas. A possible source of sulphate would be gypsum.

The equilibrium, kinetics of reaction and engineering aspects of possible water treatment processes are outside the scope of this study.

CHAPTER SEVEN

7. DISCUSSION AND CONCLUSIONS

Alluvial gold mining in Manica is undertaken by both small scale and traditional mining methods. The small scale mining utilises fairly standard surface mining methods involving removal of overburden to gain access to the auriferous gravel. The traditional mining methods are haphazard, unorganised and use very low technology. Regardless of the method used the recovery process involves washing of the auriferous gravel with large quantities of water. In the case of traditional mining the washing process occurs in the river bed, while for small scale mining the water is pumped to the washing points and returned directly to the river without any treatment. The quality of water is affected in this process.

This study was carried out with the aim of assessing the effect of alluvial gold mining in the Manica greenstone belt on the surface water quality in the Revuè basin. The dissolved concentrations of major, minor and trace metals as well as other physical and chemical field water quality parameters were determined upstream of, within and downstream of the mining area and in the main tributaries upstream of their confluence with the Revuè river. These data were used to characterise water quality.

Upstream of the mining area the rock types in the Manica greenstone belt are likely to be the only source of metals dissolved in the water. This area is far from the influence of mining activity and the ultimate source of most dissolved ions in water is the mineral assemblage in the surface outcrops. In this area the Revuè river water is clear and there is no sign of pollution. Metal concentrations are generally low, except for Cd, Mo and Ni compared with other areas, and the water is of good quality and can be used as potable water. The higher concentrations of Cd, Mo and Ni in the area can be correlated directly with lithology. In this upstream area the dominant rock types are ultramafic and mafic which contain significant concentrations of these metals. This water represents the natural background water quality in the Revuè river.

Within the mining are there is clear evidence of the negative impacts of alluvial gold mining. Physical degradation of the surface has occurred. Abandoned pits, trenches, holes and tailings are common along the river banks. Disturbance of the sediments at the current working sites has increased the amount of clay and silts particles suspended in the water which has become cloudy.

Exposure of the overburden and the auriferous gravel and the gold washing process itself has facilitated the dissolution of metals in the water. The distribution graphs drawn for each determinand show that the peak of concentrations of most metals are found in the lower part of the mining area (between sites 7 and 9) where the mining activity is very intense. Metal concentrations in this area are, with the exception of Cd, Mo and Ni, higher than in the unpolluted upstream segment of the river. Thus, the alluvial gold mining is directly responsible for elevated metal concentrations in the water and constitutes the major point source of pollution in the Revuè river. Non-point sources are limited to local domestic activities and have a negligible effect on the overall pollution load.

Several metals, Ba, Mn and Pb, have concentrations which exceed the WHO recommended standards for drinking water. Ideally this water should not be used as source of potable water. Local people dislike the cloudiness of the water and dig small holes in the riverbanks to obtain clear water for drinking. This water will probably have the same chemical composition as the river water but is free of suspended sediments.

The suspended sediments in the water, not only impair water clarity but act as a major transport pathway for various trace elements due to they high sorptive capacity.

Downstream of the mining area the impounded water in the Chicamba Dam reduces the water flow in the Revuè river creating conditions for clay and silt sedimentation. The sedimentation process is reflected in the decrease in turbidity and in the concentrations of most total dissolved metals. This results in general auto-purification and improving the water quality with only Ba and Pb exceeding WHO recommended values for drinking water. Geochemical speciation modelling, using MINTEQA2 suggests that the behaviour of most of the metals in the water is controlled by redox, precipitation and adsorption reactions. Modelling indicates that the concentrations of metals Cr, Al, Mn and Fe are controlled by precipitation processes while concentrations of As, Cd, Zn, Cu, Ni, Pb, Ba and Ca are controlled by adsorption on the sediment surfaces. The oxidation of any ferrous iron and the formation of oxyhydroxides of Fe and Mn and their co-precipitation with the settling clay and silt particles is likely to have aided

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the adsorption processes by coating the clay and silt particles and thus providing additional adsorption capacity.

As described in Chapter 1, page 8, a major limitation of this work is the lack of data for mercury. Inspection of literature (Holdgate, 1979; Hem, 1985; Lacerda & Salomons, 1991; Alloway & Ayres, 1993; Ward, 1995) indicates that mercury is likely to be found as an adsorbed phase or as organo-mercury complexes. Unfortunately data on the fate and behaviour of mercury in the Revuè river is not available.

The settling sediments act as a sink and scavenger of dissolved metals thus inducing an autopurification process in the impounded water of Chicamba Dam. Modelling predicts that this process should be capable of removing Ba, Pb, Cd, Zn, Cu and Ni totally from the water. In reality Ba and Pb concentrations remain above the WHO recommended standards for drinking water.

Concentrations of elements such as Al, Ba, K, Pb and Sr show an increase in the Chicamba Dam. This is likely to be due to the input to the dam of water from Zónue, Messica and Nhamanguena rivers which cross the Granite-gneiss complex.

If, as the geochemical modelling suggest, adsorption and precipitation are the major processes by which metals are removed from the water, then this removal may only be temporary. Changes in environmental conditions, such as pH change, could result in metals being released back into the water. Modelling at various pH values indicated that adsorption and precipitation were pH dependent, with percentage adsorption and precipitation decreasing with decreasing pH.

Modelling of the effect of dissolved organic matter on the adsorption process indicated that adsorption would decrease with increasing dissolved organic matter. This could be of concern as changes in the concentrations of dissolved organic matter are likely to be related to season. The extent of any seasonal changes are not known as the data in this study represents only one dry season sampling event.

Ideally the water in Chicamba Dam should undergo water treatment prior to distribution as potable water in Chimoio City to reduce Ba and Pb concentrations to acceptable levels. Currently only disinfection is practiced. Because of the poor economy of the country and lack of trained human resources, any water treatment scheme must need to be relatively inexpensive and be constructed of reliable and proven technology.

Traditional lime treatment followed by active carbon filtration would be suitable but the cost of activated carbon might be prohibitive. Solubility products suggest that a scheme based on precipitation of Ba and Pb as either a carbonate or sulphate might have potential.

The increased sedimentation load due to mining activity in the Revuè river will negatively impact on the Chicamba Dam by reducing the life span of the dam. The sedimentation will also impact on aquatic ecosystems. Rapid sedimentation can cause burial of small organisms, clogging of aquatic flora and eventually a reduction in biodiversity.

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APPENDIX I

OUTPUT FILES OF REVUÈ WATER QUALITY MODELLING WITH THE MINTEQA2 PROGRAM

Extended output files of the Revuè river water quality modelling with the geochemical speciation program MINTEQA2. The output has been reduced. The modelling was undertaken for sites 1, 9 and 14 which represent the areas upstream of, within and downstream of the mining area respectively. For each site four runs were undertaken to allow the program to run without a phase rule violation.

Run 1: PCO_2 , PO_2 , fixed pH, solids not allowed to precipitate. Run 2: Same as Run 1 but solids allowed to precipitate. Run 3: Same as Run 2 and Fe redox pair, Mn redox pair. Run 4: Same as Run 3 and adsorption.

1 - Modelling of water quality of Site 1

PART 1 of OUTPUT FILE Revuè river water-Site 1 - Initial run Entered alkalinity, Pco2, Po2, fixed pH and solids not allowed to precipitate Temperature (Celsius): 18.90 Units of concentration: MG/L Ionic strength to be computed. Carbonate concentration represents carbonate alkalinity. Do not automatically terminate if charge imbalance exceeds 30% Precipitation is allowed only for those solids specified as ALLOWED in the input file (if any). The maximum number of iterations is: 200 The method used to compute activity coefficients is: Davies equation Intermediate output file INPUT DATA BEFORE TYPE MODIFICATIONS NAME ACTIVITY GUESS LOG GUESS ANAL TOTAL ID
 5.012E-08
 -7.300
 0.000E-01

 6.761E-21
 -20.170
 1.942E+01

 1.479E-06
 -5.830
 4.000E-02
 330 H+1 140 CO3-2 30 Al+3 8.710E-08 60 H3AsO3 -7.060 1.100E-02 6.607E-07 100 Ba+2 -6.180 9.000E-02 9.550E-05 150 Ca+2 -4.020 3.800E+00 2.399E-08 7.413E-08 160 Cd+2 -7.620 2.700E-03 211 Cr(OH)2+ -7.130 6.400E-03 280 Fe+2 3.548E-07 -6.450 2.000E-02 3.100E+00 2.400 410 K+1 1.023E-05 -4.990 3.957E-01 460 Mg+2 470 Mn+2 1.288E-04 -3.890 4.365E-07 -6.360 2.400E-02 500 Na+1 1.778E-04 -3.750 4.100E+00 3.090E-08 540 Ni+2 -7.510 1.800E-03 -7.330 9.600E-03 -6.640 2.000E-02 -16.000 0.000E-01 Pb+2 Sr+2 4.677E-08 2.291E-07 600 800 1 E-1 1.000E-16 1.000E+00 2 H2O 0.000 0.000E-01 Charge Balance: UNSPECIATED Sum of CATIONS= 6.412E-04 Sum of ANIONS = 6.473E-04 PERCENT DIFFERENCE = 4.698E-01 (ANIONS - CATIONS)/(ANIONS + CATIONS)

		PART	3 of OUTPU	JT FILE		
Type I	- COMPONENTS	AS SPECIES IN	SOLUTION			
ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
330	H+1	5.152E-08	5.012E-08	-7.30000	0.97284	0.012
140	CO3-2	9.053E-08	8.109E-08	-7.09102	0.89572	0.048
30	A1+3	1.621E-12	1.265E-12	-11.89774	0.78053	0.108
60	H3AsO3	8.651E-08	8.652E-08	-7.06287	1.00014	0.000
100	Ba+2	6.553E-07	5.870E-07	-6.23137	0.89572	0.048
150	Ca+2	9.473E-05	8.485E-05	-4.07134	0.89572	0.048
160	Cd+2	2.336E-08	2.092E-08	-7.67944	0.89572	0.048
211	Cr(OH)2+	3.022E-08	2.940E-08	-7.53168	0.97284	0.012
280	Fe+2	3.568E-07	3.196E-07	-6.49536	0.89572	0.048
410	K+1	1.012E-05	9.845E-06	-5.00678	0.97284	0.012
460	Mg+2	1.274E-04	1.141E-04	-3.94275	0.89572	0.048
470	Mn+2	4.357E-07	3.903E-07	-6.40863	0.89572	0.048
500	Na+1	1.783E-04	1.735E-04	-3.76072	0.97284	0.012
540	Ni+2	1.977E-08	1.770E-08	-7.75192	0.89572	0.048
600	Pb+2	1.727E-08	1.547E-08	-7.81047	0.89572	0.048
800	Sr+2	2.283E-07	2.045E-07	-6.68939	0.89572	0.048
		ATTA TH AATUMT				
Type I	I - OTHER SPE	CIES IN SOLUTIO	ON OR ADSOR	BED .	CANGA	NEEL LOCK
1D	NAME C. (OU) 2 DO	CALC MOL	ACTIVITY	LOG ACTVIY	GAMMA	NEW LOGK
2113302	Cr (OH) 3 AQ	4.348E-08	4.348E-08	-7.36169	1.00014	-7.130
2113303	Cr (OH) 4-	8.51/E-12	8.285E-12	-11.08169	0.97284	-18.138
2113304	Cr02-	2.101E-11	2.102E-11	-10.6/728	0.97284	-17.734
3300020	OH-	1.28/E-0/	1.252E-07	-6.90231	0.97284	-14.190
4603300	MgOH +	2.236E-09	2.175E-09	-8.06251	0.97284	-12.008
4601400	MgCO3 AQ	8.039E-09	8.040E-09	-8.09473	1.00014	2.939
4601401	MGHCU3 +	1.30/E-0/	1.2/1E-0/	-0.89576	0.97284	11.450
1503300	CaUGO2 1	2.631E-10	2.559E-10	-9.59186	0.97284	-12.809
1501400	Carcos +	7.443E-08	7.241E-08	-7.14020	0.97284	11.334
1501401	Cacos AQ	8.625E-09	8.020E-09	-8.06420	1.00014	3.090
5001400	Nacos -	1.950E-10 0.476E-00	1.905E-10	-9.72010	1 00014	10 090
202200	NAHCUS AQ	8.476E-09	8.477E-09	-8.07173	1.00014	5 124
303300	ALUN +2	1.0900-10	1.0995-10	-7 30775	0.09372	-10 099
303301	AL (OH) Z T	4.1136-00	4.002E-08	-6 37229	0.97204	-23 663
303302	AL (OH) 3 AO	1.0058-06	4.245E-07	-5 99776	1 00014	-16 000
2803300	FOOH +	1 302F-09	1 266F-09	-8 89744	0 97284	-9 690
2803301	FOOH3 -1	8 968F-17	8 725E-17	-16 05925	0 97284	-31 452
2803302	FeoH2 AO	1.251E - 13	1.251E - 13	-12 90268	1 00014	-21 007
8003300	SrOH +	1 670F-13	1.624E - 13	-12 78930	0 97284	-13 388
1003300	BaOH +	3 101E - 13	3.017E - 13	-12 52047	0 97284	-13 577
4703300	MnOH +	1.238E - 10	1.205E - 10	-9.91907	0.97284	-10.798
4703301	Mn(OH) 3 -1	5.050E-20	4.913E-20	-19.30865	0.97284	-34.788
4700020	Mn04 -	3.883E-10	3.778E-10	-9.42276	0.97284	-130.516
4700021	MnO4 -2	3.922E-14	3.513E-14	-13,45430	0.89572	-120.689
4701400	MnHCO3 +	6.491E-10	6.315E-10	-9.19965	0.97284	11.612
1601400	Cd(CO3)3-4	2.876E-23	1.851E-23	-22.73250	0.64372	6.411
1603300	CdOH +	2.249E-11	2.188E-11	-10.66000	0.97284	-10.269
1603301	Cd(OH)2 AO	3.720E-14	3.720E-14	-13.42946	1.00014	-20.350
1603302	Cd (OH) 3 -	8.560E-20	8.328E-20	-19.07946	0.97284	-33.288
1603303	Cd(OH) 4 -2	1.653E-26	1.481E-26	-25.82947	0.89572	-47.302
1603304	Cd20H +3	3.104E-18	2.422E-18	-17.61575	0.78053	-9.449
1601400	CdHCO3 +	2.195E-10	2.136E-10	-9.67046	0.97284	12.412
1601401	CdCO3 AQ	4.251E-10	4.251E-10	-9.37146	1.00014	5.399
6001400	Pb(CO3)2-2	4.958E-12	4.441E-12	-11.35251	0.89572	10.688
6003300	PbOH +	6.187E-09	6.019E-09	-8.22047	0.97284	-7.698
6003301	Pb(OH)2 AQ	4.672E-11	4.672E-11	-10.33048	1.00014	-17.120
6003302	Pb(OH)3 -	1.100E-14	1.070E-14	-13.97048	0.97284	-28.048
6003303	Pb2OH +3	2.671E-15	2.085E-15	-14.68094	0.78053	-6.252
6003304	Pb3(OH)4+2	3.394E-19	3.040E-19	-18.51712	0.89572	-24.238
6001401	PbCO3 AQ	2.180E-08	2.180E-08	-7.66149	1.00014	7.240
6003305	Pb(OH)4 -2	5.474E-19	4.904E-19	-18.30949	0.89572	-39.651
6001402	PbHCO3 +	1.024E-09	9.966E-10	-9.00149	0.97284	13.212
5403300	NiOH +	3.235E-11	3.147E-11	-10.50206	0.97284	-10.038
5403301	Ni(OH)2 AQ	7.047E-13	7.048E-13	-12.15193	1.00014	-19.000

5403302 5401400 5401401 5401402 3300600 3300601 3300602 3301400 3301401 2113300 2113301	Ni(OH)3 - NiHCO3 + NiCO3 AQ Ni(CO3)2-2 H2AsO3 - HASO3 -2 AsO3 -3 H4AsO3 + HCO3 - H2CO3 AQ Cr+3 Cr(OH)+2	1.446E-1 2.183E-1 1.064E-0 1.674E-1 8.330E-1 1.090E-1 7.775E-2 2.208E-1 1.020E-0 1.058E-0 8.022E-1 6.857E-1	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	06E 24E 64E 00E 67E 69E 69E 25E 69E 58E 61E 42E	$ \begin{array}{cccccc} -16 & -1 \\ -10 & - \\ -08 & - \\ -12 & -1 \\ -10 & - \\ -15 & -1 \\ -21 & -2 \\ -15 & -1 \\ -05 & - \\ -05 & - \\ -13 & -1 \\ -10 & - \\ \end{array} $	5.85193 9.67294 7.97294 1.82396 9.09130 4.01025 0.21688 4.66787 4.00326 4.97562 2.20334 9.21168	0.97284 0.97284 1.00014 0.89572 0.97284 0.89572 0.78053 0.97284 0.97284 1.00014 0.78053 0.89572	-29.988 12.482 6.870 10.158 -9.316 -21.500 -34.946 -0.293 10.400 16.715 10.036 5.668
Type II: ID	I - SPECIES N NAME	WITH FIXED AC CALC MOL	CTIVIT	Y LO	G MOL	NEW LOGK	DH	
2	H20	2.056E-0	4	-3	. 687	0.000	0.000	
3300021	OZ (g) H+1	-5.398E-0	4 4	-3	. 268	-84.491	133.830	
3301403	CO2 (g)	5.447E-0	4	-3	.264	21.691	-0.530	
		PAI	RT 4 01	E OI	JTPUT FI	LE	10	
	PER TYPE I	and TYPE II	(disso	DN (Dlve	of COMPO ed and a	NENTS AMOI dsorbed) :	NG species	
Ph+2	37 3	PERCENT	BOUND	TN	SPECTES	# 600	Pb+2	
	13.4	PERCENT	BOUND	IN	SPECIES	#6003300	PbOH +	
	47.0	PERCENT	BOUND	IN	SPECIES	#6001401	PbCO3 AQ	
Ca+2	2.2	PERCENT	BOUND	IN	SPECIES	#6001402	PbHCO3 +	
	99.9	PERCENT	BOUND	IN	SPECIES	# 150	Ca+2	
Mg+2	99.9	PERCENT	BOUND	IN	SPECIES	# 460	Mg+2	
Na+1	100.0	PERCENT	BOUND	IN	SPECIES	# 500	Na+1	
K+1	100.0	PERCENT	BOUND	IN	SPECIES	# 410	K+1	
A1+3	2.8	PERCENT	BOUND	IN	SPECIES	# 303301	Al(OH)2 +	
	29.4	PERCENT	BOUND	IN	SPECIES	# 303302	Al (OH) 4 -	2
	07.0	PERCENT	BOOND	TN	SPECIES	# 303303	AI (OH) 5 AU	2
Fe+2	99.6	PERCENT	BOUND	IN	SPECIES	# 280	Fe+2	
Mn+2	99.7	PERCENT	BOUND	IN	SPECIES	# 470	Mn+2	
Sr+2	100.0	PERCENT	BOUND	IN	SPECIES	# 800	Sr+2	
H3AsO3	99.0	PERCENT	BOUND	IN	SPECIES	# 60	H3AsO3	
Ba+2	100.0	PERCENT	BOUND	IN	SPECIES	# 100	Ba+2	
Ni+2	64.5 34.7	PERCENT PERCENT	BOUND BOUND	IN IN	SPECIES SPECIES	# 540 #5401401	Ni+2 NiCO3 AQ	
Cr(OH)2+	40.6 58.4	PERCENT PERCENT	BOUND BOUND	IN IN	SPECIES SPECIES	# 211 #2113302	Cr(OH)2+ Cr(OH)3 A(2
Cd+2	97.2 1.8	PERCENT PERCENT	BOUND BOUND	IN IN	SPECIES SPECIES	# 160 #1601401	Cd+2 CdCO3 AQ	
C03-2	90.3 9.4	PERCENT PERCENT	BOUND BOUND	IN IN	SPECIES SPECIES	#3301400 #3301401	HCO3 - H2CO3 AQ	
E-1	100.0	PERCENT	BOUND	IN	SPECIES	#4700020	MnO4 -	
H+1	86.2 17.9	PERCENT PERCENT	BOUND BOUND	IN IN	SPECIES SPECIES	#3301400 #3301401	HCO3 - H2CO3 AQ	

		2.6 1.6 34.7 60.0	PERCENI PERCENI PERCENI PERCENI	BOUND BOUND BOUND BOUND	IN SPECIE IN SPECIE IN SPECIE IN SPECIE	S #3300020 S # 303301 S # 303302 S # 303303	OH- Al(OH)2 Al(OH)4 Al(OH)3	+ - AQ
			EQUILIBR	ART 5 OF ATED MA	E OUTPUT F SS DISTRIE	ILE BUTION		
IDX	NAME	MC	DISSOLVE DL/KG PE	ED ERCENT	SOR MOL/KG	BED PERCENT	PRECIE MOL/KG	PITATED PERCENT
600 800 60 100 150 211 280 410 460 470 500 540 1 140 330 2	Pb+2 Sr+2 Al+3 H3AsO3 Ba+2 Ca+2 Cd+2 Cd+2 Cr(OH)2+ Fe+2 K+1 Mg+2 Mn+2 Na+1 Ni+2 E-1 CO3-2 H+1 H2O	4.6 2.2 1.4 8.7 6.5 9.4 2.4 3.5 1.0 1.2 4.3 1.7 3.0 -1.9 1.1 1.1	34E-08 83E-07 83E-08 53E-07 81E-05 02E-08 41E-08 83E-07 12E-05 275E-04 69E-07 83E-04 66E-08 442E-09 30E-04 84E-04	100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0	0.000E-0 0.000E-0 0.000E-0 0.000E-0 0.000E-0 0.000E-0 0.000E-0 0.000E-0 0.000E-0 0.000E-0 0.000E-0 0.000E-0 0.000E-0 0.000E-0 0.000E-0 0.000E-0	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01	
	Charge Ba Sum of PERCENT NON-CARBO EQUILIBRI EQUILIBRI	lance: SF CATIONS = DIFFEREN NATE ALKA UM IONIC UM pH	PECIATED 6.365E- ICE = 7. LINITY STRENGTH	-04 Sum 220E+01 = (m) =	of ANIONS (ANIONS 7.747E-0 5.936E-0 7.300	1.028E- - CATIONS), 8 4	04 /(ANIONS +	CATIONS)
Satu 20	EQUILIBRI ration ind ID # N. 03000 ALOH	UM pe ices and AME 3(A)	PA stoichiom Sat. Inde -0.792	ART 6 of Metry of ex	13.823 E OUTPUT F E all mine Stoichie L.000] 30	or Eh = ILE rals ometry in [3.000	800.97 mv [brackets]] 2 [-3	3.000] 30
Satu 20 50 50	EQUILIBRI ration ind ID # N. 03000 ALOH 15000 ARAG 46000 ARTI	UM pe ices and AME 3(A) ONITE NITE	PA stoichiom Sat. Inde -0.792 -2.880 -10.417	ART 6 of Metry of X [[2 [-2	13.823 E OUTPUT F all mine Stoichi 1.000] 30 1.000] 150 2.000] 330	or Eh = ILE rals ometry in [3.000 [1.000 [2.000]	800.97 mv [brackets]] 2 [-3] 140] 460 [1	8.000] 30
Satu 20 50 20 20 20 50 20 30 50 50 50	EQUILIBRI ration ind ID # N. 03000 ALOH 15000 ARAG 46000 ARTI 03001 BOEH 46000 BRUC 15001 CALC 03002 DIAS 15002 DOLO 03003 GIBB 03000 AL2O 15003 HUNT 46001 HYDRI	UM pe ices and AME 3(A) ONITE NITE ITE ITE PORE MITE SITE (C) 3 ITE MAGNESIT	PA stoichiom Sat. Inde -0.792 -2.880 -10.417 0.994 -6.530 -2.722 2.752 -5.323 0.883 -2.976 -14.690 -25.511	= ART 6 of hetry of xx [-2 [-2 [-2 [-2 [-2 [-2 [-2 [-2	13.823 F OUTPUT F all mine Stoichin Stoichin Stoichin Stoichin 2.000] 30 2.000] 30 2.000] 330 2.000] 460 2.000] 330 2.000] 330 2.000] 330 2.000] 330 2.000] 330 2.000] 30 3.000] 460 5.000] 5.000] 5.000] 5.000 5.000] 5.000] 5.000 5.000] 5.000 5.000] 5.000 5.000] 5.000 5.000] 5.000 5.000] 5.000 5.000] 5.0000 5.00000 5.00000 5.00000 5.00000 5.00000 5.00000 5.00000 5.000000 5.0000000 5.0000000000	or Eh = ILE rals ometry in [3.000 [1.000 [2.000 [1.000 [1.000]	800.97 mv [brackets] 2 [-3] 140] 460 [1] 30 [2] 2 [-2] 140] 30 [2] 460 [2] 30 [3] 2 [-6] 150 [4] 140 [-2	8.000] 30 .000] 40 2.000] 2 2.000] 30 2.000] 2 2.000] 140 .000] 2 5.000] 330 .000] 140 2.000] 330

2016000	CD(OH)2 (A)	-7.127	[-2.000]	330]	1.000]	160	[2.000]	2
2016001	CD(OH)2 (C)	-6.729	[-2.000]	330]	1.000]	160	[2.000]	2
2016002	MONTEPONITE	-8.579	[-2.000]	330]	1.000]	160	[1.000]	2
60000	PB METAL	-39.720	[1.000]	600]	2.000]	1			
5060000	CERRUSITE	-1.697	[1.000]	600	[1.000]	140			
2060000	MASSICOT	-6.377	[-2.000]	330]	1.000]	600]	1.000]	2
2060001	LITHARGE	-6.181	[-2.000]	330	I	1.000]	600	[1.000]	2
2060002	PBO, .3H2O	-6.190	[-2.000]	330]	1.000]	600]	1.330]	2
5060001	PB20C03	-7.787	[-2.000]	330]	2.000]	600	[1.000]	2
			[1.000]	140						
5060002	PB302C03	-12.747	[-4.000]	330]	3.000]	600	[1.000]	40
			[2.000]	2						
2060003	PLATTNERITE	-1.348	[-4.000]	330]	-2.000]	1]	1.000]	00
			[2.000]	2						
3060000	PB203	-5.215	[-6.000]	330]	-2.000]	1	[2.000]	600
			[3.000]	2						
3060001	MINIUM	-12.649	[-8.000]	330]	-2.000]	1	[3.000]	600
			[4.000]	2						
2060004	PB(OH)2 (C)	-1.575	[-2.000]	330]	1.000]	600	[2.000]	2
5060003	HYDCERRUSITE	-5.553	[-2.000]	330	J	3.000]	600]	2.000]	140
			[2.000]	2						
2060005	PB20 (OH) 2	-12.621	[-4.000]	330]	2.000]	600	[3.000]	2
5054000	NICO3	-8.155	[1.000]	540]	1.000]	140			
2054000	NI(OH)2	-3.486	[-2.000]	330	[1.000]	540]	2.000]	2
2054001	BUNSENITE	-5.968	[-2.000]	330	I	1.000]	540	[1.000]	2
3006000	ARSENOLITE	-25.231	[4.000]	60]	-6.000]	2			
3006001	CLAUDETITE	-24.983	[4.000]	60	I	-6.000]	2			
2015000	LIME	-22.977	[-2.000]	330]	1.000]	150	[1.000]	2
2015001	PORTLANDITE	-12.616	[-2.000]	330	[1.000]	150	[2.000]	2
2028000	WUSTITE	-3.618	[-2.000]	330	[0.947]	280	[1.000]	2
2046001	PERICLASE	-11.406	[-2.000]	330	I	1.000]	460	[1.000]	2
3028001	HERCYNITE	-0.253	[-8.000]	330	[1.000]	280	[2.000]	30
			[4.000]	2						
3046000	SPINEL	-7.035	[-8.000]	330	[1.000]	460	[2.000]	30
			[4.000]	2						
3021100	FECR204	8.162	[2.000]	211	[1.000]	280	[-4.000]	330
3021101	MGCR204	-2.496	[2.000]	211	1	1.000]	460	[-4.000]	330
3021102	CR203	2.745	[2.000]	211	Ĺ	-2.000]	330	l	-1.000]	2
2021102	CR (OH) 3 (A)	0.518	[1.000]	211	l	1.000]	2	L	-1.000]	330
2021101	CR(OH)3 (C)	-2.041	1.0001	211	T	1.000]	2	1	-1.000]	330

		PART	1 of OUTPI	TT FTLF		
Donnà mi	wan water Cite	1 Dun 2	I OI OUIFC)1 ETTE		
Revue II	ver water-site					
Entered	CO_3^{-} , PCO_2 , Po_2	2, fixed pH,	Solids allo	owed to p	recipitate	
Tempera	ture (Celsius)	: 18.90				
Units o	f concentratio	n: MG/L				
IONIC S	ified carbona	computea.	tion renres	sents tota	inorganic	carbon
Do not	automatically	terminate if	charge imb	alance ex	ceeds 30%	carbon.
Precipi	tation is allo	wed for all	solids in t	the thermo	dynamic data	abase and
the p	rint option fo	r solids is	set to: 1	ino unorme		and and
The max	imum number of	iterations	is: 200			
The met	hod used to co	mpute activi	ty coeffici	lents is:	Davies equat	ion
Interme	diate output f	ile	-		-	
INPUT DA	TA BEFORE TYPE	MODIFICATIC	NS			
ID	NAME	ACTIVITY G	UESS LOC	G GUESS	ANAL TOTAL	
330	H+1	5.012	E-08	-7.300	0.000E-01	
30	A1+3	1.479	E-06	-5.830	4.000E-02	
60	H3AsO3	8.710	E-08	-7.060	1.100E-02	
100	Ba+2	6.607	E-07	-6.180	9.000E-02	
150	Ca+2	9.550	E-05	-4.020	3.800E+00	
211	Ca+2	2.399	E-08	-7.620	2.700E-03	
280	CI (OR) 2+	7.413	E-07	-6.450	0.400E-03	
410	K+1	1 023	E-07	-1 990	3.957E - 01	
460	Ma+2	1 288	E = 0.4	-3 890	3.100E+00	
470	Mn+2	4.365	E = 0.7	-6.360	2.400E-02	
500	Na+1	1.778	E-04	-3.750	4.100E+00	
540	Ni+2	3.090	E-08	-7.510	1.800E-03	
600	Pb+2	4.677	E-08	-7.330	9.600E-03	
800	Sr+2	2.291	E-07	-6.640	2.000E-02	
1	E-1	1.000	E-16	-16.000	0.000E-01	
140	CO3-2	4.786	E - 07	-6.320	6.902E+00	
2	H20	1.000	E+00	0.000	0.000E-01	
Cha	rge Balance: U	NSPECIATED				
S	UM OI CATIONS=	6.412E-04	Sum of ANIC	NS = 2.3	SOUE-04	
E.	ERCENI DIFFERE	NCE = 4.719	E+UI (ANIC	NS = CATI	ONS)/(ANIONS	+ CATIONS)
1		PART	3 of OUTPU	JT FILE		
Type I -	COMPONENTS AS	SPECIES IN	SOLUTION			*****
ID	NAME	CALC MOL	ACTIVITY	LOG ACTV	TY GAMMA	NEW LOGK
330	H+1	5.152E-08	5.012E-08	-7.300	0.97287	0.012
30	A1+3	2.868E-15	2.239E-15	-14.649	0.78072	0.108
60	H3AsO3	8.651E-08	8.652E-08	-7.062	.88 1.00014	0.000
100	Ba+2	6.553E-07	5.870E-07	-6.231	.33 0.89582	0.048
150	Ca+2	9.473E-05	8.486E-05	-4.071	.30 0.89582	0.048
160	Cd+2	2.335E-08	2.092E-08	-7.679	0.89582	0.048
211	Cr(OH)2+	2.648E-12	2.576E-12	-11.589	0.97287	0.012
280	re+2	3.198E-07	2.865E-07	-6.542	0.89582	0.048
410	K+1 M~12	1.012E-05	9.845E-06	-5.006	0.97287	0.012
400	Mg+2 Mp+2	1.2/46-04	1.141E-04 1.740E-09	-3.942	1 U.89582	0.048
470	Mn+Z	1.7935-04	1.7355-04	-7.759		0.048
540	Ni+2	1 9765-04	1.755E-04 1.771F-08	-7 751	89 0 89582	0.012
600	Ph+2	1.727E - 08	1.547E-08	-7 810	0.89582	0.048
800	Sr+2	2.283E-07	2.045E-07	-6 689	0.09502	0.048
140	CO3-2	9.052E-08	8.109E-08	-7.091	02 0.89582	0.048
Type II	- OTHER SPECI	ES IN SOLUTI	ON OR ADSOR	BED		
ID	NAME	CALC MOL	ACTIVITY	LOG ACTV	TY GAMMA	NEW LOGK
2113302	Cr(OH)3 AQ	3.810E-12	3.810E-12	-11.419	05 1.00014	-7.130
2113303	Cr(OH)4-	7.463E-16	7.260E-16	-15.139	0.97287	-18.138
2113304	Cr02-	1.894E-15	1.842E-15	-14.734	64 0.97287	-17.734

3300020	OH-	1.287E-07	1.252E-07	-6.90231	0.97287	-14.190
4603300	MgOH +	2.236E-09	2.1/5E-09	-8.66246	0.97287	-12.008
4601400	MgCOS AQ	8.040E-09	8.041E-09	-8.09409	1.00014	2.939
4001401	MgnCO3 +	2.501E-01	1.2/1E-0/ 2.560E-10	-0.09371	0.97207	-12 000
1503300	Cauco2 +	Z.051E-10	2.360E-10	-9.59102	0.97207	-12,009
1501400	Carcos +	7.444E-00	7.242E-08	-7.14016	0.97287	11.334
5001401	Cacos AQ	0.0ZJE-09	8.627E-09	-8.06416	1.00014	3.098
5001400	Nacus -	1.958E-10	1.905E-10	-9.72015	0.97287	1.144
202200	NAHCOS AQ	0.470E-09	8.4/8E-09	-8.07173	1.00014	LU.080
303300	ALOH +2	J.JJJE-13	3.005E-13	-12.52209	0.07207	-5.124
303301	AI(OH)2 +	7.278E-11	7.081E-11	-10.14993	0.97287	-10.088
303302	AI(OH) =	1.770E-10	1.308E-10	-9.12447	1.00014	-23.003
2002200	AI(UH)S AU	1.170E-09	1.125E-09	-0.74994	0.07207	-10.000
2803300	FeOH +	1.10/E-09	1.135E-09	-8.94500	0.97287	-9.690
2803301	Feons -1	0.030E-17	1.020E-17	-10.10001	0.97207	-31.452
2803302	FEOHZ AQ	1.121E-13 1.670E 13	1.121E-13	-12.95024	1.00014	-21.007
8003300	STOH +	1.0/UE-13	1.023E-13	-12.78920	0.97287	-13.388
1703300	BaOH +	5.101E-13 5.50E 10	5.01/E-13	-12.52042	0.97287	-13.577
4703300	MnOH + MnOH - 1	3.520E - 12 2.251E - 21	3.371E-12 2.100E-21	-11.20990	0.97207	-10.798
4703301	Mn(OH) = 1	2.201E-21 1 701E-11	2.190E-21	-20.03955	0.97287	-34.788
4700020	MnO4 = 2	1.740E-15	1.004E-11	-10.77307	0.97207	-130.516
4700021	MnUCO3 +	2.903E - 11	2.015E-11	-14.00521	0.09302	-120.009
4701400	Cd(CO3)3-4	2.093E-11 2.875E-23	1 8525-23	-10.55050	0.91201	6 411
1602300	Cd(CO3) = 4	2.075E-25 2.240E-11	1.0JZE-ZJ	-22.75240	0.04399	-10 269
1603301	Cd(OH)2 NO	2.249E-11 3.720E-14	2.100E-11 3 720E-14	-13 42941	1 00014	-20.350
1603302	Cd(OH)3 -	8 561F-20	8 320E-14	-19 07942	0 97297	-33 288
1603302	Cd(OH)A = 2	1 653F-26	1 <u>181E-26</u>	-19.07942	0.97207	-17 302
1603304	Cd(OH) = -2	3 103E-18	2.401E-20 2.423E-18	-17 61567	0.78072	-9 119
1601400	CdHCO3 +	2.195E - 10	2.425E-10 2.136E-10	-9 67042	0.97287	12 412
1601400	CdCO3 AO	4 251E - 10	4.252E - 10	-9.37142	1 00014	5 399
6001401	Ph(CO3)2-2	4 958E-12	4.252E = 10 4.441E = 12	-11 35249	0 89582	10 688
6003300	PbOH +	6 187E-09	6.019E-09	-8 22046	0.05502	-7 698
6003301	Pb(OH)2 AO	4.672E-11	4 672E-11	-10 33046	1 00014	-17 120
6003302	Pb(OH)3 -	1.100E-14	1.070E - 14	-13 97047	0 97287	-28 048
6003303	Pb2OH + 3	2.671E - 15	2.085E - 15	-14.68091	0.78072	-6.252
6003304	Pb3(0H)4+2	3.394E-19	3.040E - 19	-18.51707	0.89582	-24 238
6001401	PbCO3 AO	2.180E-08	2.180E - 08	-7.66147	1.00014	7.240
6003305	Pb(OH) 4 -2	5.474E - 19	4.904E - 19	-18.30947	0.89582	-39.651
6001402	PbHCO3 +	1.024E-09	9.966E-10	-9.00147	0.97287	13.212
5403300	NiOH +	3.235E-11	3.147E-11	-10.50204	0.97287	-10.038
5403301	Ni(OH)2 AO	7.048E-13	7.049E-13	-12,15190	1.00014	-19.000
5403302	Ni (OH) 3 -	1.446E-16	1.406E-16	-15.85191	0.97287	-29.988
5401400	NiHCO3 +	2.183E-10	2.124E-10	-9.67291	0.97287	12.482
5401401	NiCO3 AO	1.064E-08	1.064E-08	-7.97291	1.00014	6.870
5401402	Ni(CO3)2-2	1.674E-12	1.500E-12	-11.82393	0.89582	10.158
3300600	H2As03 -	8.330E-10	8.104E-10	-9.09131	0.97287	-9.316
3300601	HAs03 -2	1.090E-14	9.767E-15	-14.01025	0.89582	-21.500
3300602	As03 -3	7.773E-21	6.069E-21	-20.21689	0.78072	-34.947
3300603	H4As03 +	2.208E-15	2.148E-15	-14.66788	0.97287	-0.293
3301400	HCO3 -	1.020E-04	9.925E-05	-4.00326	0.97287	10.400
3301401	H2CO3 AQ	1.058E-05	1.058E-05	-4.97562	1.00014	16.715
2113300	Cr+3	7.027E-17	5.486E-17	-16.26071	0.78072	10.036
2113301	Cr(OH)+2	6.008E-14	5.382E-14	-13.26904	0.89582	5.668
			T T			
Type II	I - SPECIES	WITH FIXED ACT	TATLA	NEW LOCK	DU	
10	H20	-1 458E-06	-5 836	0 000	0 000	

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2	H20	-1.458E-06	-5.836	0.000	0.000
3300021	02 (g)	-6.959E-08	-7.157	-84.491	133.830
330	H+1	-1.220E-04	-3.914	7.300	0.000
3301403	CO2 (g)	2.066E-06	-5.685	21.691	-0.530

		EOUILI	PART 5 0 BRATED MA	f OUTPUT FI ASS DISTRIBU	LE JTION		
трх	NAME	DISSO	VED	SORB	ED	PRECIP	TTATED
1.011		MOL/KG	PERCENT	MOL/KG	PERCENT	MOL/KG	PERCENT
800	Sr+2	2.283E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
540	Ni+2	3.066E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
60	H3AsO3	8.734E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
100	Ba+2	6.553E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	9.481E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
160	Cd+2	2.402E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
211	Cr(OH)2+	6.520E-12	0.0	0.000E-01	0.0	7.436E-08	100.0
600	Pb+2	4.634E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	1.012E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	1.275E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	1.783E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
470	Mn+2	1.947E-08	4.5	0.000E-01	0.0	4.174E-07	95.5
30	A1+3	2.623E-09	0.2	0.000E-01	0.0	1.480E-06	99.8
1	E-1	-8.655E-11	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	1.130E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
280	Fe+2	3.209E-07	89.6	0.000E-01	0.0	3.718E-08	10.4
2	H20	1.474E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	1.233E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
	Charge Bala Sum of CA	ance: SPECIATEI ATIONS = 6.355) 5E-04 Sum	of ANIONS	1.023E-	04	
	PERCENT I	DIFFERENCE =	7.226E+0	1 (ANIONS -	CATIONS)	/(ANIONS +	CATIONS)
	EQUILIBRIUM	I IONIC STRENGT	CH (m) =	5.924E-04			
	EQUILIBRIUM	1 pH	=	7.300			
	EQUILIBRIUM	1 pe	=	13.823 0	r Eh =	800.97 mv	

	PART	1 of OUTPU	JT FILE		
Revuè river water-S Entered CO_3^{2-} , PCO2, Fe redox pair, Mn r	Site 1 - Run 3 PO2, fixed pH, redox pair	solids all	Lowed to	precipitate	
Temperature (Celsi Units of concentra Ionic strength to If specified, cark Do not automatical Precipitation is a the print option The maximum number The method used to Intermediate outpu	ius): 18.90 ation: MG/L be computed. conate concentra lly terminate if allowed for all n for solids is c of iterations o compute activi at file	tion repres charge im solids in t set to: 1 is: 200 ty coeffic	sents tot palance e the therm ients is:	al inorganic xceeds 30% odynamic data Davies equat	carbon. base and ion
INPUT DATA BEFORE 1 ID NAME 330 H+1 30 Al+3 60 H3AsO3 100 Ba+2 150 Ca+2 160 Cd+2 211 Cr(OH)2+ 280 Fe+2 410 K+1 460 Mg+2 470 Mn+2 500 Na+1 540 Ni+2 600 Pb+2 800 Sr+2 1 E-1 140 CO3-2 281 Fe+3 471 Mn+3 2 H2O	TYPE MODIFICATIC ACTIVITY G 5.012 1.479 8.710 6.607 9.550 2.399 7.413 3.548 1.023 1.288 4.365 1.778 3.090 4.677 2.291 1.000 4.786 1.778 1.820 1.000	$\begin{array}{l} \text{NS} \\ \text{UESS} & \text{LOO} \\ \text{E-08} \\ \text{E-07} \\ \text{E-08} \\ \text{E-08} \\ \text{E-08} \\ \text{E-08} \\ \text{E-08} \\ \text{E-08} \\ \text{E-07} \\ \text{E-04} \\ \text{E-04} \\ \text{E-08} \\ \text{E-07} \\ \text{E-04} \\ \text{E-08} \\ \text{E-07} \\ \text{E-16} \\ \text{E-07} \\ \text{E-16} \\ \text{E-21} \\ \text{E-21} \\ \text{E-21} \\ \text{E-00} \end{array}$	G GUESS -7.300 -5.830 -7.060 -6.180 -4.020 -7.620 -7.130 -6.450 -4.990 -3.890 -6.360 -3.750 -7.510 -7.510 -7.510 -6.640 -16.000 -6.320 -20.750 -20.740 0.000	ANAL TOTAL 0.000E-01 4.000E-02 1.100E-02 9.000E-02 3.800E+00 2.700E-03 6.400E-03 2.000E-02 3.957E-01 3.100E+00 2.400E-02 4.100E+00 1.800E-03 9.600E-03 2.000E-01 6.902E+00 0.000E-01 0.000E-01 0.000E-01	
Charge Balance Sum of CATIC PERCENT DIFF	e: UNSPECIATED DNS= 6.412E-04 FERENCE = 4.719	Sum of ANIC E+01 (ANIC	DNS = 2. DNS - CAT	300E-04 IONS)/(ANIONS	+ CATIONS)
Type I - COMPONENT ID NAME 330 H+1 30 Al+3 60 H3AsO3 100 Ba+2 150 Ca+2 160 Cd+2 211 Cr(OH)2+ 280 Fe+2 410 K+1 460 Mg+2 470 Mn+2 500 Na+1 540 Ni+2 600 Pb+2	PART CALC MOL 5.152E-08 2.868E-15 8.651E-08 6.553E-07 9.473E-05 2.335E-08 1.282E-09 5.523E-25 1.012E-05 1.274E-04 4.194E-16 1.783E-04 1.976E-08 1.727E-08	3 of OUTPU SOLUTION ACTIVITY 5.012E-08 2.239E-15 8.652E-08 5.871E-07 8.486E-05 2.092E-08 1.247E-09 4.948E-25 9.845E-06 1.141E-04 3.757E-16 1.735E-04 1.771E-08 1.547E-08	JT FILE LOG ACT -7.30 -14.64 -7.06 -6.23 -4.07 -7.67 -8.90 -24.30 -5.00 -3.94 -15.42 -3.76 -7.75 -7.81	VTY GAMMA 000 0.97288 992 0.78082 288 1.00014 130 0.89587 127 0.89587 938 0.89587 404 0.97288 556 0.89587 676 0.97288 269 0.89587 516 0.89587 070 0.97288 188 0.89587 044 0.89587	NEW LOGK 0.012 0.107 0.000 0.048 0.048 0.048 0.012 0.048 0.012 0.048 0.012 0.048 0.012 0.048 0.012

2.283E-07 2.045E-07

2.468E-27 1.927E-27 9.052E-08 8.109E-08 2.751E-24 2.148E-24

800 Sr+2

471 Mn+3 140 CO3-2 281 Fe+3

0.89587

0.78082

0.89587

0.78082

-6.68932

-26.71503

-7.09102 -23.66789 0.048

0.107

0.048

0.107

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Type II	- OTHER SPE	CIES IN SOLUTI	ON OR ADSOF	RBED		
ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
2113302	Cr(OH)3 AQ	1.845E-09	1.845E-09	-8.73404	1.00014	-7.130
2113303	Cr(OH)4-	3.613E-13	3.515E-13	-12.45405	0.97288	-18.138
2113304	Cr02-	9.169E-13	8.920E-13	-12.04964	0.97288	-17.734
3300020	OH-	1.287E-07	1.252E-07	-6.90231	0.97288	-14.190
4603300	MgOH +	2.236E-09	2.176E-09	-8.66244	0.97288	-12.008
4601400	MgCO3 AQ	8.040E-09	8.041E-09	-8.09466	1.00014	2.939
4601401	MgHCO3 +	1.307E-07	1.271E-07	-6.89569	0.97288	11.450
1503300	CaOH +	2.631E-10	2.560E-10	-9.59180	0.97288	-12.809
1501400	CaHCO3 +	7.444E-08	7.242E-08	-7.14014	0.97288	11.334
1501401	CaCO3 AQ	8.626E-09	8.627E-09	-8.06413	1.00014	3.098
5001400	NaCO3 -	1.958E-10	1.905E-10	-9.72014	0.97288	1.144
5001401	NaHCO3 AQ	8.477E-09	8.478E-09	-8.07172	1.00014	10.080
303300	AlOH +2	3.355E-13	3.005E-13	-12.52209	0.89587	-5.124
303301	Al(OH)2 +	7.278E-11	7.081E-11	-10.14993	0.97288	-10.088
303302	Al(OH)4 -	7.717E-10	7.508E-10	-9.12447	0.97288	-23.663
303303	Al(OH)3 AQ	1.778E-09	1.779E-09	-8.74994	1.00014	-16.000
2803300	FeOH +	2.015E-27	1.961E-27	-26.70763	0.97288	-9.690
2803301	FeOH3 -1	1.388E-34	1.351E-34	-33.86944	0.97288	-31.452
2803302	FeOH2 AQ	1.937E-31	1.937E-31	-30.71287	1.00014	-21.007
2813300	FeOH +2	2.141E-19	1.918E-19	-18.71709	0.89587	-2.301
2813301	FeOH2 +	1.880E-15	1.829E-15	-14.73790	0.97288	-5.658
2813302	FeOH3 AQ	4.286E-16	4.286E-16	-15.36790	1.00014	-13.600
2813303	FeOH4 -	8.791E-17	8.553E-17	-16.06790	0.97288	-21.588
2813304	Fe2(OH)2+4	1.989E-36	1.281E-36	-35.89246	0.64415	-2.966
2813305	Fe3(OH)4+5	9.459E-49	4.758E-49	-48.32260	0.50296	-6.220
8003300	SrOH +	1.670E-13	1.625E-13	-12.78923	0.97288	-13.388
1003300	BaOH +	3.101E-13	3.017E-13	-12.52040	0.97288	-13.577
4703300	MnOH +	1.192E-19	1.160E-19	-18.93560	0.97288	-10.798
4703301	Mn(OH)3 -1	4.861E-29	4.730E-29	-28.32517	0.97288	-34.788
4700020	MnO4 -	3.738E-19	3.637E-19	-18.43929	0.97288	-130.516
4700021	MnO4 -2	3.775E-23	3.382E-23	-22.47082	0.89587	-120.689
4701400	MnHCO3 +	6.248E-19	6.079E-19	-18.21618	0.97288	11.612
1601400	Cd (CO3) 3-4	2.875E-23	1.852E-23	-22.73243	0.64415	6.411
1603300	CdOH +	2.249E-11	2.188E-11	-10.65994	0.97288	-10.269
1603301	Cd(OH)2 AQ	3.720E-14	3.721E-14	-13.42939	1.00014	-20.350
1603302	Cd (OH) 3 -	8.561E-20	8.329E-20	-19.07940	0.97288	-33.288
1603303	Cd (OH) 4 -2	1.653E-26	1.481E-26	-25.82940	0.89587	-47.302
1603304	Cd2OH + 3	3.103E-18	2.423E-18	-17.61562	0.78082	-9.449
1601400	CdHCO3 +	2.196E-10	2.136E-10	-9.67040	0.97288	12.412
1601401	Cacos AQ	4.252E-10	4.252E-10	-9.3/140	1.00014	5.399
6001400	Pb(CO3)2-2	4.958E-12	4.441E-12	-11.35248	0.89587	10.688
6003300	PDOH +	6.18/E-09	6.019E-09	-8.22045	0.97288	-7.698
6003301	PD(OH) Z AQ	4.672E-11	4.0725-11	-10.33045	1.00014	-17.120
6003302	PD(OH) 5 -	1.100E-14 2.670E 15	1.070E-14	-13.97040	0.97200	-28.048
6003303	PD20H +3	2.070E-13	2.085E-15	-14.08089	0.76082	-0.200
6003304	PDS (OR) 4+2	3.394E-19	3.04IE-19	-10.51/04	1 00014	-24.230
6001401	PDCOS AQ	2.100E-00	2.100E-00	-7.00140	1.00014	20 651
6003303	PD(OH) 4 - 2	5.474E-19	4.904E-19	-18.30946	0.07200	-39.031
5402200	NOU +	2 2255 11	9.900E-10 2 140E-11	-9.00140	0.97200	-10 020
5403300	NICH +	J.235E-11	J.140E-11	-10.50202	0.97200	-10.038
5403301	NI (OH) Z AQ	1.046E-15	1.049E-15	-12.15109	0.07200	-19.000
5405502	NI (OR) 5 -	1.440E-10 2.102E 10	1.400E-10	-13.65109	0.97200	-29.900
5401400	NICO2 DO	2.105E-10 1.064E-09	2.124E-10	-9.07290	1 00014	6 070
5401402	Ni (CO3) 2-2	1 67/1-10	1 5005-12	-11 97209	0 80507	10 150
3300600	H2AG03 -	8 330E-10	8 104F-10	_9 00121	0.03307	_0 316
3300601	HASO3 -2	1 0005-14	9 7675-15	-14 01025	0.97200	-21 500
3300602	As03 -3	7 770E-14	6 069F-21	-20 21699	0.78082	-31 917
3300602	H4As03 +	2 208F-15	2 148F - 15	-14 66788	0 97288	-0 203
3301400	HCO3 -	1.020E-04	9.925E-05	-4.00326	0.97288	10 400
3301401	H2CO3 A0	1.058E-05	1.058E-05	-4,97562	1.00014	16 715
2113300	Cr+3	3.402E-14	2.656E-14	-13,57570	0.78082	10.036
2113301	Cr (OH) +2	2.909E-11	2.606E-11	-10.58404	0.89587	5.668

Type III - SPECIES WITH FIXED AC ID NAME CALC MOI 2 H20 -1.799E-0		CTIVITY L 06	LOG MOL -5.745	NEW LOGK 0.000	DH 0.000			
4704710 Mn+2/Mn+3 -4.369E-0 330 H+1 -1.213E-0 3301403 CO2 (g) 2.068E-0 3300021 O2 (g) -3.080E-0		07	-6.360 -3.916 -5.684 -6.511	25.113 7.300 21.691 -84.491	25.760 0.000 -0.530 133.830			
		-04 -06 -07						
2802	810	Fe+2/Fe+3	-3.581E-	07	-6.446	13.185	-10.000	
Tvr	e IV	- FINITE S	SOLIDS (prese	nt at e	guilibrium)			
I	D	NAME	CALC MC	L	LOG MOL	NEW LOGK	DH	
3028100 HEMATITE		1.791E-07		-6.747	3.536	30.845		
2047	000	PYROLUSITE	4.369E-	07	-6.360	-16.308	29.180	
2003	102	CR2O3	1.480E- 3.563E-	08	-5.830	-7.250	24.630	
5021	102	01/200	J. JUJE	00	7.440	5.200	12.120	
			E	ART 5 O	f OUTPUT FI	LE		
			EQUILIB	RATED MA	ASS DISTRIB	UTION		
IDX	ľ	JAME	DISSOLV	DISSOLVED		SORBED		TATED
			MOL/KG E	ERCENT	MOL/KG	PERCENT	MOL/KG	PERCENT
540	Ni+2	2	3.066E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	L	1.783E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
60	H3As	503	8.734E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
100	Ba+2	2	6.553E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
160	Cd+2		9.401E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
800	Sr+2	>	2.402E-00 2.283E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
600	Ph+2	>	4 634E-08	100.0	0.000E-01	0.0	0.000E - 01	0.0
410	K+1	-	1.012E - 05	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Ma+2	2	1.275E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
211	Cr(C)H)2+	3.157E-09	4.2	0.000E-01	0.0	7.125E-08	95.8
470	Mn+2	2	4.205E-16	100.0	0.000E-01	0.0	0.000E-01	0.0
30	A1+3	3	2.623E-09	0.2	0.000E-01	0.0	1.480E-06	99.8
140	C03-	-2	1.129E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
471	Mn+3	3	2.468E-27	0.0	0.000E-01	0.0	4.369E-07	100.0
280	Fe+2	2	5.543E-25	100.0	0.000E-01	0.0	0.000E-01	0.0
281	Fe+3	3	2.396E-15	0.0	0.000E-01	0.0	3.581E-07	100.0
1	E-1		-1.869E-18	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1		1.233E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
2	H20		1.479E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
	Char	rge Balance	: SPECIATED				-	
	Su	m of CATIC	NS = 6.348E	-04 Sum	of ANIONS	1.023E-	04	
	PE	ERCENT DIFF	ERENCE = 7	.224E+0	I (ANIONS -	CATIONS)	/(ANIONS + (CATIONS)
	EQUI	LIBRIUM IC	NIC STRENGTR	(m) =	5.91/E-04			
	EQUI	LIBRIUM PH	1	=	1.300	The second	000 07	
	EQU1	TIPKIAW DE		=	13.023 0	r FU =	000.9/ mv	

0.046

PART 1 of OUTPUT FILE Revuè river water-Site 1 - Run 4 Entered CO3²⁻, Pco2, Po2, fixed pH, Fe redox pair, Mn redox pair, solids allowed to precipitate Adsorption _____ Temperature (Celsius): 18.90 Units of concentration: MG/L Ionic strength to be computed. If specified, carbonate concentration represents total inorganic carbon. Do not automatically terminate if charge imbalance exceeds 30% Precipitation is allowed for all solids in the thermodynamic database and the print option for solids is set to: 1 The maximum number of iterations is: 200 The method used to compute activity coefficients is: Davies equation Intermediate output file Adsorption model: Diffuse Layer Number of adsorbing surfaces: 1 INPUT DATA BEFORE TYPE MODIFICATIONS ANAL TOTAL ID NAME ACTIVITY GUESS LOG GUESS -7.300 330 H+1 5.012E-08 0.000E-01 30 Al+3 60 H3AsO3 1.479E-06 8.710E-08 4.000E-02 1.100E-02 -5.830 -7.060 100 Ba+2 6.607E-07 -6.180 9.000E-02 150 Ca+2 9.550E-05 -4.020 3.800E+00 2.700E-03 2.399E-08 7.413E-08 -7.620 -7.130 160 Cd+2 Cr(OH)2+ 211 6.400E-03 280 Fe+2 3.548E-07 -6.450 2.000E-02 -4.990 410 K+1 1.023E-05 3.957E-01 1.288E-04 3.100E+00 460 Mg+2 470 Mn+2 -6.360 4.365E-07 2.400E-02 1.778E-04 500 Na+1 -3.750 4.100E+00 540 Ni+2 3.090E-08 -7.510 1.800E-03 4.677E-08 2.291E-07 600 Pb+2 800 Sr+2 -7.330 9.600E-03 -6.640 2.000E-02 -16.000 0.000E-01 -6.320 6.902E+00 -20.750 0.000E-01 1.000E-16 E-1 1 140 CO3-2 4.786E-07 281 Fe+3 471 Mn+3 1.778E-21 1.820E-21 1.000E+00 -20.740 0.000E-01 0.000 0.000E-01 -3.720 1.922E-04 813 ADS1PSIO 811 ADS1TYP1 1.905E-04 812 ADS1TYP2 2 H20 7.690E-03 7.762E-03 -2.110 1.000E+00 0.000 0.000E-01 Charge Balance: UNSPECIATED Sum of CATIONS= 6.412E-04 Sum of ANIONS = 2.300E-04 PERCENT DIFFERENCE = 4.719E+01 (ANIONS - CATIONS)/(ANIONS + CATIONS) PART 3 of OUTPUT FILE Type I - COMPONENTS AS SPECIES IN SOLUTION LOG ACTVTY 5.146E-085.012E-08-7.300000.973870.0112.842E-152.239E-15-14.649920.787960.1035.627E-115.628E-11-10.04054 NAME CALC MOL ACTIVITY H+1 5.146E-08 5.012E-08 ID 30 H+1 30 Al+3 330 H+1 60 H3AsO3 5.627E-11 5.628E-11 -10.24964 1.00013 100 Ba+2 150 Ca+2 3.561E-07 3.203E-07 7.315E-05 6.580E-05 -6.49441 0.89950 -4.18179 0.89950 0.046 0.046 2.354E-11 2.117E-11 160 Cd+2 -10.67420 0.89950 0.046 1.281E-09 5.501E-25 1.012E-05 1.274E-04 1.146E-04 211 Cr(OH)2+ -8.90404 0.97387 0.011 280 Fe+2 410 K+1 -24.30555 0.89950 0.046 -5.00632 0.97387 -3.94093 0.89950 0.011 460 Mg+2 0.046 470 Mn+2 4.177E-16 3.757E-16 -15.42515 0.89950 0.046 1.783E-041.737E-04-3.760260.973875.304E-114.771E-11-10.321420.899502.431E-152.187E-15-14.660220.89950 500 Na+1 0.011 0.046 540 Ni+2 600 Pb+2

800 Sr+2

2.431E-15 2.187E-15 -14.66022 0.89950 0.046 2.283E-07 2.053E-07 -6.68756 0.89950 0.046

811	ADS1TYP1	1.320E-04	1.320E-04	-3.87954	1.00000	0.000			
281	E0+3	9.015E-08 2 727E-24	2.148E - 24	-23 66789	0.89950	0.046			
471	Mn+3	2.446E-27	1.927E-27	-26.71503	0.78796	0.103			
812	ADS1TYP2	5.902E-03	5.902E-03	-2.22903	1.00000	0.000			
mene TT	OWNED CDECT	EQ IN COLUMN	ON OD 30000	DED					
Type II	- OTHER SPECI	CALC MOL	ACTIVITY	LOG ACTVTY	CAMMA	NEW			
LOCK	WANTS	CALC MOL	ACIIVIII	TOG ACIVII	GAIMA	IN E. W			
8120600	=S2H2AsO3(o)	8.538E-08	8.538E-08	-7.06866	1.00000	5.410			
2113302	Cr(OH) 3 AQ	1.845E-09	1.845E-09	-8.73404	1.00013	-7.130			
2113303	Cr(OH)4-	3.610E-13	3.515E-13	-12.45405	0.97387	-18.139			
2113304	CrO2-	9.159E-13	8.920E-13	-12.04964	0.97387	-17.734			
3300020	OH-	1.286E-07	1.252E-07	-6.90231	0.97387	-14.191			
4603300	MgOH +	2.243E-09	2.184E-09	-8.66068	0.97387	-12.008			
4601400	MgCO3 AQ	8.0/3E-09	8.0/4E-09	-8.09291	1.00013	2.939			
4601401	CaOH +	2.038E - 10	1.277E-07 1.985E-10	-0.89393 -9.70231	0.97387	-12 809			
1501400	CaHCO3 +	5.766E-08	5.615E-08	-7.25065	0.97387	11.334			
1501401	CaCO3 AO	6.688E-09	6.689E-09	-8.17465	1.00013	3.098			
5001400	NaCO3 -	1.958E-10	1.907E-10	-9.71970	0.97387	1.143			
5001401	NaHCO3 AQ	8.485E-09	8.486E-09	-8.07128	1.00013	10.080			
303300	AloH +2	3.341E-13	3.005E-13	-12.52209	0.89950	-5.126			
303301	Al(OH)2 +	7.271E-11	7.081E-11	-10.14993	0.97387	-10.089			
303302	Al (OH) 4 -	7.710E-10	7.508E-10	-9.12447	0.97387	-23.663			
303303	AI (OH) 3 AQ	1.778E-09	1.779E-09	-8.74994	1.00013	-16.000			
2803300	FeoH3 -1	2.013E-27 1 397E-34	1.901E-27	-20.10162	0.97387	-9.691			
2803302	FeOH2 AO	1.937E-31	1.937E - 31	-30.71287	1.00013	-21 007			
2813300	FeOH +2	2.133E-19	1.918E-19	-18.71709	0.89950	-2.303			
2813301	FeOH2 +	1.878E-15	1.829E-15	-14.73790	0.97387	-5.659			
2813302	FeOH3 AQ	4.286E-16	4.286E-16	-15.36790	1.00013	-13.600			
2813303	FeOH4 -	8.782E-17	8.553E-17	-16.06790	0.97387	-21.589			
2813304	Fe2(OH)2+4	1.957E-36	1.281E-36	-35.89246	0.65464	-2.973			
2813305	Fe3(OH)4+5	9.223E-49	4.758E-49	-48.32260	0.51583	-6.231			
8003300	SrOH +	1.6/5E-13	1.631E-13	-12.78747	0.97387	-13.388			
1703300	BaOH +	1.690E-13	1.646E-13	-12.78351	0.97387	-13.578			
4703301	Mn(OH) 3 -1	4.857E-29	4.730E-29	-28.32517	0.97387	-34.789			
4700020	MnO4 -	3.734E-19	3.637E-19	-18.43929	0.97387	-130.516			
4700021	MnO4 -2	3.760E-23	3.382E-23	-22.47082	0.89950	-120.691			
4701400	MnHCO3 +	6.242E-19	6.079E-19	-18.21617	0.97387	11.611			
1601400	Cd(CO3)3-4	2.862E-26	1.874E-26	-25.72725	0.65464	6.404			
1603300	CdOH +	2.274E-14	2.214E-14	-13.65476	0.97387	-10.269			
1603301	Cd(OH)2 AQ	3.765E-17	3.765E-17	-16.42421	1.00013	-20.350			
1603302	Cd(OH) 3 - Cd(OH) 4 - 2	8.655E-23	8.429E-23	-22.07421	0.9/38/	-33.289			
1603304	Cd(OH) = -2 Cd2OH = +3	1.000E-29 3.149E-24	2 482E - 24	-23 60526	0.89950	-9 453			
1601400	CdHCO3 +	2.220E-13	2.162E-13	-12.66522	0.97387	12.411			
1601401	CdCO3 AQ	4.303E-13	4.303E-13	-12.36622	1.00013	5.399			
6001400	Pb(CO3)2-2	6.978E-19	6.277E-19	-18.20226	0.89950	10.686			
6003300	PbOH +	8.735E-16	8.507E-16	-15.07023	0.97387	-7.699			
6003301	Pb(OH)2 AQ	6.603E-18	6.603E-18	-17.18023	1.00013	-17.120			
6003302	Pb (OH) 3 -	1.553E-21	1.513E-21	-20.82024	0.97387	-28.049			
6003303	PD20H +3	5.285E-29	4.164E-29	-28.38045	0.78796	-6.257			
6001401	PD3 (OH) 4+2	9.541E-40 3.081E-15	8.583E-40 3.081E-15	-39.06638	0.89950	-24.240			
6003305	Pb(OH)4 = 2	7.705E-26	6 930E-26	-25 15924	0 89950	-39 653			
6001402	PbHCO3 +	1.446E-16	1.409E-16	-15.85124	0.97387	13.211			
5403300	NiOH +	8.708E-14	8.481E-14	-13.07156	0.97387	-10.039			
5403301	Ni(OH)2 AQ	1.899E-15	1.899E-15	-14.72143	1.00013	-19.000			
5403302	Ni(OH)3 -	3.891E-19	3.789E-19	-18.42143	0.97387	-29.989			
5401400	NiHCO3 +	5.876E-13	5.722E-13	-12.24244	0.97387	12.481			
5401401	NICO3 AQ	2.868E-11	2.868E-11	-10.54244	1.00013	6.870			
5401402	N1 (CO3) 2-2	4.493E-15	4.042E-15	-14.39345	0.89950	10.156			
3300600	HASO3 -2	J.413E-13	5.2/2E-13 6 353E-10	-17 10701	0.9/38/	-9.31/ -21 501			
3300602	As03 -3	5.010E-24	3.948E-24	-23.40365	0.78796	-34.951			
3300603 3301400 3301401 2113300 2113301 8123301 8123302 8113302 8113302 8121600 8115400 8115400 8125400 8125400 812500 8121500 8111500 8111000 8121000	H4AsO3 + HCO3 - H2CO3 AQ Cr+3 Cr(OH)+2 =SO2- =SO2H2+ =SO1- =SO1H2+ =SO2Cd+ =SO1Cd+ =SO1Cd+ =SO1Pb+ =SO2Pb+ =SO2Ca+ =SO1HCa++ =SO1HBa++ =SO2Ba+ =SO1H2ASO3(O)	1.435E-18 1.019E-04 1.058E-05 3.371E-14 2.897E-11 8.832E-04 9.034E-04 1.975E-05 2.020E-05 4.917E-10 2.351E-08 2.779E-08 2.783E-09 4.625E-08 8.048E-11 1.714E-06 1.988E-05 2.992E-07 5.840E-11 1.909E-09	1.39 9.92 1.05 2.65 2.60 8.83 9.03 1.97 2.02 4.91 2.35 2.77 2.78 4.62 8.04 1.71 1.98 2.99 5.84 1.90	8E- 5E- 6E- 2E- 4E- 5E- 0E- 7E- 1E- 9E- 3E- 8E- 4E- 8E- 8E- 8E- 8E- 9E- 9E- 9E- 9E- 9E- 9E- 9E- 9E- 9E- 9	-18 -05 -05 -14 -04 -04 -05 -05 -05 -08 -08 -08 -08 -08 -08 -08 -08 -09 -08 -09 -08 -01 -06 -05 -07 -11 -06 -05 -05	-17 -44 -44 -133 -33 -44 -44 -95 -77 -77 -78 -77 -100 -55 -44 -66 -100 -88	.85464 .00326 .97562 .57570 .58404 .05395 .04411 .70446 .69462 .30831 .62882 .55604 .55553 .33484 .09434 .76590 .70149 .52411 .23360 .71917	0.97387 0.97387 1.00013 0.78796 0.89950 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000	-0.294 10.399 16.715 10.032 5.666 -8.930 7.290 -2.900 0.430 0.150 -2.500 4.710 0.300 -5.850 4.970 5.460 -7.200 5.410
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Type II	T - SPECTES WI	TH FIXED AC	ጥተህተጥል						
ID ID	NAME	CALC MOL	11/11	LOC	G MOL	N	IEW LOGK	DH	
4704710	H2O Mn+2/Mn+3	-1.650E-06		-5.	. 782 . 360		25.113	25.760	
330	H+1	-1.404E-04		-3.	853		7.300	0.000	
3301403	CO2 (g)	2.224E-06		-5.	. 653 511	_	21.691	-0.530	
2802810	Fe+2/Fe+3	-3.581E-07		-6	446		13.185	-10.000	
ID 3028100 2047000 2003002 3021102	NAME HEMATITE PYROLUSITE DIASPORE CR203	CALC MOL 1.791E-07 4.369E-07 1.480E-06 3.563E-08	at eq	LO(-6. -5. -7.	G MOL .747 .360 .830 .448		IEW LOGK 3.536 16.308 -7.250 3.208	DH 30.845 29.180 24.630 12.125	
	PERCE	PAR	T 4 of	JO N (JTPUT	FIL	E	NG	
	TYPE I a	nd TYPE II	(disso	lve	ed and	ac	lsorbed)	species	
ADS1PSI0									
	>1000. 32.1 2.7 63.3	PERCENT PERCENT PERCENT PERCENT	BOUND BOUND BOUND BOUND	IN IN IN IN	SPECI SPECI SPECI SPECI	ES ES ES	#8123302 #8113302 #8121500 #8111500	2 =S02H2+ 2 =S01H2+) =S02Ca+) =S01HCa++	
Ca+2	77 0	DEDGEN	DOUND	TN	ODECT	TO	# 150	0-10	
	1.8	PERCENT	BOUND	IN	SPECI	ES	# 150	= S02Ca+	
	21.0	PERCENT	BOUND	IN	SPECI	ES	#8111500) =SO1HCa++	
Mg+2	99 9	PERCENT	BOUND	TN	SPECT	ES	# 460) Ma+2	
Na+1	55.5	LEROBINI	200112		01001	20		119.1	
K+1	100.0	PERCENT	BOUND	IN	SPECI	ES	# 500) Na+1	
1(11	100.0	PERCENT	BOUND	IN	SPECI	ES	# 410) K+1	
Pb+2	99 8	DEDCENT	ROUND	TN	SDECT	FC	#8116000	-901 Pb +	
ADS1TYP1	55.0	LEKCENI	DOOND	TIA	DIDCI		#0110000	-501151	
	68.7	PERCENT	BOUND	IN	SPECI	ES	# 811	ADS1TYP1	
	10.5	PERCENT	BOUND	IN	SPECI	ES	#8113302	= SO1- 2 = SO1H2+	
	10.3	PERCENT	BOUND	IN	SPECI	ES	#8111500) =SO1HCa++	
ADS1TYP2	76 7	DEDOENI	ROUND	TNT	CDECT	FC	# 010		
	11.5	PERCENT	BOUND	IN	SPECI	ES	# 8123301	= SO2-	
	11.7	PERCENT	BOUND	IN	SPECI	ES	#8123302	=SO2H2+	

Sr+2									
H3As(03	100.0	PERCENT	BOUND	IN	SPECIES	# 800	Sr+2	
		97.7 2.2	PERCENT PERCENT	BOUND BOUND	IN IN	SPECIES SPECIES	#8120600 #8110600	=S2H2AsO3 =S1H2AsO3	3(0) 3(0)
Ba+2		54.3 45.6	PERCENT PERCENT	BOUND BOUND	IN IN	SPECIES SPECIES	# 100 #8111000	Ba+2 =SO1HBa+-	÷
Ni+2		90.7	PERCENT	BOUND	IN	SPECIES	#8115400	=SO1Ni+	
Cd+2		2.0	PERCENT	BOUND	IN	SPECIES	#8121600	=S02R1+	
Cr (Ol	H)2+	97.9	PERCENT	BOUND	IN	SPECIES	#8111600	=SO1Cd+	
Mn+2		40.6	PERCENT PERCENT	BOUND	IN	SPECIES SPECIES	# 211 #2113302	Cr(OH)2+ Cr(OH)3 A	QA
N1+3		99.7	PERCENT	BOUND	IN	SPECIES	# 470	Mn+2	
ALTO		2.8 29.4	PERCENT PERCENT	BOUND BOUND	IN IN	SPECIES SPECIES	# 303301 # 303302	Al(OH)2 - Al(OH)4 -	+
C03-2	2	67.8	PERCENT	BOUND	IN	SPECIES	# 303303	Al(OH)3 2	QA
Fall		90.4 9.4	PERCENT PERCENT	BOUND BOUND	IN IN	SPECIES SPECIES	#3301400 #3301401	HCO3 - H2CO3 AQ	
retz		99.6	PERCENT	BOUND	IN	SPECIES	# 280	Fe+2	
E-1 Fe+3		100.0	PERCENT	BOUND	IN	SPECIES	#4700020	MnO4 -	
10,5		78.4	PERCENT PERCENT PERCENT	BOUND BOUND	IN IN	SPECIES SPECIES	#2813301 #2813302 #2813303	FeOH2 + FeOH3 AQ	
Mn+3		100.0	PERCENT	BOUND	TN	SPECIES	# 471	Mn+3	
H+1		71.7	PERCENT	BOUND	TN	SPECIES	#3301400	HCO3 -	
		14.9 636.0 14.2	PERCENT PERCENT PERCENT	BOUND BOUND BOUND	IN IN IN	SPECIES SPECIES SPECIES	#3301401 #8123302 #8113302	H2CO3 AQ =SO2H2+ =SO1H2+	
H2O		1.2	PERCENT	BOUND	IN	SPECIES	#2113302	Cr(OH)3 A	AQ
		1.4 2.0 3.4	PERCENT PERCENT PERCENT PERCENT	BOUND BOUND BOUND	IN IN IN	SPECIES SPECIES SPECIES	#303300 # 303302 # 303303	MgOH + Al(OH)4 - Al(OH)3 2	– AQ
		15.2 17.9 1.8 29.8	PERCENT PERCENT PERCENT PERCENT	BOUND BOUND BOUND	IN IN IN IN	SPECIES SPECIES SPECIES SPECIES	#8111600 #8115400 #8125400 #8116000	=SO1Cd+ =SO1Ni+ =SO2Ni+ =SO1Pb+	
			PAI	RT 5 01	E OI	JTPUT FI	LE		
			EQUILIBRA	TED MA	SS	DISTRIBU	TION		
IDX	NAME		DISSOLVE MOL/KG PEI	D RCENT	1	SORBI 10L/KG	ED PERCENT	PRECIP: MOL/KG	ITATED PERCENT
800 60 100 150	Sr+2 H3AsO3 Ba+2 Ca+2	2 5 3 7	.283E-07 .682E-11 .561E-07 .321E-05	100.0 0.1 54.3 77.2	0 8 2 2	.000E-01 .729E-08 .992E-07 .160E-05	0.0 99.9 45.7 22.8	0.000E-01 0.000E-01 0.000E-01 0.000E-01	0.0 0.0 0.0
160	Cd+2 Pb+2	2	.421E-11 .537E-15	0.1	2.4	400E-08 634E-08	99.9	0.000E-01 0.000E-01	0.0

100.0

100.0

100.0

0.3

4.2

0.000E-01

0.000E-01 0.000E-01

3.058E-08

0.000E-01

0.000E-01

0.000E-01

0.000E-01

0.000E-01

7.125E-08

0.0

0.0

0.0

99.7

0.0

0.0

0.0

0.0

95.8

410

460

500

K+1

Mg+2

Na+1

540 Ni+2

211 Cr(OH)2+ 3.156E-09

1.012E-05

1.275E-04 1.783E-04

8.239E-11

470 30 140 280 1 281 471 330 2	Mn+2 Al+3 CO3-2 Fe+2 E-1 Fe+3 Mn+3 H+1 H2O	4 2 1 5 -1 2 2 1	.188E- .622E- .128E- .521E- .867E- .394E- .446E- .232E- .414E-	16 100 09 0 25 100 18 100 15 0 27 0 04 86 07 91	.0 .2 .0 .0 .0 .0 .0 .0 .0 .7 .2	0.00 0.00 0.00 0.00 0.00 0.00 1.88 1.36	0E-0 0E-0 0E-0 0E-0 0E-0 0E-0 7E-0 2E-0	1 1 1 1 5 8	0.0 0.0 0.0 0.0 0.0 0.0 13.3 8.8	0.00 1.48 0.00 0.00 3.58 4.36 0.00)0E- 30E-)0E-)0E-)0E- 31E- 59E-)0E-)0E-	-01 -06 -01 -01 -01 -07 -07 -01 -01		0.0 9.8 0.0 0.0 0.0 0.0 0.0 0.0 0.0
	Charo Sur PEI EQUII EQUII EQUII	ge Balance: S n of CATIONS RCENT DIFFER LIBRIUM IONIC LIBRIUM PH LIBRIUM PE	SPECIA = 1.9 ENCE = C STREN	TED 557E-03 2.153 NGTH (m)	Sum E+0: = =	of AN (ANI 5.47 7.30 13.82	IONS ONS 8E-0 0 3	- C. 4 or	1.005E- ATIONS) Eh =	03 /(ANIC 800.9	ons 97 r	+ (1.v	CATION	NS)
**** El Ad	*** D: * Para ectros sorben ecific	IFFUSE LAYER ameters For A static Varial nt Concentrat c Surface Are	ADSORI Adsorbe bles: tion (q ea (sq	PTION MO psi0 = psib = psid = g/l): . meters	DEL 0.04 0.00 0.00 3.44 /g)	***** 46652 00000 00000 42 : 600	.00	sig sig sig	0 = 0.0 b = 0.0 d = 0.0	02938 00000 00000				
				PART	6 0:	E OUTP	UT F	ILE						
Satu	ratio	n indices and	d stoid	chiometr	y of	f all i	mine	ral	S					
	ID #	NAME	Sat.	Index		Sto	ichi	ome	try in	[brac]	cets	5]		
20	03000	ALOH3(A)	-3.	.544	[-	L.000]	30	Ĺ	3.000] 2	L	-3	.000]:	330
50	15000	ARAGONITE	-2	.991	L -	1.000]	150	l	1.000] 140		1	0001	
50	46000	ARTINITE	-10	.413	[-2	2.000]	330	l	2.000] 460	L	1	.000]:	140
					[5.000]	2							
20	03001	BOEHMITE	-1	.759	[-:	3.000]	330	[1.000] 30	[2	.000]	2
20	46000	BRUCITE	-6	.529	[]	1.000]	460]	2.000] 2	[-2	.000]:	330
50	15001	CALCITE	-2	.832	[]	L.000]	150	[1.000] 140				
20	03002	DIASPORE	0	.000	[-:	3.000]	330	[1.000] 30	[2	.000]	2
50	15002	DOLOMITE	-5.	.432	[]	1.000]	150]	1.000] 460	[2	.000]:	140
20.	28100	FERRIHYDRITH	E -6.	.659	[-:	3.000]	330]	1.000] 281	[3	.000]	2
20.	28101	FE3 (OH) 8	-33	.463	[-8	3.000]	330	[2.000] 281	[1	.000]2	280
					[{	3.000]	2							
20	03003	GIBBSITE (C)) -1.	.869	[-:	3.000]	330]	1.000] 30	Ε	3	.000]	2
30	03000	A1203	-8	.480	[2	2.000]	30	[3.000] 2]	-6	.000]:	330
20	28102	GOETHITE	-2	.490	[-:	3.000]	330]	1.000] 281	[2	.000]	2
30	28100	HEMATITE	0	.000	[- 6	5.000]	330	[2.000] 281	[3	.000]	2
50	15003	HUNTITE	-14	.795	[]	3.000]	460]	1.000] 150]	4	.000]:	140
50	46001	HYDRMAGNESI	r -25.	.502	[!	5.000]	460]	4.000] 140]	-2	.000]:	330
					[(5.000]	2							
30	28101	MAGHEMITE	-9.	922	[- {	5.000]	330	[2.000] 281	[3	.000]	2
50	46002	MAGNESITE	-3.	.097	[]	L.000]	460	[1.000] 140				
30	28000	MAGNETITE	-17.	.751	[-{	3.000]	330]	2.000] 281	[1	.000]2	280
					[4	1.000]	2							
30	50000	NATRON	-13	.060	[2	2.000]	500	[1.000] 140	[10	.000]	2
50	46003	NESQUEHONITE	E -5.	.500	[]	L.000]	460]	1.000] 140	[3	.000]	2
50	28000	SIDERITE	-20.	928	[]	L.000]	280]	1.000] 140				
50	80000	STRONTIANITE	E -4.	539	[]	L.000]	800]	1.000] 140				
50	50001	THERMONATR	-14.	779	[2	2.000]	500]	1.000] 140	[1	.000]	2
50	10000	WITHERITE	-4.	995	[]	L.000]	100]	1.000] 140				
20	47000	PYROLUSITE	0.	.000	[-4	1.000]	330]	-1.000] 1	[1	.000]4	471
					[2	2.000]	2							
20	47001	BIRNESSITE	-1.	783	[-4	1.000]	330]	-1.000] 1	I	1	.000]4	471
					[2	2.000]	2							
20	47002	NSUTITE	-1.	196	[-4	1.0001	330	ſ	-1.000] 1	٢	1	.00014	471
					[2	2.0001	2			-				
30	47100	BIXBYITE	-9.	252	[-6	5.0001	330	٢	2.000] 471	٢	3	.0001	2
30	47000	HAUSMANNITE	-22	997	[-8	3.0001	330	r	-2.000] 1	ſ	3	.00014	170
2.2					[]	1.0001	2	L		-	L	-	1	
20	47003	PYROCROITE	-16.	259	1 -2	2.0001	330	٢	1.000	1 470	٢	2	.0001	2
20	47100	MANGANITE	-4	577	[-]	3.0001	330	ſ	1.000	1 471	ſ	2	.0001	2
50	47000	RHODOCHROSIT	r -12.	138	[1.000]	470	Ĩ	1.000] 140				1

16000	CD METAL	-52.085	[1.000]	160]	2.000]	1			
16001	GAMMA CD	-52.187	[1.000]	160]	2.000]	1			
5016000	OTAVITE	-4.034	[1.000]	160]	1.000]	140			
2016000	CD(OH)2 (A)	-10.122	[-2.000]	330	[1.000]	160	I	2.000]	2
2016001	CD(OH)2 (C)	-9.724	[-2.000]	330	I	1.000]	160	I	2.000]	2
2016002	MONTEPONITE	-11.573	[-2.000]	330]	1.000]	160	Ι	1.000]	2
60000	PB METAL	-46.570	[1.000]	600]	2.000]	1			
5060000	CERRUSITE	-8.547	[1.000]	600	Ĩ	1.000]	140			
2060000	MASSICOT	-13.227	[-2.000]	330	Ī	1.000]	600	[1.000]	2
2060001	LITHARGE	-13.031	[-2.000]	330	Ĩ	1.000]	600]	1.000]	2
2060002	PBO, .3H2O	-13.040	[-2.000]	330	ſ	1.000]	600	Ţ	1.330]	2
5060001	PB2OCO3	-21.487	[-2.000]	330	ſ	2.0001	600	ſ	1.0001	2
			[1.000]	140				-		
5060002	PB302C03	-33.296	[-4.000]	330	Γ	3.000]	600	I	1.000]	40
			[2.000]	2		_				
2060003	PLATTNERITE	-8.198	[-4.000]	330]	-2.000]	1	[1.000]6	500
			[2.000]	2				-		
3060000	PB203	-18.915	[-6.000]	330	ſ	-2.000]	1	[2.000]6	500
			3.0001	2		-		-		
3060001	MINIUM	-33.198	[-8.000]	330	Γ	-2.000]	1	[3.000]6	500
			[4.000]	2		-				
2060004	PB(OH)2 (C)	-8.424	[-2.000]	330	Γ	1.000]	600	[2.000]	2
5060003	HYDCERRUSITE	-26.103	[-2.000]	330	[3.000]	600]	2.000]1	40
			[2.000]	2						
2060005	PB20 (OH) 2	-26.320	[-4.000]	330	I	2.000]	600	[3.000]	2
5054000	NICO3	-10.725	[1.000]	540]	1.000]	140			
2054000	NI (OH) 2	-6.055	[-2.000]	330	E	1.000]	540	I	2.000]	2
2054001	BUNSENITE	-8.538	[-2.000]	330	L	1.000]	540	J	1.000]	2
3006000	ARSENOLITE	-37.978	[4.000]	60	I	-6.000]	2			
3006001	CLAUDETITE	-37.730	[4.000]	60	[-6.000]	2			
2015000	LIME	-23.087	[-2.000]	330]	1.000]	150	[1.000]	2
2015001	PORTLANDITE	-12.727	[-2.000]	330	[1.000]	150	[2.000]	2
2028000	WUSTITE	-20.485	[-2.000]	330	[0.947]	280	[1.000]	2
2046001	PERICLASE	-11.404	[-2.000]	330	I	1.000]	460	[1.000]	2
3028001	HERCYNITE	-23.567	[-8.000]	330	[1.000]	280	C	2.000]	30
			[4.000]	2						
3046000	SPINEL	-12.538	[-8.000]	330	I	1.000]	460	[2.000]	30
			[4.000]	2						
3046001	MAG-FERRITE	-10.662	[-8.000]	330	[1.000]	460	[2.000]2	281
			[4.000]	2						
3028102	LEPIDOCROCIT	-3.139	[-3.000]	330	I	1.000]	281	Ι	2.000]	2
3021100	FECR204	-12.393	[2.000]	211	[1.000]	280]	-4.000]3	330
3021101	MGCR204	-5.239	[2.000]	211]	1.000]	460]	-4.000]3	330
3021102	CR203	0.000	[2.000]	211]	-2.000]	330]	-1.000]	2
2021102	CR(OH)3 (A)	-0.854	[1.000]	211]	1.000]	2	[-1.000]3	330
2021101	CR(OH)3 (C)	-3.413	[1.000]	211]	1.000]	2	[-1.000]3	330

2 - Modelling of water quality of Site 9

		PART	1 of OUTPU	T FILE		
Revuè ri	ver water-Site	9 - Initial	run			
Entered a	alkalinity, Pcoz	, Poz, fixed	pH, solids	not allo	wed to precip	pitate
Tempera	ture (Celsius).	17 30				
Inite	f concentration	. MC /T				
UNILS O	I concentration	: MG/L				
Ionic s	trength to be co	omputed.				
Carbona	te concentration	n represent.	s carbonate	alkalini	ty.	
Do not	automatically to	erminate if	charge imb	alance ex	ceeds 30%	
Precipi	tation is allow	ed only for	those soli	ds specif	ied as ALLOW	ED.
in th	e input file (i	f any)	00000 0011	de opeer		
The men	imum number of	itang/.	ia. 200			
The max	Indun number or	iterations	15: 200			
The met	hod used to com	pute activi	ty coeffici	ents 1s:	Davies equat:	lon
Interme	diate output fi	le				
INPUT DA	TA BEFORE TYPE I	MODIFICATIO	NS			
TD	NAME	ACTIVITY G	UESS LOG	GUESS	ANAL TOTAL	
220	U 1	2 162	E_00	7 500	0.000E-01	
330	n+1	5.102		-7.500	0.000E-01	
30	A1+3	2.239	E-06	-5.650	6.000E-02	
60	H3AsO3	3.162	E-08	-7.500	4.000E-03	
100	Ba+2	1.230	E-06	-5.910	1.700E-01	
150	Ca+2	1.778	E - 04	-3.750	7.200E+00	
160	Cd+2	2 818	E-09	-8 550	3 200E-04	
211	Cx(04)2+	5 195	E_09	-7.260	4 700E-03	
211	CI (OH) 2+	0.495	E-00	-7.200	4.700E-03	
280	re+2	8.913	E-07	-6.050	5.000E-02	
410	K+1	1.950	E-05	-4.710	7.644E-01	
460	Mg+2	3.090	E - 04	-3.510	7.600E+00	
470	Mn+2	3.631	E-06	-5.440	2.000E-01	
500	Na+1	2.239	E - 0.4	-3.650	5.200E+00	
600	Ph+2	1 288	E = 0.7	-6 890	2 700E-02	
000	Cm12	1 571		6.240	A 000E-02	
800	Sr+Z	4.5/1.	E-07	-6.340	4.000E-02	
1	E-1	1.000	E-16	-16.000	0.000E-01	
140	CO3-2	8.511	E-07	-6.070	3.693E+01	
2	H20	1.000	E+00	0.000	0.000E-01	
Cha	rge Balance: UN	SPECIATED				
S	IT OF CATIONS=	1 250F-03	Sum of ANTO	NS = 1.2	31E-03	
D	EDCENT DIFFEDEN	CE - 7 607	E-01 (ANTO	NG - CATT	ONG) / (ANTONS	+ CATTONS)
F.	ERCENI DIFFEREN	CE - 1.001.	E-OI (ANIO	ND - CALL	OND)/ (ANIOND	+ CALLONS)
			0 0 0000000			
		PART	3 of OUTPU	T FILE		
Type I	- COMPONENTS AS	SPECIES IN	SOLUTION			
ID	NAME	CALC MOL	ACTIVITY	LOG ACTV	TY GAMMA	NEW LOGK
330	H+1	3.287E-08	3.162E-08	-7.500	0.96212	0.017
30	A1+3	6.711E-13	4.740E - 13	-12.324	19 0.70640	0.151
60	437603	3 1315-08	3 132E-08	-7 504	1 00028	0,000
100	NJASUJ	1.0000	1.0010.00	F. 074	11 0.050020	0.000
100	Ba+2	1.230E-00	1.001E-00	-5.974	0.05000	0.067
150	Ca+2	1.794E-04	1.537E-04	-3.813	327 0.85686	0.067
160	Cd+2	2.688E-09	2.303E-09	-8.637	0.85686	0.067
211	Cr(OH)2+	1.670E-08	1.607E-08	-7.794	0.96212	0.017
280	Fe+2	8.910E-07	7.634E-07	-6.117	0.85686	0.067
110	K+1	1 9555-05	1 8815-05	-1 725	63 0 96212	0 017
410	K+1	1.9000-00	1.001E-05	2.122	0.90212	0.017
460	Mg+2	3.121E-04	2.674E-04	-3.572	0.85686	0.067
470	Mn+2	3.620E-06	3.102E-06	-5.508	342 0.85686	0.067
500	Na+1	2.262E-04	2.176E-04	-3.662	0.96212	0.017
600	Pb+2	2.794E-08	2.394E-08	-7.620	0.85686	0.067
800	Sr+2	4.565E-07	3.912E-07	-6.407	61 0.85686	0.067
140	CO3-2	2 3655-07	2 027E-07	-6 693	0 85686	0 067
140	005 2	2.0000 07	2.02/11 0/	0.055	0.00000	0.007
	0.000					
Type II	- OTHER SPECIE	S IN SOLUTI	ON OR ADSOR	BED		
ID	NAME	CALC MOL	ACTIVITY	LOG ACTV	TY GAMMA	NEW LOGK
2113302	Cr(OH) 3 AQ	3.766E-08	3.767E-08	-7.424	104 1.00028	-7.130
2113303	Cr (OH) 4-	1.182E-11	1.138E-11	-10.944	0.96212	-18.133
2113304	Cr02-	3.000E-11	2.887E-11	-10.530	0.96212	-17.729
33000000	04-	1 8175 07	1 7/05 07	_6 757	132 0 06212	-11 011
5500020	011	T.01/E-0/	1.1996-01	0.151	0.90212	14.241

4603300	MgOH +	7.260E-09	6.98	85E-	09	-8	.15583	0.96212	-12.066
4601400	MgCO3 AQ	4.594E-08	4.5	95E-	80	-7	.33769	1.00028	2.928
4601401	MgHCO3 +	5.031E-07	4.84	41E-	07	-6	.31509	0.96212	11.468
1503300	CaOH +	6.654E-10	6.40	02E-	10	-9	.19371	0.96212	-12.864
1501400	CaHCO3 +	2.12/E-0	2.04	4 /E-	07	-6	.68892	0.96212	11.334
1501401	CaCO3 AQ	3.796E-UE	5 3.7	97E-	10	- /	.42060	1.00028	3.086
5001400	Nacos -	5.703E-10	1 - 5.40	57E- 77E	00	-9	.20007	0.96212	1.112
303300	NARCUS AQ	1.070E-00)/E-)7F-	11 _	- 1 0	. 11552	1.00028	-5 154
303301	A1(0H)2 +	3 9135-08	2 3 7	65F-	08	-7	12121	0.05000	-10.083
303302	A1 (OH) 4 -	6 861E-07		11F-	07	-6	18037	0.96212	-23 839
303303	A1 (OH) 3 AO	1.4995-06	5 1.40	99E-	06	-5	82422	1.00028	-16,000
2803300	FeOH +	4.396E-09	4.22	29E-	09	-8	.37371	0.96212	-9.740
2803301	FeOH3 -1	6.468E-16	6.22	23E-	16 -	-15	.20603	0.96212	-31.572
2803302	FeOH2 AQ	5.722E-13	5.72	24E-	13 -	-12	.24230	1.00028	-21.125
8003300	SrOH +	4.462E-13	4.29	93E-	13 -	-12	.36727	0.96212	-13.443
1003300	BaOH +	7.781E-13	3 7.48	86E-	-13 –	-12	.12574	0.96212	-13.635
4703300	MnOH +	1.376E-09	1.32	24E-	09	-8	.87822	0.96212	-10.853
4703301	Mn(OH)3 -1	1.616E-18	3 1.55	54E-	18 -	-17	.80845	0.96212	-34.783
4700020	MnO4 -	1.137E-08	3 1.09	94E-	08	-7	.96102	0.96212	-131.239
4700021	MnO4 -2	1.763E-12	2 1.5	LIE-	12 -	-11	.82083	0.85686	-121.288
4701400	MnHCO3 +	8.225E-09	2 7.9.	14E-	09	-8	.10162	0.96212	11.617
1601400	Cd(CO3) 3-4	5.903E-23	3.10	32E-	23 -	11	.49726	0.53907	6.488
1603300	Cd(OH)2 DO	1 029E-1/		DOF-	14 -	12	.47220	1 00029	-10.318
1603302	Cd(OH) = AQ	3 7945-20	3 6	50F-	20 -	.19	13767	0 96212	-33 283
1603303	Cd(OH)4 -2	1.201E-26	5 1.02	29E-	26 -	-25	98768	0.85686	-47,283
1603304	Cd2OH +3	5.941E-20	4.19	97E-	20 -	-19	.37707	0.70640	-9.451
1601400	CdHCO3 +	3.854E-11	3.70)8E-	11 -	-10	.43085	0.96212	12.417
1601401	CdCO3 AQ	1.170E-10) 1.1	70E-	10	-9	.93185	1.00028	5.399
6001400	Pb(CO3)2-2	5.009E-11	4.29	92E-	11 -	10	.36733	0.85686	10.707
6003300	PbOH +	1.534E-08	3 1.4	76E-	08	-7	.83092	0.96212	-7.693
6003301	Pb(OH)2 AQ	1.815E-10) 1.81	16E-	10	-9	.74093	1.00028	-17.120
6003302	Pb (OH) 3 -	6.852E-14	6.59	93E-	14 -	-13	.18094	0.96212	-28.043
6003303	Pb2OH + 3	1.120E-14	1.9.	LOE-	15 -	-14	.10184	0.70640	-6.209
6003304	PD3 (OH) 4+2	6.44/E-18	0 0 1	24E-	18 -	-17	.25//1	0.85686	-24.328
6003305	Pb(OH)A = 2	5 586F-18	A 79	375-	18 -	.17	31995	0.85686	-39 632
6001402	PbHCO3 +	2.527E-09	2.4	32E-	09	-8	61412	0.96212	13 217
3300600	H2AsO3 -	4.540E-10	4.36	68E-	10	-9	.35969	0.96212	-9.339
3300601	HAs03 -2	9.057E-15	5 7.76	60E-	15 -	14	.11013	0.85686	-21.539
3300602	As03 -3	1.022E-20	7.23	16E-	21 -	20	.14171	0.70640	-34.987
3300603	H4AsO3 +	5.100E-16	5 4.90)7E-	16 -	15	.30922	0.96212	-0.288
3301400	HCO3 -	1.690E-04	1.62	26E-	04	-3	.78877	0.96212	10.421
3301401	H2CO3 AQ	1.075E-05	5 1.0	75E-	05	-4	.96855	1.00028	16.725
2113300	Cr+3	2.335E-13	3 1.64	19E-	13 -	-12	.78266	0.70640	10.162
2113301	Cr(OH)+2	2.472E-10	2.11	18E-	10	-9	.67401	0.85686	5.687
Type II	I - SPECIES	WITH FIXED AC	TIVITY	Y					
ID	NAME	CALC MOL		LOG	MOL	N	EW LOGK	DH	
2	H2O	1.053E-03	3	-2.	978		0.000	0.000	
3300021	02 (g)	-1.421E-08	3	-7.	847	-	85.043	133.830	
330	H+1	-2.304E-03	5	-2.	638		7.500	0.000	
3301403	CO2 (g)	1.060E-03	5	-2.	9/5		21.693	-0.530	
		PAF	RT 4 of	E OU	TPUT F	IL	Ε		
	PER	CENTAGE DISTR	RIBUTIC	O NC	F COMP	ON	ENTS AMON	NG .	
Cm12	TYPE I	and TYPE II	(disso	DIVE	d and	ad	sorbed) s	species	
SI+Z	100.0	PERCENT	BOUND	ΙN	SPECIE	5	# 800	Sr+2	
A1+3	1.8	PERCENT	BOUND	IN	SPECIE	S	# 303301	Al (OH)	2 +
	30.9	PERCENT	BOUND	IN	SPECIE	S	# 303302	Al (OH)	4 -
	67.4	PERCENT	BOUND	IN	SPECIE	S	# 303303	Al (OH)	3 AQ
									-
H3AsO3	98.6	PERCENT	BOUND	IN	SPECIE	S	# 60	H3AsO3	
	1.4	PERCENT	BOUND	IN	SPECIE	S	#3300600	H2AsO3	-
Po+2	100 0	DEDOENE	DOUND	TN	ODEGTE	C		Dela	
Da+2	100.0	PERCENT	ROOND	TN	SPECIE	S	# 100	Ba+2	

Ca+2	99.9	PERCENT BO	UND IN	SPECIES	#	150	Ca+2
Cd+2	94.4 1.4 4.1	PERCENT BO PERCENT BO PERCENT BO	UND IN UND IN UND IN	SPECIES SPECIES SPECIES	# #1601 #1601	160 400 401	Cd+2 CdHCO3 + CdCO3 AQ
Cr(OH)2+	30.6 68.9	PERCENT BO PERCENT BO	UND IN UND IN	SPECIES SPECIES	# #2113	211 302	Cr(OH)2+ Cr(OH)3 AQ
Fe+2	99.5	PERCENT BO	UND IN	SPECIES	#	280	Fe+2
K+1	100.0	PERCENT BO	UND IN	SPECIES	#	410	K+1
Mg+2	99.8	PERCENT BO	UND IN	SPECIES	#	460	Mg+2
Mn+2	99.4	PERCENT BO	UND IN	SPECIES	#	470	Mn+2
Na+1	100.0	PERCENT BO	UND IN	SPECIES	#	500	Na+1
Pb+2	21.4 11.8 64.7 1.9	PERCENT BO PERCENT BO PERCENT BO PERCENT BO	UND IN UND IN UND IN UND IN	SPECIES SPECIES SPECIES SPECIES	# #6003 #6001 #6001	600 300 401 402	Pb+2 PbOH + PbCO3 AQ PbHCO3 +
CO3-2	93.4 5.9	PERCENT BO PERCENT BO	UND IN UND IN	SPECIES SPECIES	#3301 #3301	400 401	HCO3 - H2CO3 AQ
E-1	100.0	PERCENT BO	UND IN	SPECIES	#4700	020	Mn04 -
H+1	92.0 11.7	PERCENT BO PERCENT BO	UND IN UND IN	SPECIES SPECIES	#3301 #3301	400 401	HCO3 - H2CO3 AQ
Н2О	2.4 1.0 36.1 59.1	PERCENT BO PERCENT BO PERCENT BO PERCENT BO	UND IN UND IN UND IN UND IN	SPECIES SPECIES SPECIES SPECIES	#3300 #303 #303 #303	020 301 302 303	OH- Al(OH)2 + Al(OH)4 - Al(OH)3 AQ

PART 5 of OUTPUT FILE

IDX	NAME	DISSOI	LVED	SORBI	ED	PRECIP	TATED
		MOL/KG	PERCENT	MOL/KG	PERCENT	MOL/KG	PERCENT
800	Sr+2	4.565E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
30	A1+3	2.224E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
60	H3AsO3	3.176E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
100	Ba+2	1.238E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	1.797E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
160	Cd+2	2.847E-09	100.0	0.000E-01	0.0	0.000E-01	0.0
211	Cr(OH)2+	5.465E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
280	Fe+2	8.954E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	1.955E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	3.126E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
470	Mn+2	3.641E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	2.262E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
600	Pb+2	1.303E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	1.809E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
1	E-1	-5.686E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	1.837E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
2	H20	7.612E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
	Charge Balance	e: SPECIATEI		- F INTONO	1 7045	0.4	
	DEDCENT DIEL	PNS = 1.242	2E-03 Sum	OI ANIONS	1.704E-0	J4	
	NON CAPPONATE	ERENCE =	1.38/E+U	I (ANIONS -	CATIONS),	(ANIONS + (CATIONS)
	FOULT TRATING TO	ALKALINIII		1.495E-07			
	EQUILIBRIUM IC	JAIC SIRENGI	LH (III) -	1.2046-03			
	EQUILIBRIUM pe	2	=	13.761 01	c Eh =	793.00 mv	

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		PART 6	of OUI	PUT F	ILE						
Saturation	n indices and	stoichiometry	of all	. mine	ral	S					
ID #	NAME	Sat. Index	St	oichi	ome	try in [bracl	ket:	s]		
2003000	ALOH3(A)	-0.730 [1.000)] 30	[3.000]	2	[-3.0	00]	330
5015000	ARAGONITE	-2.238 [1.000)] 150	E	1.000]	140				
5046000	ARTINITE	-8.997 [-2.000)] 330	[2.000]	460	[1.0	00]	140
		[5.000)] 2							
2003001	BOEHMITE	1.051 [-3.000)] 330	[1.000]	30	[2.0	00]	2
2046000	BRUCITE	-5.867 [1.000)] 460	[2.000]	2	[-2.0	00]	330
5015001	CALCITE	-2.074 [1.000)] 150	[1.000]	140				
2003002	DIASPORE	2.824 [-3.000)] 330	[1.000]	30]	2.0	00]	2
5015002	DOLOMITE	-3.934 [1.000)] 150	[1.000]	460	[2.0	00]	140
2003003	GIBBSITE (C)	0.963 [-3.000)] 330	[1.000]	30	[3.0	00]	2
3003000	A1203	-2.628 [2.000)] 30	[3.000]	2	[-6.0	00]	330
5015003	HUNTITE	-11.837 [3.000)] 460	[1.000]	150	[4.0	00]	140
5046001	HYDRMAGNESIT	-21.886	5.000) 460	L	4.000]	140	L	-2.0	00]	330
5016000			6.000)] 2			4.4.0				
5046002	MAGNESITE	-2.357 [1.000	1 460	L	1.000]	140		10.0	0.0.1	0
3050000	NATRON	-12.401 [2.000	500	l	1.000]	140	L	10.0	00]	2
5046003	NESQUEHONITE	-4.758 [1.000	460	L	1.000]	140	L	3.0	00]	2
5028000	SIDERITE	-2.364 [1.000	280	L	1.000]	140				
5080000	STRONTIANITE	-3.864 [1.000	01 800	L	1.000]	140		1 0	0.01	0
5050001	THERMONATR	-14.197	2.000	500	L	1.000]	140	L	1.0	00]	2
5010000	WITHERITE	-4.076 [1.000	1 100	L	1.000]	140		2 0	001	170
3047000	HAUSMANNITE	7.899 [-8.000	1] 330	L	-2.000]	1	L	3.0	00]	4/0
0047000	DUDOODOTED		4.000	1 220	r	1 0001	170	r	0.0	0.01	0
2047003	PYROCROITE	-6.035 [-2.000	1 330	L	1.000]	4/0	L	2.0	00]	2
5047000	RHODOCHROSIT	-1.832 [1.000	4/0	L	1.000]	140				
16000	CD METAL	-49.999 [1.000	1 160	l	2.000]	1				
16001	GAMMA CD	-50.101 [1.000	1 160	L	2.000]	1 1 0				
5016000	OTAVITE CD (OU) 2 (D)	-1.602	1.000	1 160	l	1.000]	140	r	2 0	001	0
2016000	CD(OH) Z (A)	-7.771 [-2.000	1 330	L	1.000]	160	L	2.0	001	2
2016001	CD(OH)Z (C)	-7.288 [-2.000	330	L	1.000]	160	L	2.0	001	2
2016002	MONTEPONITE	-9.239 [-2.000	1 330	L	1.000]	160	L	1.0	00]	2
60000	PB METAL	-39.404 [1.000	600	L	2.000]	1				
5060000	CERRUSITE	-1.090 [1.000	0 600	L	1.000]	140		1 0	0.01	0
2060000	MASSICOT	-5.857 [-2.000	1 330	L	1.000]	600	L	1.0	00]	2
2060001	LITHARGE	-5.659 [-2.000	0] 330	L	1.000]	600	L	1.0	00]	2
2060002	PBO, .3H2O	-5.601	-2.000] 330	l	1.000]	600	L	1.3	30]	2
5060001	PB20C03	-6.658 [-2.000] 330	l	2.000]	600	L	1.0	00]	2
5050000	22200000	11 000	1.000	140		0 0001	600		1 0	0.0.1	1 1 0
5060002	PB302C03	-11.090 [-4.000	330	L	3.000]	600	L	1.0	00]	140
200000			2.000	2 220	r	0 0001	1	r	1 0	0.01	600
2060003	PLATTNERITE	-0.774 [-4.000	330	L	-2.000]	T	L	1.0	00]	600
200000	22000	2 7 6 1	2.000	2 220	r	0 0001	1		0.0	0.01	600
3060000	PB203	-3.761 [-6.000	330	l	-2.000]	1	l	2.0	00]	600
2000001	MINITAN	11 000	3.000	2 220	r	0 0001	1	r	2 0	0.01	600
3060001	MINIOM	-11.028 [-8.000	1 330	L	-2.000]	T	L	3.0	00]	600
2060004		1 042	4.000	1 220	r	1 0001	600	г	2 0	001	2
2060004	PB(UR)2 (C)	-1.045 [-2.000	1 220	L	1.000]	600	L	2.0	001	110
2000003	HIDCERRUSITE	-3.789 [-2.000	330	L	3.000]	600	L	2.0	00]	140
2060005	DD20 (011) 2	11 440 L	2.000	1 220	r	2 0001	600	r	2 0	001	0
2060005	PBZO (OH) Z	-11.442 [-4.000	1 530	L	2.000]	000	L	3.0	00]	2
3006000	ARSENULITE	-26.937	4.000	0 60	L	-6.000]	2				
3006001	CLAUDETITE	-26.694 [4.000	1 00	L	-6.000]	150	r	1 0	001	0
2015000	LIME	-22.509 [-2.000	330	L	1.000]	150	L	1.0	00]	2
2015001	PORTLANDITE	-12.085 [-2.000] 330	L	1.000]	150	L	2.0	001	2
2028000	WUSTITE	-2.963 [-2.000	1 330	L	0.947]	280	l	1.0	00]	2
2046001	PERICLASE	-10.785 [-2.000	0] 330	L	1.000]	460	l	1.0	00]	2
3028001	HERCYNITE	0.550 [-8.000	0] 330	l	1.000]	280	l	2.0	00]	30
0016000			4.000)] 2			1.60				
3046000	SPINEL	-6.285 [-8.000	1 330	l	1.000]	460	l	2.0	00]	30
2001100	EEGD004	0 710	4.000	2		1 0003	000			0.03	000
3021100	FECR204	8.713 [2.000	1 211	l	1.000]	280	L	-4.0	00]	330
3021101	MGCR204	-2.015 [2.000	1 211	L	1.000]	460	L	-4.0	00]	330
3021102	CR203	2.570 [2.000	1 211	J	-2.000]	330	I	-1.0	00]	2
2021102	CR (OH) 3 (A)	0.456 [1.000	1 211	[1.000]	2	E	-1.0	00]	330
2021101	CR(OH)3 (C)	-2.133 [1.000	211	[1.000]	2	[-1.0	00]	330

Revuè ri Entered	ver water-Site CO3 ²⁻ , Pco2, Po2,	PART 9 - Run 2 fixed pH, S	1 of OUTPU olids allow	T FILE	itate	
Tempera Units o Ionic s If spec Do not Precipi the p The mat The met Interme	ture (Celsius): f concentration trength to be c ified, carbonat automatically t tation is allow rint option for imum number of hod used to com diate output fi	17.30 : MG/L omputed. e concentra erminate if ed for all solids is iterations pute activi le	tion repres charge imb solids in t set to: 1 is: 200 ty coeffici	ents total i valance excee he thermodyn ents is: Dav	norganic ca ds 30% amic databa ies equatic	arbon. ase and on
INPUT DA ID 330 60 100 150 160 211 280 410 460 470 500 600 800 1 140 2 Cha	TA BEFORE TYPE NAME H+1 Al+3 H3AsO3 Ba+2 Ca+2 Cd+2 Cd+2 Cr(OH)2+ Fe+2 K+1 Mg+2 Mn+2 Na+1 Pb+2 Sr+2 E-1 CO3-2 H2O rge Balance: UN	MODIFICATIO ACTIVITY G 3.162 2.239 3.162 1.230 1.778 2.818 5.495 8.913 1.950 3.090 3.631 2.239 1.288 4.571 1.000 1.259 1.000 SPECIATED	NS UESS LOG E-08 E-06 E-04 E-09 E-08 E-07 E-07 E-05 E-04 E-04 E-04 E-07 E-06 E-07 E-07 E-07 E-07 E-07 E-06 E-07 E-	GUESS ANA -7.500 0. -5.650 6. -7.500 4. -5.910 1. -3.750 7. -8.550 3. -7.260 4. -6.050 5. -4.710 7. -3.510 7. -3.650 5. -6.890 2. -6.340 4. -16.000 0. -5.900 1. 0.000 0.	L TOTAL 000E-01 000E-02 000E-03 700E-01 200E+00 200E-04 700E-03 000E-02 644E-01 600E+00 000E-01 200E+00 700E-02 000E-01 105E+01 000E-01	
S' P.	um of CATIONS= ERCENT DIFFEREN	1.250E-03 CE = 5.448 PART	Sum of ANIC E+01 (ANIC 3 of OUTPU	NS = 3.683E NS - CATIONS T FILE	-04)/(ANIONS -	CATIONS)
Type I ID 330 60 100 150 160 211 280 410 460 470 500 600 800 140	- COMPONENTS AS NAME H+1 Al+3 H3AsO3 Ba+2 Ca+2 Cd+2 Cd+2 Cr(OH)2+ Fe+2 K+1 Mg+2 Mn+2 Na+1 Pb+2 Sr+2 CO3-2	SPECIES IN CALC MOL 3.286E-08 1.005E-15 3.131E-08 1.238E-06 1.794E-04 2.688E-09 7.459E-13 8.637E-07 1.955E-05 3.121E-04 8.424E-09 2.262E-04 2.793E-08 4.565E-07 2.364E-07	SOLUTION ACTIVITY 3.162E-08 7.106E-16 3.132E-08 1.061E-06 1.538E-04 2.304E-09 7.178E-13 7.405E-07 1.881E-05 2.675E-04 7.222E-09 2.176E-04 2.394E-08 3.914E-07 2.027E-07	LOG ACTVTY -7.50000 -15.14840 -7.50424 -5.97422 -3.81307 -8.63745 -12.14402 -6.13050 -4.72559 -3.57265 -8.14137 -3.66227 -7.62088 -6.40741 -6.69321	GAMMA 0.96223 0.70715 1.00028 0.85727 0.85727 0.96223 0.85727 0.96223 0.85727 0.96223 0.85727 0.96223 0.85727 0.96223 0.85727 0.85727 0.85727	NEW LOGK 0.017 0.150 0.000 0.067 0.067 0.017 0.067 0.017 0.067 0.017 0.067 0.017 0.067 0.017
Type II ID 2113302 2113303 2113304 3300020 4603300 4601400	- OTHER SPECIE NAME Cr(OH)3 AQ Cr(OH)4- CrO2- OH- MgOH + MgCO3 AQ	S IN SOLUTI CALC MOL 1.682E-12 5.281E-16 1.340E-15 1.817E-07 7.263E-09 4.596E-08	ON OR ADSOR ACTIVITY 1.683E-12 5.081E-16 1.289E-15 1.749E-07 6.988E-09 4.597E-08	BED LOG ACTVTY -11.77403 -15.29404 -14.88962 -6.75732 -8.15563 -7.33749	GAMMA 1.00028 0.96223 0.96223 0.96223 0.96223 1.00028	NEW LOGK -7.130 -18.133 -17.729 -14.241 -12.066 2.928

800 500	Sr+2 Na+1	2	4.565E-07 10 2.262E-04 10	0.0	0.000E 0.000E	-01 0.0 -01 0.0	0.000E-01 0.000E-01	0.0
IDX	1	NAME	DISSOLVED MOL/KG PERC	ENT	SO MOL/K	ORBED G PERCENT	PRECIP MOL/KG	PITATED PERCENT
			EQUILIBRATI	ED MAS	SS DISTR	RIBUTION		
			PART	5 of	OUTPUT	FILE		
30470	002	HAUSMANNITE	2.220E-06 E 1.211E-06		-5.917	-63.097	80.140	
30211	100	FECR204	2.732E-08		-7.563	0.419	24.860	
II	e IV	- FINITE SC NAME	CALC MOL	at eq	LOG MOL	NEW LOGK	DH	
m		DINITUR OF		-		·····)		
33014	103	CO2 (g)	3.230E-06		-5.491	21.693	-0.530	
	330	H+1	-1.835E-04		-3.736	7.500	0.000	
33000	2	H2O O2 (g)	-5.064E-06 -6.054E-07		-5.296 -6.218	0.000 - 85.043	0.000 133.830	
II)	NAME	CALC MOL		LOG MOL	NEW LOGK	DH	
TVD	e IT	I - SPECIES	WITH FIXED ACT	IVITY				
		GI (011) 12	1.1045 14	5.40		T1.07101	5.05121	5.007
21133	300	Cr+3 Cr(OH)+2	1.042E - 17 1.104E - 14	7.36	8E-18 2E-15	-17.13266 -14.02401	0.70715	10.162
33014	101	H2CO3 AQ	1.075E-05	1.07	5E-05	-4.96854	1.00028	16.725
33014	100	п4АSU3 + НСОЗ -	1.690E-04	4.90	6E-04	-3.78877	0.96223	-0.288 10.421
33000	502	As03 -3	1.020E-20	7.21	6E-21	-20.14172	0.70715	-34.987
33000	501	HAs03 -2	9.052E-15	7.76	0E-15	-14.11014	0.85727	-21.539
60014 33004	402 500	PDHCO3 + H2AsO3 -	2.52/E-09 4.540E-10	2.43	∠E-09 8E-10	-8.61408 -9.35970	0.96223	-9.339
60033	305	Pb (OH) 4 -2	5.584E-18	4.78	7E-18	-17.31990	0.85727	-39.632
60014	401	PbCO3 AQ	8.429E-08	8.43	2E-08	-7.07408	1.00028	7.240
60033	303	Pb2OH + 3 Pb3(OH) 4+2	1.119E-14 6.446E-18	7.91	1E-15 6E-18	-14.10176 -17.25759	0.70715	-6.210
60033	302	Pb (OH) 3 -	6.852E-14	6.59	3E-14	-13.18090	0.96223	-28.043
60033	301	Pb (OH) 2 AQ	1.815E-10	1.81	6E-10	-9.74089	1.00028	-17.120
60014	100	Pb(CO3)2-2	5.007E-11	4.29	3E-11	-10.36729	0.85727	10.707
16014	101	CdCO3 AQ	1.170E-10	1.17	0E-10	-9.93166	1.00028	5.399
16014	304 400	CdHCO3 +	3.855E-11	4.20	0E - 11	-10.43066	0.96223	-9.451 12.417
16033	303	Cd (OH) 4 -2	1.201E-26	1.02	9E-26	-25.98748	0.85727	-47.283
16033	302	Cd (OH) 3 -	3.795E-20	3.65	2E-20	-19.43747	0.96223	-33.283
1603	300	Cd(OH) 2 AO	3.505E-12 1.029E-14	1.02	3E-12 9E-14	-13.98747	1.00028	-20.318
16014	100	Cd(CO3)3-4	5.895E-23	3.18	4E-23	-22.49707	0.54009	6.488
47014	100	MnHCO3 +	1.915E-11	1.84	3E-11	-10.73457	0.96223	11.617
47000)20	Mn04 - Mn04 -2	2.64/E-11 4 103E-15	2.54	7E-11 7E-15	-10.59397 -14.45377	0.96223	-131.239 -121.288
47033	301	Mn(OH)3 -1	3.761E-21	3.61	9E-21	-20.44139	0.96223	-34.783
47033	300	MnOH +	3.203E-12	3.08	2E-13	-12.12554	0.96223	-13.635 -10.853
80033	300	SrOH +	4.463E-13	4.29	5E-13	-12.36708	0.96223	-13.443
28033	302	FeOH2 AQ	5.550E-13	5.55	2E-13	-12.25556	1.00028	-21.125
28033	300	FeOH + FeOH3 -1	4.263E-09 6.272E-16	4.10	2E-09 6E-16	-8.38698	0.96223	-9.740 -31.572
3033	303	Al(OH)3 AQ	2.246E-09	2.24	7E-09	-8.64842	1.00028	-16.000
3033	302	Al (OH) 4 -	1.028E-09	9.89	6E-10	-9.00456	0.96223	-23.839
3033	300	AlOH +2	1.575E-13 5.866E-11	1.35	0E-13 4E-11	-12.86961 -10.24841	0.85727	-5.154 -10.083
50014	101	NaHCO3 AQ	1.676E-08	1.67	7E-08	-7.77548	1.00028	10.080
50014	100	NaCO3 -	5.703E-10	5.48	7E-10	-9.26063	0.96223	1.112
15014	100	CaHCO3 +	2.128E-07 3.797E-08	2.04	8E-07 8E-08	-6.68873	0.96223	11.334
15033	300	CaOH +	6.656E-10	6.40	5E-10	-9.19351	0.96223	-12.864
46014	101	MaHCO3 +	5.033E-07	4.84	3E-07	-6.31489	0.96223	11.468

60	H3AsO3	3.176E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
100	Ba+2	1.238E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	1.796E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
160	Cd+2	2.847E-09	100.0	0.000E-01	0.0	0.000E-01	0.0
211	Cr(OH)2+	2.441E-12	0.0	0.000E-01	0.0	5.464E-08	100.0
600	Pb+2	1.303E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	1.955E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	3.126E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
470	Mn+2	8.473E-09	0.2	0.000E-01	0.0	3.632E-06	99.8
30	A1+3	3.333E-09	0.1	0.000E-01	0.0	2.220E-06	99.9
1	E-1	-1.324E-10	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	1.809E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
280	Fe+2	8.680E-07	96.9	0.000E-01	0.0	2.732E-08	3.1
2	H20	2.207E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	1.911E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
	Charge Bal	lance: SPECIATED					
	Sum of (CATIONS = 1.235E	-03 Sum	of ANIONS	1.697E-C	14	
	PERCENT	DIFFERENCE = 7	.583E+0	1 (ANIONS -	CATIONS)/	(ANIONS + C	ATIONS)
	EQUILIBRIU	JM IONIC STRENGTH	(m) =	1.196E-03			

COTTICKTON	TONIC	SIKENGIH	(111)	-	1.1906-	03				
EQUILIBRIUM	pH			=	7.500					
EQUILIBRIUM	pe			=	13.761	or	Eh	=	793.00	mv

			PART	1 of OUTP	UT FILE			
Revuè ri	ver water	-Site 9 - Ru	n 3					
Entered	CO_3^{2-} , PCO ₂	2, PO2, fixe	d pH,	solids al	lowed to	precipi	tate	
Fe redox	pair, Mn	redox pair						
Tempera	ture (Cels	sius): 17.3	0					
Units o	of concent:	cation: MG/L						
Ionic s	strength to	be compute	d.					
If spec	cified, car	cbonate conc	entra	tion repre	sents tot	al inor	ganic c	arbon.
Do not	automatica	ally termina	te if	charge im	balance e	xceeds	30%	
Precipi	tation is	allowed for	all :	solids in	the therm	odynami	.c datab	ase and
the p	orint optic	on for solid	s is :	set to: 1				
The max	imum numbe	er of iterat	ions :	is: 200				
The met	hod used t	to compute a	ctivi	ty coeffic	ients is:	Davies	equati	on
Interme	diate out	out file						
INPUT DA	TA BEFORE	TYPE MODIFI	CATIO	NS				
ID	NAME	ACTIV	ITY G	UESS LO	G GUESS	ANAL I	OTAL	
330	H+1		3.1621	E-08	-7.500	0.000	E - 01	
30	A1+3		2.2391	E-06	-5.650	6.000	E - 02	
60	H3AsO3		3.162	E-08	-7.500	4.000	E = 03	
100	Ba+2		1.230	E-06	-5.910	1.700	E - 01	
150	Ca+2		1.7781	E - 04	-3.750	7.200	E+00	
160	Cd+2		2.8181	E-09	-8.550	3.200	E - 04	
211	Cr(OH)2+		5.4951	E-08	-7.260	4.700	E - 03	
280	Fe+2		8.913	E-07	-6.050	5.000	E = 02	
410	K+1		1.950	E-05	-4.710	7.644	E-01	
460	Mg+2		3.090	E-04	-3.510	7.600	DE+00	
470	Mn+2		3.631	E-06	-5.440	2.000	DE-01	
500	Na+1		2.239	E-04	-3.650	5.200	DE+00	
600	Pb+2		1.288	E-07	-6.890	2.700	DE-02	
800	Sr+2		4.5/1	E-07	-6.340	4.000	DE-02	
1	E-1		1.0001	E-16	-16.000	0.000	DE-01	
140	CO3-2		1.259	E-06	-5.900	1.105	E+01	
281	Fe+3		1.778	E-21	-20.750	0.000)E-01	
4/1	Mn+3		1.820	E-21	-20.740	0.000	DE-OI	
2	HZO		1.0001	E+00	0.000	0.000	E-01	
Cha	rao Polon	TINGDECTA	TT					
CIIa	inge Baland	Le. UNSFECTA	F-03	Sum of ANT	ONG - 3	6835-04		
P	FRCENT DI	FERENCE =	5 4481	F+01 (ANT	ONS - CAT	TONS) / (ANTONS	+ CATTONS)
Ľ	ERCENT DI	FERENCE -	5.440	CIOI (ANI)	UND CAI	1010)//	ANTONO	(CATIONS)
		and the second second	PART	3 of OUTP	ALTA TI			
Type T	- COMPONEN	ITS AS SPECT	ES TN	SOLUTION				
TD	NAME	CALC	MOT.	ACTIVITY	LOG ACT	VTY	GAMMA	NEW LOGK
330	H+1	3.286	E-08	3.162E-08	-7.50	000 0	96226	0.017
30	A1+3	1,005	E-15	7.106E-16	-15.14	839 (,70732	0.150
60	H3AsO3	3,131	E = 0.8	3.132E-08	-7.50	424 1	.00028	0.000
100	Ba+2	1,238	E-06	1.061E-06	-5.97	417 0	85736	0.067
150	Ca+2	1.794	E - 04	1.538E-04	-3.81	303 0	.85736	0.067
160	Cd+2	2 688	E-09	2.305E-09	-8 63	741 (85736	0 067
211	Cr (OH) 2+	8,663	E - 10	8.336E-10	-9.07	905 0	96226	0.017
280	Fe+2	2 129	E-25	1.825E-25	-24 73	867 0	85736	0.067
410	K+1	1.955	E = 0.5	1.881E-05	-4.72	557 0	96226	0.017
460	Ma+2	3,121	E = 0.4	2.675E-04	-3.57	260 0	.85736	0.067
470	Mn+2	9.549	E - 17	8.187E-17	-16.08	688 0	.85736	0.067
500	Na+1	2 262	E = 0.4	2.176E-04	-3.66	226 0	96226	0.017
600	Ph+2	2.202	E-08	2 394E-08	-7 62	087 0	85736	0.067
800	Sr+2	4 565	E = 0.7	3 9145-07	-6 40	737 0	85736	0.067
471	Mn+3	6 570	E-28	4 649E-28	-27 33	266 0	,70732	0.150
140	CO3-2	2 364	E-07	2.027E-07	-6 69	321 0	.85736	0.067
281	Fe+3	8.832	E-25	6.247E-25	-24.20	431 0	.70732	0.150

Type II	- OTHER SPEC.	LES IN SOLUTI	ON OR ADSOR	BED		
ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
2113302	Cr(OH) 3 AQ	1.954E-09	1.954E-09	-8.70906	1.00028	-7.130

2113303	Cr(OH)4-	6.133E-13	5.901E-13	-12.22907	0.96226	-18.133
2113304	Cr02-	1.556E - 12	1.497E - 12	-11.82465	0.96226	-17.729
3300020	OH-	1.817E - 07	1 749E - 07	-6 75732	0.96226	-14 241
4603300	MaOH +	7.263E-09	6 989E-09	-8 15559	0.96226	-12 066
4601400	Macos AO	4 597E-08	4 598F-08	-7 33744	1 00028	2 928
4601400	MaHCO3 +	5 033E-07	4.90500 00	-6 31/85	0.96226	11 169
1502200	CoON 1	5.055E-07	4.045E-07	-0.10247	0.90220	12 064
1503300	Cauco2 I	0.000E-10 2.120E-07	0.405E-10 2.040E 07	-9.19347	0.90220	-12.004
1501400	Carcos +	2.120E-07	2.040E-07	-0.00000	0.90220	11.334
1501401	Lacos AQ	5.798E-08	5.799E-08	-7.42035	1.00028	3.080
5001400	Nacos -	5.703E-10	5.488E-10	-9.20002	0.96226	1.112
5001401	Nahcos AQ	1.67/E-08	1.677E-08	-7.77547	1.00028	10.080
303300	AIOH +2	1.5/5E-13	1.350E-13	-12.86961	0.85736	-5.154
303301	A1 (OH) 2 +	5.865E-11	5.644E-11	-10.24841	0.96226	-10.083
303302	AI(OH)4 =	1.028E-09	9.895E-10	-9.00456	0.96226	-23.839
303303	AI(OH)3 AQ	2.246E-09	2.24/E-09	-8.64842	1.00028	-16.000
2803300	FeOH +	1.051E-27	1.011E-2/	-26.99515	0.96226	-9.740
2803301	FeOH3 -1	1.546E-34	1.488E-34	-33.82746	0.96226	-31.572
2803302	FeOH2 AQ	1.368E-31	1.369E-31	-30.86374	1.00028	-21.125
2813300	FeOH +2	9.342E-20	8.010E-20	-19.09638	0.85736	-2.325
2813301	FeOH2 +	1.388E-15	1.336E-15	-14.87433	0.96226	-5.653
2813302	FeOH3 AQ	4.961E-16	4.962E-16	-15.30433	1.00028	-13.600
2813303	FeOH4 -	1.631E-16	1.569E-16	-15.80434	0.96226	-21.583
2813304	Fe2(OH)2+4	4.430E-37	2.394E-37	-36.62096	0.54032	-2.945
2813305	Fe3(OH)4+5	1.686E-49	6.444E-50	-49.19083	0.38218	-6.160
8003300	SrOH +	4.464E-13	4.295E-13	-12.36703	0.96226	-13.443
1003300	BaOH +	7.784E-13	7.490E-13	-12.12549	0.96226	-13.635
4703300	MnOH +	3.631E-20	3.494E-20	-19.45668	0.96226	-10.853
4703301	Mn(OH)3 -1	4.264E-29	4.103E-29	-28.38690	0.96226	-34.783
4700020	Mn04 -	3.001E-19	2.887E-19	-18.53948	0.96226	-131.239
4700021	MnO4 -2	4.651E-23	3.988E-23	-22.39928	0.85736	-121.288
4701400	MnHCO3 +	2.171E-19	2.089E-19	-18.68009	0.96226	11.617
1601400	Cd(CO3)3-4	5.893E-23	3.184E-23	-22.49703	0.54032	6.487
1603300	CdOH +	3.505E-12	3.373E-12	-11.47197	0.96226	-10.318
1603301	Cd(OH)2 AQ	1.029E-14	1.029E-14	-13.98742	1.00028	-20.350
1603302	Cd(OH)3 -	3.796E-20	3.652E-20	-19.43743	0.96226	-33.283
1603303	Cd(OH)4 -2	1.201E-26	1.029E-26	-25.98744	0.85736	-47.283
1603304	Cd2OH +3	5.940E-20	4.201E-20	-19.37661	0.70732	-9.451
1601400	CdHCO3 +	3.856E-11	3.710E-11	-10.43062	0.96226	12.417
1601401	CdCO3 AQ	1.170E-10	1.171E-10	-9.93161	1.00028	5.399
6001400	Pb(CO3)2-2	5.007E-11	4.293E-11	-10.36728	0.85736	10.707
6003300	PbOH +	1.534E-08	1.476E-08	-7.83087	0.96226	-7.693
6003301	Pb(OH)2 AQ	1.816E-10	1.816E-10	-9.74088	1.00028	-17.120
6003302	Pb(OH)3 -	6.852E-14	6.593E-14	-13.18089	0.96226	-28.043
6003303	Pb20H +3	1.119E-14	7.912E-15	-14.10174	0.70732	-6.210
6003304	Pb3(OH)4+2	6.446E-18	5.526E-18	-17.25755	0.85736	-24.328
6001401	PbCO3 AQ	8.430E-08	8.432E-08	-7.07407	1.00028	7.240
6003305	Pb(OH)4 -2	5.584E-18	4.787E-18	-17.31990	0.85736	-39.632
6001402	PbHCO3 +	2.527E-09	2.432E-09	-8.61407	0.96226	13.217
3300600	H2As03 -	4.539E-10	4.368E-10	-9.35970	0.96226	-9.339
3300601	HAs03 -2	9.051E-15	7.760E-15	-14.11014	0.85736	-21.539
3300602	As03 -3	1.020E-20	7.216E-21	-20.14172	0.70732	-34.987
3300603	H4As03 +	5.099E-16	4.906E-16	-15.30924	0.96226	-0.288
3301400	HCO3 -	1.690E-04	1.626E-04	-3.78877	0.96226	10.421
3301401	H2CO3 AQ	1.075E-05	1.075E-05	-4.96854	1.00028	16.725
2113300	Cr+3	1.210E-14	8.557E-15	-14.06769	0.70732	10.162
2113301	Cr(OH)+2	1.282E-11	1.099E-11	-10.95904	0.85736	5.687
Type II	I - SPECIES	WITH FIXED ACT	IVITY			
ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH	
2	H20	-5.934E-06	-5.227	0.000	0.000	
1701710	Mn+2/Mn+3	-3 641F-06	-5 139	25 006	25 760	

			2000 1102	112011 20 0 L C	B. A A
2	H20	-5.934E-06	-5.227	0.000	0.000
4704710	Mn+2/Mn+3	-3.641E-06	-5.439	25.006	25.760
330	H+1	-1.818E-04	-3.741	7.500	0.000
3301403	CO2 (g)	3.235E-06	-5.490	21.693	-0.530
3300021	02 (g)	-2.044E-06	-5.689	-85.043	133.830
2802810	Fe+2/Fe+3	-8.953E-07	-6.048	13.226	-10.000

Тур	e IV - FIN	ITE SOLIDS (p)	resent at o	equilibrium)		
I 3028 2047 2003 3021	D N 100 HEMAT 000 PYROL 002 DIASP 102 CR2O3	AME CALC ITE 4.4 USITE 3.64 ORE 2.22 2.59	C MOL 77E-07 41E-06 20E-06 91E-08	LOG MOL -6.349 -5.439 -5.654 -7.587	NEW LOGK 3.409 -16.428 -7.352 3.158	DH 30.845 29.180 24.630 12.125	
		EQUI	PART 5 (LIBRATED M	OF OUTPUT F ASS DISTRIE	ILE BUTION		
IDX	NAME	DIS	SOLVED	SOR.	BED	PRECIP.	ITATED
500 800 60 100 150 160 460 600 211 470 30 140 471 280 281 1 330 2	Na+1 Sr+2 H3AsO3 Ba+2 Ca+2 Cd+2 Mg+2 Pb+2 K+1 Cr(OH)2+ Mn+2 A1+3 CO3-2 Mn+3 Fe+2 Fe+3 E-1 H+1 H2O	2.262E-(4.565E-(3.176E-(1.238E-(1.796E-(2.847E-(3.126E-(1.303E-(1.955E-(2.835E-(9.604E-) 3.333E-(1.809E-(6.572E-2 2.139E-2 2.047E-1 1.911E-(2.183E-(2.183E-(04 100.0 07 100.0 08 100.0 09 100.0 04 100.0 09 100.0 01 100.0 02 100.0 03 100.0 04 100.0 05 100.0 09 5.2 17 100.0 09 0.1 04 100.0 05 100.0 04 100.0 05 0.0 10 0.0 100.0 0.0 100.0 0.0 100.0 0.0 100.0 0.0 100.0 0.0 100.0 0.0 100.0 0.0	0.000E-0 0.000E	1 0.0 1 0.0	0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 2.220E-06 0.000E-01 3.641E-06 0.000E-01 8.953E-07 0.000E-01 0.000E-01 0.000E-01 0.000E-01	$\begin{array}{c} 0.0\\ 0.0\\ 0.0\\ 0.0\\ 0.0\\ 0.0\\ 0.0\\ 0.0$
	Charge Ba Sum of PERCENT EQUILIBRI EQUILIBRI EQUILIBRI	lance: SPECIA CATIONS = 1.2 DIFFERENCE = UM IONIC STREM UM pH UM pe	TED 233E-03 Sur 7.580E+4 NGTH (m) = = =	n of ANIONS 01 (ANIONS 1.195E-0 7.500 13.761	1.697E- - CATIONS) 3 or Eh =	-04 /(ANIONS + 0 793.00 mv	CATIONS)

PART 1 of OUTPUT FILE Revuè river water-Site 9 - Run 4 Entered CO_3^{2-} , P_{c02}, P₀₂, fixed pH, Fe redox pair, Mn redox pair, solids allowed to precipitate Adsorption Temperature (Celsius): 17.30 Units of concentration: MG/L Ionic strength to be computed. If specified, carbonate concentration represents total inorganic carbon. Do not automatically terminate if charge imbalance exceeds 30% Precipitation is allowed for all solids in the thermodynamic database and the print option for solids is set to: 1 The maximum number of iterations is: 200 The method used to compute activity coefficients is: Davies equation Intermediate output file Adsorption model: Diffuse Layer Number of adsorbing surfaces: 1 INPUT DATA BEFORE TYPE MODIFICATIONS ANAL TOTAL ID NAME ACTIVITY GUESS LOG GUESS -7.500 330 H+1 3.162E-08 0.000E-01 30 Al+3 60 H3AsO3 2.239E-06 3.162E-08 -5.650 6.000E-02 -7.500 4.000E-03 100 Ba+2 1.230E-06 -5.910 1.700E-01 150 Ca+2 1.778E-04 -3.750 7.200E+00 2.818E-09 3.200E-04 160 Cd+2 -8.550 Cr(OH)2+ 5.495E-08 -7.260 4.700E-03 211 280 Fe+2 8.913E-07 -6.050 5.000E-02 1.950E-05 410 K+1 -4.710 7.644E-01 -3.510 3.090E-04 3.631E-06 460 Mg+2 7.600E+00 2.000E-01 470 Mn+2 -5.440500 Na+1 2.239E-04 -3.650 5.200E+00 1.288E-07 -6.890 2.700E-02 600 Pb+2 -6.890 -6.340 -16.000 -6.340 4.571E-07 800 Sr+2 4.000E-02 1.000E-16 0.000E-01 1 E - 1140 CO3-2 1.259E-06 1.105E+01 -5.900 281 Fe+3 1.778E-21 -20.750 0.000E-01 -20.740 0.000E-01 471 Mn+3 1.820E-21 1.000E+00 1.905E-04 0.000 ADS1PSIO ADS1TYP1 813 0.000E-01 1.922E-04 -3.720 811 7.690E-03 812 ADS1TYP2 7.762E+00 0.890 1.000E+00 0.000 0.000E-01 2 H2O Charge Balance: UNSPECIATED Sum of CATIONS= 1.250E-03 Sum of ANIONS = 3.683E-04 PERCENT DIFFERENCE = 5.448E+01 (ANIONS - CATIONS)/(ANIONS + CATIONS) PART 3 of OUTPUT FILE Type I - COMPONENTS AS SPECIES IN SOLUTION CALC MOLACTIVITYLOGACTVTYGAMMA3.280E-083.162E-08-7.500000.964189.867E-167.106E-16-15.148390.72017 ID NEW LOGK NAME CALC MOL ACTIVITY 0.016 330 H+1 30 Al+3 0.143 60 H3AsO3 2.057E-11 2.058E-11 -10.68666 1.00025 0.000 100 Ba+2 5.010E-07 4.330E-07 -6.36352 0.86425 0.063 0.86425 1.173E-04 1.014E-04 1.521E-12 1.315E-12 -3.99402 150 Ca+2 0.063 160 Cd+2 -11.88112 0.86425 0.063 8.645E-10 8.336E-10 211 Cr(OH)2+ -9.07905 0.96418 0.016 280 Fe+2 2.112E-25 1.825E-25 -24.73867 0.86425 0.063 -4.72470 0.96418 410 K+1 1.955E-05 1.885E-05 0.016 3.121E-04 2.697E-04 9.473E-17 8.187E-17 2.697E-04 -3.56913 0.86425 460 Mg+2 0.063 -16.08688 470 Mn+2 0.86425 0.063 2.262E-04 2.181E-04 -3.66139 0.96418 500 Na+1 0.016 -14.48986 0.86425 600 Pb+2 3.745E-15 3.237E-15 0.063 4.565E-07 3.946E-07 1.040E-04 1.040E-04 2.345E-07 2.027E-07 Sr+2 ADS1TYP1 -6.40388 0.86425 -3.98289 1.00000 800 0.063 811 0.000 -6.69321 0.86425 0.063 140 CO3-2

281	Fe+3	8.675E-25	6.247E-25	-24.20431	0.72017	0.143
471	Mn+3	6.455E-28	4.649E-28	-27.33266	0.72017	0.143
812	ADS1TYP2	5.898E-03	5.898E-03	-2.22933	1.00000	0.000

Type	TT -	OTHER	SPECIES	TN	SOLUTION	OR	ADSORBED
TYNC	when subs	O T TTTT	OTTOTTO			~ × ·	

TD	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
0120600	-52427202(0)	2 1105-00	3 1105-00	_7 50500	1 00000	5 410
0120000	-32HZASU3(0)	J. 0540 00	J. 119E-00	-7.30390	1.00000	7 120
2113302	Cr (OH) 3 AQ	1.954E-09	1.954E-09	-8.70906	1.00025	-7.130
2113303	Cr (OH) 4-	6.120E-13	5.901E-13	-12.22907	0.96418	-18.134
2113304	Cr02-	1.553E-12	1.497E-12	-11.82465	0.96418	-17.730
3300020	OH-	1.814E - 07	1.749E-07	-6.75732	0.96418	-14.241
4603300	MgOH +	7.307E-09	7.045E-09	-8.15211	0.96418	-12.067
4601400	MgCO3 AQ	4.634E-08	4.635E-08	-7.33396	1.00025	2.928
4601401	MgHCO3 +	5.064E-07	4.882E-07	-6.31137	0.96418	11.467
1503300	CaOH +	4.379E-10	4.222E-10	-9.37446	0.96418	-12.865
1501400	CaHCO3 +	1.400E-07	1.350E-07	-6.86967	0.96418	11.333
1501401	CaCO3 AO	2.504E-08	2.504E-08	-7.60134	1.00025	3.086
5001400	NaCO3 -	5.703E-10	5.499E-10	-9.25975	0.96418	1.111
5001401	NaHCO3 AO	1.680E-08	1.680E-08	-7.77460	1.00025	10.080
303300	A10H +2	1.562E - 13	1.350E-13	-12,86961	0.86425	-5.158
303301	A1 (OH) 2 +	5.854E-11	5.644E-11	-10.24841	0.96418	-10.084
303302	Al (OH) 4 -	1.026E - 0.9	9.895E-10	-9.00456	0.96418	-23.840
303303	A1 (OH) 3 AO	2 246F-09	2 247E - 09	-8 64842	1 00025	-16 000
2803300	FOOH +	1.049F - 27	1 011F - 27	-26 99515	0.96418	-9 741
2003301	FOOUS -1	1 5435-34	1 /995-3/	-33 82746	0.96418	-31 573
2003301	FeoH2 NO	1 3605-31	1 3605-31	-30 96374	1 00025	_21 125
2003302	Feonz AU	1.300E-31	1.309E-31	-30.00374	1.00025	-21.125
2813300	FEOH +2	9.208E-20	8.010E-20	-19.09638	0.86425	-2.329
2813301	FeOH2 +	1.385E-15	1.336E-15	-14.8/433	0.96418	-5.654
2813302	FEOH3 AQ	4.961E-16	4.962E-16	-15.30433	1.00025	-13.600
2813303	FeOH4 -	1.62/E-16	1.569E-16	-15.80434	0.96418	-21.584
2813304	Fe2(OH)2+4	4.290E-37	2.394E-37	-36.62096	0.55790	-2.959
2813305	Fe3(OH)4+5	1.604E-49	6.444E-50	-49.19083	0.40178	-6.182
8003300	SrOH +	4.490E-13	4.330E-13	-12.36355	0.96418	-13.444
1003300	BaOH +	3.170E-13	3.056E-13	-12.51484	0.96418	-13.635
4703300	MnOH +	3.624E-20	3.494E-20	-19.45668	0.96418	-10.854
4703301	Mn(OH)3 -1	4.255E-29	4.103E-29	-28.38690	0.96418	-34.784
4700020	Mn04 -	2.995E-19	2.887E-19	-18.53948	0.96418	-131.240
4700021	Mn04 -2	4.614E-23	3.988E-23	-22.39928	0.86425	-121.292
4701400	MnHCO3 +	2.166E-19	2.089E-19	-18.68008	0.96418	11.616
1601400	Cd (CO3) 3-4	3.256E-26	1.817E-26	-25.74074	0.55790	6.473
1603300	CdOH +	1.996E-15	1.925E-15	-14.71568	0.96418	-10.319
1603301	Cd(OH)2 AQ	5.872E-18	5.873E-18	-17.23114	1.00025	-20.350
1603302	Cd (OH) 3 -	2.161E-23	2.084E-23	-22.68115	0.96418	-33.284
1603303	Cd (OH) 4 -2	6.795E-30	5.873E-30	-29.23115	0.86425	-47.287
1603304	Cd20H +3	1.899E-26	1.368E-26	-25.86404	0.72017	-9.459
1601400	CdHCO3 +	2.195E-14	2.117E-14	-13.67433	0.96418	12.416
1601401	CdCO3 AO	6.677E-14	6.678E-14	-13.17533	1.00025	5.399
6001400	Pb(CO3)2-2	6.716E-18	5.804E-18	-17,23627	0.86425	10.703
6003300	PbOH +	2.070E - 15	1.996E - 15	-14 69987	0.96418	-7.694
6003301	Ph(OH)2 AO	2.070E 13 2.455E - 17	2 455E - 17	-16 60987	1 00025	-17 120
6003302	Ph (OH) 3 -	9 246F-21	8 9155-21	-20 04988	0 96418	-28 044
6003303	Ph20H +3	2.008E - 28	1 116E-28	-27 83972	0.72017	-6 217
6003304	PP3 (01) 1+3	1 591 E - 39	1 3665-30	-37 86453	0.86425	-24 332
6001401	PbCO2 10	1.301E-30	1 1405-14	12 04206	1 00025	7 240
6001401	PDCUS AQ	1.1406-14	1.140E-14	-13.94300	1.00025	20 626
6003305	PD(OH)4 = 2	7.490E-25	0.4/3E-25	-24.10009	0.06425	-39.030
0001402	PDHC03 +	3.410E-16	3.288E-10	-15.48307	0.90418	13.210
3300600	HZASO3 -	2.977E-13	2.870E-13	-12.54213	0.96418	-9.340
3300601	HASO3 -2	5.899E-18	5.098E-18	-17.29256	0.86425	-21.543
3300602	As03 -3	6.583E-24	4./41E-24	-23.32414	0.72017	-34.995
3300603	H4ASO3 +	3.343E-19	3.224E-19	-18.49166	0.96418	-0.289
3301400	HC03 -	1.687E-04	1.626E-04	-3.78877	0.96418	10.420
3301401	H2CO3 AQ	1.075E-05	1.075E-05	-4.96854	1.00025	16.725
2113300	Cr+3	1.188E-14	8.557E-15	-14.06769	0.72017	10.154
2113301	Cr(OH)+2	1.272E-11	1.099E-11	-10.95904	0.86425	5.683
8123301	=S02-	9.202E-04	9.202E-04	-3.03614	1.00000	-8.930
8123302	=S02H2+	8.659E-04	8.659E-04	-3.06252	1.00000	7.290
8113301	=S01-	1.623E-05	1.623E-05	-4.78970	1.00000	-8.930
8113302	=SO1H2+	1.527E-05	1.527E-05	-4.81608	1.00000	7.290

S121600 =S02Cd+ 8116000 =S01Cd+ 8126000 =S02Pb+ 8121500 =S02Ca+ 8111500 =S01HCa++ 8111000 =S01HBa++ 8121000 =S02Ba+ 8110600 =S1H2As03 (c	7.351E- 2.772E- 1.300E- 2.868E- 6.360E- 5.581E- 7.366E- 2.889E- 5.501E-	-11 7.3 -09 2.7 -07 1.3 -10 2.8 -06 6.3 -05 5.5 -07 7.3 -10 2.8 -10 5.5	3512-11 772E-09 808E-10 868E-10 860E-06 581E-05 866E-07 889E-10 501E-10	-10.13365 -8.55721 -6.88595 -9.54239 -5.19654 -4.25329 -6.13279 -9.53923 -9.25954	1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000	-2.900 0.430 4.710 0.300 -5.850 4.970 5.460 -7.200 5.410
Type III - SPECIES ID NAME 2 H2O 3300021 O2 (g) 2802810 Fe+2/Fe+3 4704710 Mn+2/Mn+3 330 H+1 3301403 CO2 (g)	WITH FIXED CALC MC -5.511E- -2.044E- -8.953E- -3.641E- -1.207E- 3.744E-	ACTIVIT DL -06 -06 -07 -06 -04 -06	LOG MOL -5.259 -5.689 -6.048 -5.439 -3.918 -5.427	NEW LOGK 0.000 -85.043 13.226 25.006 7.500 21.693	DH 0.000 133.830 -10.000 25.760 0.000 -0.530	
Type IV - FINITE SC ID NAME 3028100 HEMATITE 2047000 PYROLUSITE 2003002 DIASPORE 3021102 CR203	DLIDS (prese CALC MC 4.477E- 3.641E- 2.220E- 2.591E-	ent at e DL -07 -06 -06 -08	equilibriu LOG MOL -6.349 -5.439 -5.654 -7.587	NEW LOGK 3.409 -16.428 -7.352 3.158	DH 30.845 29.180 24.630 12.125	
	E	PART 5 c	of OUTPUT	FILE		
IDX NAME	DISSOLV MOL/KG F	VED PERCENT	ASS DISTR S(MOL/K(DRBED G PERCENT	PRECIP: MOL/KG	ITATED PERCENT
800 Sr+2 60 H3AsO3 100 Ba+2 150 Ca+2 160 Cd+2 600 Pb+2 410 K+1 460 Mg+2 500 Na+1 211 Cr (OH) 2+ 1 E-1 280 Fe+2 470 Mn+2 30 Al+3 140 CO3-2 281 Fe+3 471 Mn+3 330 H+1 2 H2O	$\begin{array}{c} 4.565E-07\\ 2.087E-11\\ 5.010E-07\\ 1.175E-04\\ 1.612E-12\\ 1.759E-14\\ 1.955E-05\\ 3.126E-04\\ 2.262E-04\\ 2.833E-09\\ -1.498E-18\\ 2.122E-25\\ 9.528E-17\\ 3.331E-09\\ 1.804E-04\\ 2.044E-15\\ 6.455E-28\\ 1.907E-04\\ 2.020E-07\\ \end{array}$	$\begin{array}{c} 100.0\\ 0.1\\ 40.5\\ 65.4\\ 0.1\\ 0.0\\ 100.0\\ 100.0\\ 100.0\\ 100.0\\ 100.0\\ 100.0\\ 100.0\\ 100.0\\ 100.0\\ 0.1\\ 100.0\\ 0.1\\ 100.0\\ 0.1\\ 100.0\\ 0.1\\ 100.0\\ 0.1\\ 100.0\\ 0.0\\ $	0.000E- 3.174E- 7.368E- 6.217E- 2.845E- 1.303E- 0.000E- 0.000E- 0.000E- 0.000E- 0.000E- 0.000E- 0.000E- 0.000E- 0.000E- 0.000E- 0.000E- 0.000E- 0.000E- 0.000E- 0.000E- 0.000E- 1.014E-	$\begin{array}{cccccccc} -01 & 0.0 \\ -08 & 99.9 \\ -07 & 59.5 \\ -05 & 34.6 \\ -09 & 99.9 \\ -07 & 100.0 \\ -01 & 0.0 \\ -01 & 0.0 \\ -01 & 0.0 \\ -01 & 0.0 \\ -01 & 0.0 \\ -01 & 0.0 \\ -01 & 0.0 \\ -01 & 0.0 \\ -01 & 0.0 \\ -01 & 0.0 \\ -01 & 0.0 \\ -01 & 0.0 \\ -01 & 0.0 \\ -01 & 0.0 \\ -01 & 0.0 \\ -05 & -47.8 \\ -07 & 33.4 \\ \end{array}$	0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 0.000E-01 2.220E-06 0.000E-01 8.953E-07 3.641E-06 0.000E-01 0.000E-01 0.000E-01	$\begin{array}{c} 0.0\\ 0.0\\ 0.0\\ 0.0\\ 0.0\\ 0.0\\ 0.0\\ 0.0$
Charge Balance: Sum of CATION PERCENT DIFFE EQUILIBRIUM ION EQUILIBRIUM PH EQUILIBRIUM PE	SPECIATED IS = 2.108E ERENCE = 3 NIC STRENGTH	2-03 Sum 8.118E+0 I (m) = = =	of ANION 1 (ANIONS 1.069E- 7.500 13.761	NS 1.106E- 5 - CATIONS) -03 or Eh =	-03 /(ANIONS + (793.00 mv	CATIONS)
****** DIFFUSE LAYE **** Parameters For Electrostatic Vari Adsorbent Concentr Specific Surface F	CR ADSORPTIC Adsorbent ables: psi psi psi cation (g/l) Area (sq. me	N MODEI Number 0 = 0.0 b = 0.0 d = 0.0 : 3.4 eters/g)	1 **** 1 **** 35914 00000 00000 42 : 600.00	sig0 = 0.(sigb = 0.(sigd = 0.(003009 000000 000000	

		PART	6 of OUT	PUT	FILI	Ξ				
Saturatio	on indices and	stoichiomet	cy of all	min	era	ls				
ID #	NAME	Sat. Index	St	oich	iome	etry in	[brad	cket	s]	
2003000	ALOH3(A)	-3.554	1.0001	30	٦	3.0001	2]	-3.0001	330
5015000	ARAGONITE	-2 418	1,0001	150	ſ	1,0001	140			
5015000	ADUTNITUE	_0 000		330	r	2 0001	160	Г	1 0001	140
5046000	ARIINIIE	-0.990	[-2.000]	550	L	2.000]	400	L	1.000]	140
		4 556	[5.000]	2		1 0003	2.0		0 0001	0
2003001	BOEHMITE	-1.773	[-3.000]	330	L	1.000]	30	L	2.000]	2
2046000	BRUCITE	-5.863	[1.000]	460	[2.000]	2	[-2.000]	330
5015001	CALCITE	-2.254	[1.000]	150]	1.000]	140			
2003002	DIASPORE	0.000	-3.0001	330	1	1.0001	30	٢	2.0001	2
5015002	DOLOMITE	-4 111	1,0001	150	ſ	1,0001	460	ſ	2.0001	140
20201002	FEDDIUVDDITE	-6 505		330	r	1 0001	281	r	3 0001	210
2020100	FERRINIDRITE	-0.090		220	L	1.000]	201	L	1.000]	200
2028101	FE3 (OH) 8	-33.369	[-8.000]	330	l	2.000]	201	L	1.000]	200
			8.000]	2						
2003003	GIBBSITE (C)	-1.861	[-3.000]	330	[1.000]	30	I	3.000]	2
3003000	A1203	-8.277	[2.000]	30	[3.000]	2	[-6.000]	330
2028102	GOETHITE	-2.486	-3.0001	330	[1.0001	281	Γ	2.0001	2
3028100	HEMATITE	0 000	-6 0001	330	ſ	2 0001	281	ſ	3,0001	2
5015003	UIINTTTE	-12 007	3 0001	460	r	1 0001	150	r	4 0001	140
5015005	HUNDENDOLT	21.007		100	L r	1.000]	140	r	2.0001	220
5046001	HIDRMAGNESII	-21.00/	[5.000]	400	L	4.000]	140	L	-2.000]	220
			[6.000]	2						
3028101	MAGHEMITE	-9.795	[-6.000]	330	[2.000]	281	[3.000]	2
5046002	MAGNESITE	-2.353	[1.000]	460	[1.000]	140			
3028000	MAGNETITE	-17.865	-8.0001	330]	2.0001	281]	1.000]	280
			4 0001	2						
2050000	NATION	12 200	2 0001	500	Г	1 0001	110	Г	10 0001	2
5050000	NAIRON	-12.399		100	L	1.000]	140	L	2 000]	20
5046003	NESQUEHONITE	-4.754	[1.000]	400	L	1.000]	140	L	3.000]	2
5028000	SIDERITE	-20.985	[1.000]	280	l	1.000]	140			
5080000	STRONTIANITE	-3.860	[1.000]	800	[1.000]	140			
5050001	THERMONATR	-14.195	[2.000]	500]	1.000]	140	[1.000]	2
5010000	WITHERITE	-4.465	1.0001	100]	1.0001	140			
2047000	PYROLUSITE	0 000	-4 0001	330	Г	-1 0001	1	٢	1,0001	471
2011000	LINODODIID	0.000	2 0001	200	L	1.000]	-	L	1.000]	
0047001	DIDNDGGIMD	1 (())		220	r	1 0001	1	r	1 0001	171
2047001	BIRNESSITE	-1.663	[-4.000]	330	L	-1.000]	T	L	1.000]	4/1
			[2.000]	2						
2047002	NSUTITE	-1.076	[-4.000]	330	[-1.000]	1	E	1.000]	471
			[2.000]	2						
3047100	BIXBYITE	-9.351	-6.0001	330]	2.0001	471	Γ	3.0001	2
3047000	HAUSMANNTTE	-23.837	-8.0001	330	ſ	-2.0001	1	ſ	3.0001	470
001/000	in io of manifer 12	20.007		2	L	1.000		L		
2017002	DUDOGDOTEE	10 014		220	r	1 0001	170	r	2 0001	2
2047003	PIROCROITE	-16.614	[-2.000]	330	L	1.000]	470	L	2.000]	2
204/100	MANGANITE	-4.595	[-3.000]	330	L	1.000]	4/1	L	2.000]	2
5047000	RHODOCHROSIT	-12.410	[1.000]	470	1	1.000]	140			
16000	CD METAL	-53.242	[1.000]	160	[2.000]	1			
16001	GAMMA CD	-53.345	[1.000]	160]	2.000]	1			
5016000	OTAVITE	-4.846	1.0001	160	1	1.0001	140			
2016000	CD(OH)2(A)	-11 015	[-2,000]	330	ſ	1 0001	160	Г	2,0001	2
2016000	CD(OH)2 (C)	-10 531		330	r	1 0001	160	Г	2 0001	2
2016001	CD(OH)Z (C)	-10.551		220	L	1.000]	100	L	2.000]	40
2016002	MONTEPONITE	-12.482	-2.000]	530	L	1.000]	TOO	L	1.000]	2
60000	PB METAL	-46.273	[1.000]	600	l	2.000]	1			
5060000	CERRUSITE	-7.959	[1.000]	600]	1.000]	140			
2060000	MASSICOT	-12.726	[-2.000]	330	[1.000]	600	[1.000]	2
2060001	LITHARGE	-12.528	-2.0001	330	1	1.0001	600	ſ	1.0001	2
2060002	PBO 3H2O	-12 470	[-2,000]	330	r	1.0001	600	ſ	1 3301	2
5060002	PB20C03	-20 396		330	L L	2 0001	600	L L	1 0001	2
3000001	FDZOCOJ	-20.390		140	L	2.000]	000	L	1.000]	2
500000	DD200000	21 606	[1.000]	140		2 0001	600	r	1 0001	140
5060002	PB302C03	-31.696	[-4.000]	330	L	3.000]	600	l	1.000]	140
			[2.000]	2						
2060003	PLATTNERITE	-7.643	[-4.000]	330]	-2.000]	1	[1.000]	600
			[2.000]	2						
3060000	PB203	-17.498	-6.0001	330	٦	-2.0001	1	Γ	2,0001	600
			3 0001	2	L]	-	L]	
3060001	MINITIM	-31 625		330	r	-2 0001	1	Г	3 0001	600
2000001	LITINI ON	-31.033		330	ι	-2.000]	T	L	5.000]	000
		-	4.000]	2			600		0 000-	
2060004	PB(OH)2 (C)	-7.912	[-2.000]	330	L	1.000]	600	l	2.000]	2
5060003	HYDCERRUSITE	-24.396	[-2.000]	330	[3.000]	600	[2.000]	140
			[2.000]	2						

2060005	PB20(OH)2	-25.180]	-4.000]	330	J	2.000]	600	I	3.000]	2
3006000) ARSENOLITE	-39.667		[4.000]	60		[-6.000]	2			
3006001	CLAUDETITE	-39.423	[4.000]	60]	-6.000]	2			
2015000	LIME	-22.690]	-2.000]	330	I	1.000]	150	[1.000]	2
2015001	PORTLANDITE	-12.265	Ι	-2.000]	330]	1.000]	150]	2.000]	2
2028000	WUSTITE	-20.597]	-2.000]	330	I	0.947]	280	[1.000]	2
2046001	PERICLASE	-10.781	[-2.000]	330]	1.000]	460	Ε	1.000]	2
3028001	HERCYNITE	-23.720]	-8.000]	330]	1.000]	280	[2.000]	30
]	4.000]	2						
3046000	SPINEL	-11.930	[-8.000]	330	Ξ	1.000]	460	[2.000]	30
]	4.000]	2						
3046001	MAG-FERRITE	-10.038]	-8.000]	330]	1.000]	460	Γ	2.000]	281
]	4.000]	2						
3028102	LEPIDOCROCIT	-3.075	[-3.000]	330]	1.000]	281	[2.000]	2
3021100	FECR204	-12.478]	2.000]	211	[1.000]	280	Γ	-4.000]	330
3021101	MGCR204	-4.581]	2.000]	211]	1.000]	460	3	-4.000]	330
3021102	CR203	0.000]	2.000]	211	I	-2.000]	330	C	-1.000]	2
2021102	CR (OH) 3 (A)	-0.829]	1.000]	211	I	1.000]	2	[-1.000]	330
2021101	CR(OH)3 (C)	-3.418]	1.000]	211	Ι	1.000]	2	C	-1.000]	330

3 - Modelling of water quality of Site 14

		PART 1	of OUTPUT	FILE		
Revuè ri Entered	ver water-Site Alkalinity, PCO	14 - Initia 2. PO2. fixe	l run ed pH, solic	ls not al	lowed to prec	ipitate
				at		
Tempera Units o Ionic s Carbona Do not Precipi in th The max The met Interme	ture (Celsius): f concentration trength to be c te concentratio automatically t tation is allow e input file (i imum number of hod used to com diate output fi	19.30 : MG/L omputed. n represent erminate if ed only for f any). iterations pute activi le	s carbonate charge imb those soli is: 200 ty coeffici	alkalini alance ex ds specif ents is:	lty. cceeds 30% fied as ALLOWE Davies equati	:D .on
INPUT DA ID 330 140 30 150 160 211 231 280 410 460 500 540 600 800 950 1 2 Cha S P	TA BEFORE TYPE N NAME H+1 CO3-2 Al+3 Ba+2 Ca+2 Cd+2 Cd+2 Cr(OH)2+ Cu+2 Fe+2 K+1 Mg+2 Na+1 Ni+2 Pb+2 Sr+2 Zn+2 E-1 H20 rge Balance: UN: um of CATIONS= ERCENT DIFFEREN	MODIFICATIO ACTIVITY G 2.512 6.761 4.786 1.380 1.288 4.677 2.818 3.162 5.370 6.607 1.445 2.089 1.862 1.778 5.754 3.090 1.000 1.000 SPECIATED 8.438E-04 CE = 1.349	NS UESS LOG E-08 E-21 E-06 E-04 E-09 E-07 E-07 E-07 E-07 E-04 E-04 E-04 E-04 E-04 E-07 E-08 E-09 E-04 E-08 E-04 E-08 E-04 E-08 E-04 E-08 E-04 E-08 E-07 E-16 E+00 E-07 E-16 E+00 E-07 E-16 E+00 E-07 E-16 E+00 E-07 E-07 E-07 E-16 E-07 E-07 E-07 E-16 E+00 E-07 E-	GUESS -7.600 -20.170 -5.320 -3.890 -8.330 -7.550 -6.500 -6.270 -4.180 -3.840 -3.680 -7.730 -6.750 -6.240 -6.510 -16.000 0.000 NS = 6.4 NS - CATI	ANAL TOTAL 0.000E-01 1.930E+01 1.300E-01 5.200E+00 5.300E-04 2.400E-03 2.000E-02 3.000E-02 2.599E+00 3.500E+00 4.800E+00 1.100E-03 3.700E-02 5.000E-02 2.000E-02 0.000E-01 0.000E-01 4.33E-04 CONS) / (ANIONS	+ CATIONS)
m	COMPONENTED DO	PART	3 of OUTPUT	FILE		
Type 1 ID 330 140 30 100 150 160 211 231 280 410 460 500 540 600 800 950	- COMPONENTS AS NAME H+1 CO3-2 Al+3 Ba+2 Ca+2 Cd+2 Cr(OH)2+ Cu+2 Fe+2 K+1 Mg+2 Na+1 Ni+2 Pb+2 Sr+2 Zn+2	CALC MOL 2.593E-08 3.669E-07 5.117E-13 1.383E-06 1.295E-04 4.319E-09 7.203E-09 9.796E-09 5.332E-07 6.647E-05 1.436E-04 2.088E-04 5.973E-09 2.632E-08 5.707E-07 2.734E-07	ACTIVITY 2.512E-08 3.232E-07 3.847E-13 1.219E-06 1.141E-04 3.804E-09 6.978E-09 8.629E-09 4.697E-07 6.440E-05 1.265E-04 2.023E-04 5.261E-09 2.319E-08 5.027E-07 2.409E-07	LOG ACTV -7.600 -6.490 -12.414 -3.942 -8.419 -8.156 -8.064 -6.328 -4.191 -3.897 -3.694 -8.278 -7.634 -6.298 -6.618	GAMMA 000 0.96880 048 0.88091 85 0.75180 009 0.88091 821 0.88091 970 0.88091 926 0.96880 902 0.88091 914 0.88091 914 0.96880 809 0.96880 809 0.96880 809 0.88091 90 0.96880 829 0.88091 921 0.88091	NEW LOGK 0.014 0.055 0.124 0.055 0.055 0.055 0.014 0.055 0.014 0.055 0.014 0.055 0.014 0.055 0.055 0.055
Type II ID 2113302 2113303	- OTHER SPECIE: NAME Cr(OH)3 AQ Cr(OH)4-	S IN SOLUTI CALC MOL 2.059E-08 8.082E-12	ON OR ADSOR ACTIVITY 2.059E-08 7.829E-12	BED LOG ACTV -7.686 -11.106	GAMMA 527 1.00018 527 0.96880	NEW LOGK -7.130 -18.136

3300020 OH- 2.661E-07 2.578E-07 -6.58865 0.96880 -11.1990 4601400 MgCO3 AQ 3.576E-08 3.576E-07 -7.44657 1.00018 2.1942 1503100 CaCH 7.333E-10 7.105E-10 -9.14486 0.96880 11.349 1501400 CaCHO3 AQ 4.656E-08 4.657E-08 -7.33193 1.00018 3.101 1501401 CaCHO3 AQ 4.656E-08 4.657E-08 -7.33193 1.00018 3.101 1501401 NatCO3 AQ 1.974E-08 1.974E-08 -7.0457 1.00018 -6.105 303300 ALOHH 2 4.999E-08 4.843E-08 -7.31487 0.96880 -12.622 303303 ALOHH 2 4.999E-08 4.843E-08 -7.31487 0.96880 -12.792 2003302 FeOH 4 3.954E-09 3.841E-09 -8.41670 0.96880 -2.3616 303301 ALOHH 2 4.242E-06 2.427E-06 2.427E-06 2.427E-06 2.427E-06 2.427E-06 2.427E-06 2.42	2113304	Cr02-	2.051E-11	1.987E-11	-10.70186	0.96880	-17.732
4603300 MgCH + 5.151E-09 4.991E-09 -8.30184 0.96880 -11.990 4601401 MgCO3 AQ 3.576E-08 -7.74657 1.00018 2.942 4601400 CARC3 + 2.013E-07 1.950E-10 -9.14846 0.96680 -12.792 1501401 CaCO3 AQ 4.656E-08 4.657E-08 -7.33193 1.00018 3.101 5001400 NaCO3 - 9.330E-10 9.039E-10 -9.04387 0.96680 -10.086 303300 AlOH + 2 1.203E-10 1.060E-10 -9.97485 0.86080 -10.086 303301 AlOH + 2 1.203E-10 1.060E-10 -9.97485 0.86080 -10.086 303301 AlOH + 2 3.954E-09 3.831E-09 -8.41670 0.96680 -3.1419 2803301 FeOH3 - 1 1.229E-12 1.048715 0.496680 -3.371 100300 SCH + 1.337E-12 1.2295E-12 -11.86775 0.96680 -1.3.570 2311400 CuCO3 AQ 1.496E-09 3.454E-09<	3300020	OH-	2.661E-07	2.578E-07	-6.58865	0.96880	-14.175
4601400 MgC03 AQ 3.576E-06 3.576E-06 -7.44657 1.00018 2.9482 1503400 CaRCA 7.333E-10 7.105E-10 -9.14484 0.96880 11.349 1501400 CaRCO3 AQ 4.656E-08 4.657E-08 -7.33193 1.00018 3.101 1501401 CaRCO3 AQ 4.656E-08 4.657E-08 -7.33193 1.00018 3.101 1501401 CARCO3 AQ 1.974E-08 -9.70487 1.00018 3.101 303300 AlOHH 2 4.999E-08 4.843E-08 -7.31487 0.96880 -12.632 303301 AlOHH 2 4.999E-08 4.843E-08 -7.31487 0.96880 -12.602 2003302 FeOH3 -1 1.228E-15 -14.96102 0.96880 -3.1419 203302 FeOH2 AQ 7.829E-13 7.210627 1.00018 -6.075 203302 FeOH2 AQ 1.498E-06 1.498E-08 -12.49610 0.96880 -7.3451 203302 FeOH2 AQ 1.498E-08 1.498E-08	4603300	MgOH +	5.151E-09	4.991E-09	-8.30184	0.96880	-11.990
4601401 MgHCO3 + 2.887E-07 2.796E-07 -6.55339 0.96680 -12.792 1501400 CaRCO3 A 2.013E-07 1.950E-07 -6.70989 0.96680 -12.792 1501401 CaRCO3 A 4.656E-08 4.657E-08 -7.33193 1.00018 3.101 5001401 NaCO3 - 9.330E-10 9.039E-10 -9.04387 0.96680 -1.00018 10.060 303300 AlOH + 2 1.203E-10 1.060E-10 -9.97485 0.88091 -5.105 303301 AlOH + 2 1.203E-10 1.060E-10 -9.97485 0.8800 -6.610 303303 AlOH + 2 2.427E-66 2.427E-66 -5.61487 1.00018 -16.000 303303 FeOH + 3.954E-09 3.831E-09 -8.41670 0.96680 -9.675 2003302 FeOH + 1.3954E-029 3.831E-03 -1.210622 0.96880 -13.319 2003302 FeOH + 1.33546E-09 3.435E-13 -12.04234 1.00018 -10.554 2311401 </td <td>4601400</td> <td>MgCO3 AQ</td> <td>3.576E-08</td> <td>3.576E-08</td> <td>-7.44657</td> <td>1.00018</td> <td>2.942</td>	4601400	MgCO3 AQ	3.576E-08	3.576E-08	-7.44657	1.00018	2.942
1503400 CaRCO3 + 7.332E-10 7.105E-10 -9.14846 0.96880 11.337 1501400 CARCO3 AQ 4.656E-08 4.657E-08 -7.33193 1.00018 3.101 1501401 NaCO3 - 9.330E-10 9.04387 0.96880 1.154 5001401 NaRCO3 AQ 1.974E-08 1.974E-08 -7.70457 1.00018 10.0018 303301 Al(H) 2 + 4.999E-08 4.843E-08 -7.31497 0.96880 -10.066 303302 Al(OH) 4 - 2.341E-06 2.268E-06 -5.61481 1.00018 -16.000 2803301 FeOH + 3.954E-05 3.631E-09 -8.41670 0.96880 -3.419 2803302 FeOH3 -1 1.128E-15 1.0487E-15 -12.08762 1.00018 -5.301 2803300 SCH + 1.537E-12 1.295E-12 -11.8777 0.96880 -13.510 2811400 Cu(Co3) AQ 1.498E-08 -7.82449 1.00018 -5.332 2811401 Cu(Co3) A2 2.692E-12 2.6196E-13 -12.16324 1.00018 -5.3333 2813304	4601401	MgHCO3 +	2.887E-07	2.796E-07	-6.55339	0.96880	11.449
1501400 C2HCO3 + 2.013E-07 1.950E-07 -6.70989 0.06880 11.337 5001401 NaCO3 - 9.330E-10 9.039E-10 -9.04387 0.0680 1.54 5001401 NaCO3 AQ 1.974E-08 -9.77455 0.8680 1.55 503301 Al(OH1 - 2.341E-06 2.268E-06 -5.6447 0.96880 -2.3616 303303 Al(OH1 - 2.341E-06 2.477E-06 -5.6147 1.00018 -16.000 2803301 FeOH3 -1 1.129E-15 1.094E-15 -14.96102 0.96880 -3.3149 2803302 FeOH2 AQ 7.829E-13 7.830E-13 -12.08376 0.96880 -3.371 201401 Cu(CO32-2 6.920E-12 6.006E-12 -11.21497 0.80819 9.855 2313401 Cu(H1 - 3.546E-09 3.435E-09 -8.46402 0.96880 -7.986 2313401 Cu(H2 AQ 2.857E-07 -6.54403 1.00018 -13.871 2313401 Cu(H2 AQ 2.856E-12 2.903E-12 -11.21497 0.8680 -2.6488 2313302 Cu(H1 -	1503300	CaOH +	7.333E-10	7.105E-10	-9.14846	0.96880	-12.792
	1501400	CaHCO3 +	2.013E-07	1.950E-07	-6.70989	0.96880	11.337
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1501401	CaCO3 AQ	4.656E-08	4.657E-08	-7.33193	1.00018	3.101
	5001400	NaCO3 -	9.330E-10	9.039E-10	-9.04387	0.96880	1.154
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	5001401	NaHCO3 AQ	1.974E-08	1.974E-08	-7.70457	1.00018	10.080
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	303300	AlOH +2	1.203E-10	1.060E-10	-9.97485	0.88091	-5.105
$\begin{array}{llllllllllllllllllllllllllllllllllll$	303301	Al(OH)2 +	4.999E-08	4.843E-08	-7.31487	0.96880	-10.086
$ \begin{array}{c} 103303 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ $	303302	Al(OH)4 -	2.341E-06	2.268E-06	-5.64431	0.96880	-23.616
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	303303	A1 (OH) 3 AO	2.427E-06	2.427E-06	-5.61487	1.00018	-16.000
$ \begin{array}{c} 203301 \\ 203302 \\ 2040 \\ 1 \\ 302311401 \\ 2040232 \\ 20402 \\ 2040 \\ 203302 \\ 2040 \\ 1 \\ 302311401 \\ 204023 \\ 2040 $	2803300	FeOH +	3.954E-09	3.831E-09	-8.41670	0.96880	-9.675
2803302 FeGH2 AQ 7.829E-13 7.830E-13 -12.10827 1.00018 -20.978 8003300 SrOH + 8.511E-13 8.246E-13 -12.08276 1.00018 -20.978 8003300 SrOH + 1.337E-12 1.295E-12 -11.88775 0.96880 -13.560 2311401 Cu(C03)2-2 6.920E-12 6.096E-12 -11.21497 0.86801 -7.986 2313300 Cu(OH) A 2.857E-07 2.657E-07 -6.54403 1.00018 -13.660 2313303 Cu(OH) A -2 6.181E-18 5.444E-18 -17.26404 0.96880 -26.885 2313303 Cu(OH) A -2 6.181E-18 5.444E-18 -17.26404 0.96880 -9.138 2503301 Zn(OH) A -2 6.348E-09 6.767E-09 -8.1663 0.96880 -22.835 2503302 Zn(OH) A -2 4.348E-18 -17.41724 0.80891 -41.44 9501400 Zn(C03) 2-2 1.219E-10 1.074E-10 -9.96917 0.88091 -41.44 9501402 Zn(C03)2-2	2803301	FeOH3 -1	1.129E-15	1.094E-15	-14.96102	0.96880	-31.419
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2803302	FeOH2 AO	7.829E-13	7.830E-13	-12.10622	1.00018	-20.978
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	8003300	SrOH +	8.511E-13	8.246E-13	-12.08376	0.96880	-13.371
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1003300	BaOH +	1.337E - 12	1.295E - 12	-11.88775	0.96880	-13.560
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2311400	CUCO3 AO	1.498E - 08	1.498E - 08	-7.82449	1,00018	6.730
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2311401	$C_{11}(C_{03})_{2-2}$	6.920E-12	6.096E-12	-11,21497	0.88091	9.885
$ \begin{array}{c} 2.313301 & Cu(OH)2 AQ \\ 2.857E-07 & 2.857E-07 & -6.54403 & 1.00018 & -13.680 \\ 2.313302 & Cu(OH)3 & - & 7.091E-13 & 6.870E-13 & -12.16304 & 0.96880 & -26.885 \\ 2.313303 & Cu(OH)4 & -2 & 6.181E-18 & 5.444E-18 & -17.26404 & 0.88091 & -10.554 \\ 2.311402 & CuHCO3 & + & 7.232E-10 & 7.007E-10 & -9.15449 & 0.96880 & 13.014 \\ 9503300 & ZnOH & & 6.984E-09 & 6.767E-09 & -8.15963 & 0.96880 & -9.138 \\ 9503301 & Zn(OH)2 AQ & 4.816E-09 & 4.817E-09 & -8.31722 & 1.00018 & -16.899 \\ 9503302 & Zn(OH)3 & - & 6.259E-13 & 6.064E-13 & -12.21723 & 0.96880 & -24.885 \\ 9503303 & Zn(OH)4 & -2 & 4.343E-18 & 3.826E-18 & -17.41724 & 0.88091 & -41.144 \\ 9501400 & ZnHCO3 & + & 5.071E-09 & 4.913E-09 & -8.30869 & 0.96880 & 12.414 \\ 9501400 & ZnHCO3 & + & 5.071E-09 & 4.913E-09 & -8.30869 & 0.96880 & 12.414 \\ 9501402 & Zn(CO3)2-2 & 1.219E-10 & 1.074E-10 & -9.96917 & 0.88091 & 9.685 \\ 1601400 & Cd(CO3)3-4 & 3.541E-22 & 2.132E-22 & -21.67114 & 0.60219 & 6.440 \\ 1603300 & Cd(OH)2 & AQ & 2.693E-14 & 2.693E-14 & -13.56972 & 1.00018 & -20.350 \\ 1603301 & Cd(OH)4 & -2 & 4.845E-26 & 4.268E-26 & -25.36973 & 0.88091 & -47.295 \\ 1603302 & Cd(OH)3 & - & 1.242E-19 & 1.203E-19 & -18.91972 & 0.96880 & -33.286 \\ 6003303 & Cd(OH)4 & -2 & 4.845E-26 & 4.268E-26 & -25.36973 & 0.88091 & -47.295 \\ 1601400 & CdCO3 + & 0.09E-11 & 7.759E-11 & -10.11018 & 0.96880 & -7.696 \\ 6003301 & Cd(OH)4 & -2 & 1.82E-19 & 1.640E-19 & -18.78512 & 0.75180 & -9.422 \\ 6003302 & Pb(OH)3 & - & 1.35E-13 & 1.274E-13 & -12.89481 & 0.96880 & -7.696 \\ 6003303 & PbO(H) & -2 & 1.322E-17 & 1.726E-17 & -16.76297 & 0.88091 & -7.696 \\ 6003301 & Pb(OH)2 & AQ & 2.787E-10 & 2.787E-10 & -9.55180 & 1.00018 & -17.120 \\ 6003302 & Pb(OH)3 & - & 1.322E-17 & 1.165E-17 & -16.93382 & 0.88091 & -39.644 \\ 6001400 & Pb(CO3) + & & 3.080E-09 & 2.942E-19 & -16.93382 & 0.88091 & -39.644 \\ 6003303 & Pb2OH + & & 1.302E-07 & -6.88527 & 0.96880 & 13.214 \\ 5403300 & NiOH + & & 9.394E-13 & -12.07891 & 0.0018 & -19.000 \\ 5403302 & Ni(OH)2 & AQ & 8.337E-13 & 8.339E-13 & -12.07891 & 0.96880 & -29.986 \\ 5401400 & NiHCO3 $	2313300	C110H +	3.546E-09	3.435E-09	-8.46402	0.96880	-7.986
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2313301	C11 (OH) 2 AO	2.857E - 07	2.857E-07	-6 54403	1,00018	-13,680
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2313302	Cu(OH) 3 -	7.091E - 13	6 870E-13	-12 16304	0.96880	-26.885
$\begin{array}{c} 2313304 \\ Cu2(0H)2+2 \\ 2313304 \\ Cu2(0H)2+2 \\ 23128-10 \\ 7.007E-10 \\ -9.153449 \\ 0.96880 \\ 13.014 \\ 9503301 \\ Zn(0H)2 \\ AQ \\ 4.816E-09 \\ 4.817E-09 \\ -8.16953 \\ 0.96880 \\ -9.138 \\ 9503302 \\ Zn(0H)4 \\ -2 \\ 4.816E-09 \\ 4.817E-09 \\ -8.1723 \\ 0.96880 \\ -28.385 \\ -$	2313303	Cu(OH) 4 = 2	6.181E - 18	5.444E - 18	-17 26404	0 88091	-39 545
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2313304	$C_{11}^{2}(OH)^{2+2}$	3 296F-12	2.903E - 12	-11 53711	0 88091	-10.554
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2311402	CuHCO3 +	7.232F - 10	7 007F - 10	-9 15/49	0.96880	13 014
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9503300	7nOH +	6 984F-09	6 767E-09	-8 16963	0.96880	-9 138
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9503300	$2\pi(OH) 2$ AO	4 816F-09	4 817E-09	-8 31722	1 00018	-16 899
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9503301	$Z_{\rm II}(OH) Z_{\rm AQ}$	6 250F-13	4.01/E - 05	-12 21723	0.96880	-28 385
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9503302	$2\pi (OH) 4 = 2$	4.343E = 18	3 826F-18	-17 11721	0.88091	-11 114
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9501400	$2\pi HCO3 +$	5 071F-09	4 913F-09	-8 30869	0.96880	12 414
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9501400	Znc03 A0	1 5538-08	1.554E - 08	-7 80869	1 00018	5 300
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	9501401	Zn(CO3)2-2	1 219F-10	1.074E - 10	-9 96917	0 88091	9 685
1001400 Cd(Cd) + 8.1341E 22 2.132E 22 -211.08685 0.96880 -10.253 1603300 Cd(OH) 2 AQ 2.693E-14 2.693E-14 -13.56972 1.00018 -20.350 1603301 Cd(OH) 3 - 1.242E-19 1.203E-19 -18.91972 0.96880 -33.286 1603303 Cd(OH) 4 -2 4.845E-26 4.268E-26 -25.36973 0.88091 -47.295 1603304 Cd2OH +3 2.182E-19 1.640E-19 -18.78512 0.75180 -9.422 1601400 CdHCO3 + 8.009E-11 7.759E-11 -10.11018 0.96880 12.414 1601401 CdCO3 AQ 3.081E-10 3.082E-10 -9.51118 1.00018 5.399 6003300 Pb(H + 1.858E-08 1.800E-08 -7.74480 0.96880 -7.696 6003301 Pb(OH) 2 AQ 2.787E-10 2.787E-10 -9.55480 1.00018 -17.120 6003302 Pb(OH) 3 - 1.315E-13 1.274E-13 -12.89481 0.96880 -28.046 6003303 Pb2OH +3 1.243E-14 9.341E-15 -14.02959 0.75180	1601402	Cd(CO3) = 1	35/1F-22	2 132E - 22	-21 67114	0 60219	6.440
1003300 Cd(OH) 2 AQ 2.693E-14 2.603E-14 -13.56972 1.00018 -20.350 1603301 Cd(OH) 3 - 1.242E-19 1.203E-19 -18.91972 0.96880 -33.286 1603303 Cd(OH) 4 -2 4.845E-26 4.268E-26 -25.36973 0.88091 -47.295 1601304 Cd2OH +3 2.182E-19 1.640E-19 -18.78512 0.75180 -9.422 1601400 CdHCO3 + 8.009E-11 7.759E-11 -10.11018 0.96680 12.414 1601401 CdCO3 AQ 3.081E-10 3.082E-10 -9.51118 1.00018 5.399 6001400 Pb(CO3)2-2 1.20DE-10 1.057E-10 -9.97575 0.88091 10.695 6003301 Pb(OH)2 AQ 2.787E-10 2.787E-10 -9.55480 1.00018 -7.7496 6003302 Pb(OH)3 - 1.315E-13 1.274E-13 -12.89481 0.96880 -28.046 6003303 Pb2OH +3 1.243E-14 9.341E-15 -14.02959 0.75180 -6.236 6003304 Pb3(OH)4 +2 1.959E-17 1.726E-17 -16.93382 0.88091	1603300		8 151F-12	8 187F-12	-11 08685	0.96880	-10 253
1003301 Cd(OH)2 AQ 2.0352-14 1.2032-19 -1.8.91972 0.96880 -33.286 1603303 Cd(OH)4 -2 4.8452-26 4.2682-26 -25.36973 0.88091 -47.295 1603304 Cd2OH +3 2.182E-19 1.640E-19 -18.78512 0.75180 -9.422 1601400 CdHCO3 + 8.009E-11 7.759E-11 -10.11018 0.96880 12.414 1601401 CdCO3 AQ 3.081E-10 3.082E-10 -9.951118 1.00018 5.399 6001300 PbOH + 1.858E-08 1.800E-08 -7.74480 0.96880 -7.696 6003301 Pb(OH)2 AQ 2.787E-10 2.787E-10 -9.55480 1.00018 -17.120 6003302 Pb(OH)3 - 1.315E-13 1.274E-13 -12.89481 0.96880 -28.046 6003303 Pb2OH +3 1.242E-17 1.165E-17 -16.93382 0.88091 -24.204 6001401 PbCO3 AQ 1.302E-07 1.302E-07 -6.88527 1.00018 7.240 6003305 Pb(OH)4 -2 1.322E-11 1.165E-17 -16.93382 0.88091 -3	1603301	Cd(OH) 2 NO	2 6935-14	2 6935-14	-13 56972	1 00018	-20.350
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1603302	Cd(OH) = AQ	1 2/2F - 19	1 203E - 19	-18 91972	0.96880	-33 286
1603303 Cd(OH) + 2 4.049E-20 4.260E-20 -23.305/5 0.06031 47.253 1603304 Cd2OH + 3 2.182E-19 1.640E-19 -18.78512 0.75180 -9.422 1601400 CdHCO3 + 8.009E-11 7.759E-11 -10.11018 0.96880 12.414 1601401 CdCO3 AQ 3.081E-10 3.082E-10 -9.51118 1.00018 5.399 6001400 Pb(CO3)2-2 1.200E-10 1.057E-10 -9.97575 0.88091 10.695 6003301 Pb(OH)2 AQ 2.787E-10 2.787E-10 -9.55480 1.00018 -17.120 6003302 Pb(OH)3 - 1.315E-13 1.274E-13 -12.89481 0.96880 -28.046 6003303 Pb2OH +3 1.243E-14 9.341E-15 -14.02959 0.75180 -6.236 6003304 Pb3(OH)4+2 1.959E-17 1.726E-17 -16.76297 0.88091 -24.204 6001401 PbCO3 AQ 1.302E-07 1.302E-07 -6.88527 1.00018 7.240 6003305 Pb(OH)4 -2 1.322E-17 1.165E-17 -16.93382 0.88091 </td <td>1603303</td> <td>Cd(OH) = 2</td> <td>1 8455-26</td> <td>1.203E 19</td> <td>-25 36073</td> <td>0.88091</td> <td>-17 295</td>	1603303	Cd(OH) = 2	1 8455-26	1.203E 19	-25 36073	0.88091	-17 295
1001304 CdLC1 2.102 1.10401 1.04011 10.1012 0.96880 12.414 1601400 CdC03 AQ 3.081E-10 3.082E-10 -9.51118 1.00018 5.399 6001400 Pb(C03)2-2 1.200E-10 1.057E-10 -9.97575 0.88091 10.695 6003300 PbOH + 1.858E-08 1.800E-08 -7.74480 0.96880 -7.696 6003301 Pb(OH)2 AQ 2.787E-10 2.787E-10 -9.55480 1.00018 -17.120 6003302 Pb(OH)3 - 1.315E-13 1.274E-13 -12.89481 0.96880 -28.046 6003303 Pb2OH +3 1.243E-14 9.341E-15 -14.02959 0.75180 -6.236 6003304 Pb3 (OH) 4+2 1.959E-17 1.726E-17 -16.76297 0.88091 -24.204 6001401 PbC03 AQ 1.302E-07 1.302E-07 -6.8527 1.00018 7.240 6003305 Pb (OH) 4 -2 1.322E-17 1.165E-17 -16.93382 0.88091 -39.644 6001402 PbHCO3 + 3.080E-09 2.984E-09 -8.52527 0.96880	1603304	Cd(OH) = -2	2 182E - 19	4.200E-20 1 640F-19	-18 78512	0.75180	-9 422
1001400 CdCO3 AQ 3.081E-10 3.082E-10 -9.51118 1.00018 5.399 1001400 Pb(CO3)2-2 1.200E-10 1.057E-10 -9.97575 0.88091 10.695 6003300 PbOH + 1.858E-08 1.800E-08 -7.74480 0.96880 -7.696 6003301 Pb(OH)2 AQ 2.787E-10 2.787E-10 -9.55480 1.00018 -17.120 6003302 Pb(OH)3 - 1.315E-13 1.274E-13 -12.89481 0.96880 -28.046 6003303 Pb2OH +3 1.243E-14 9.341E-15 -14.02959 0.75180 -6.236 6003304 Pb3(OH)4+2 1.959E-17 1.726E-17 -16.76297 0.88091 -24.204 6001401 PbcO3 AQ 1.302E-07 1.302E-07 -6.88527 1.00018 7.240 6003305 Pb(OH)4 -2 1.322E-17 1.165E-17 -16.93382 0.88091 -39.644 6001402 PbHCO3 + 3.080E-09 2.984E-09 -8.52527 0.96880 12.484 5403301 Ni (OH)2 AQ 8.337E-13 8.339E-13 -12.07890 <	1601400	CdHCO3 +	2.102E-19 8 009F-11	7 759F - 11	-10.11018	0.96880	12 414
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1601400	CdCO2 TO	3.009E-11	7.759E-11 3.092E-10	-9 51110	1 00018	5 300
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	6001401	Cacos AQ	1 200E-10	1.057E - 10	-9.51110	0 88091	10 695
6003300Fb0n1.030E1.030E1.030E1.044000.0400E1.044006003301Pb(OH) 2 AQ2.787E-102.787E-10-9.554801.00018-17.1206003302Pb(OH) 3 -1.315E-131.274E-13-12.894810.96880-28.0466003303Pb2OH +31.243E-149.341E-15-14.029590.75180-6.2366003304Pb3(OH) 4+21.959E-171.726E-17-16.762970.88091-24.2046001401PbCO3 AQ1.302E-071.302E-07-6.885271.000187.2406003305Pb(OH) 4-21.322E-171.165E-17-16.933820.88091-39.6446001402PbHCO3 +3.080E-092.984E-09-8.525270.9688013.2145403301Ni (OH) 2 AQ8.337E-138.339E-13-12.078901.00018-19.0005403302Ni (OH) 3 -3.427E-163.320E-16-15.478910.96880-29.9865401400NiHCO3 +1.301E-101.261E-10-9.899370.9688012.4845401401NiCO3 AQ1.261E-081.261E-08-7.899371.000186.8705401402Ni (CO3)2-28.039E-127.082E-12-11.149850.8809110.1653301400HCO3 -2.028E-041.964E-04-3.706800.9688010.3973301401H2CO3 AQ1.053E-051.053E-05-4.977381.0001816.7132113300Cr+34.736E-143.560E-14-13.448530.75180 <t< td=""><td>6003300</td><td>PD(CU3)2-2</td><td>1.858F-08</td><td>1.800 E - 10</td><td>-7 74480</td><td>0.06091</td><td>-7 696</td></t<>	6003300	PD(CU3)2-2	1.858F-08	1.800 E - 10	-7 74480	0.06091	-7 696
6003301FB (0H) 2 Ag2.787E-102.787E-10-9.334001.0001017.1206003302Pb (0H) 3 -1.315E-131.274E-13-12.894810.96880-28.0466003303Pb20H +31.243E-149.341E-15-14.029590.75180-6.2366003304Pb3 (0H) 4+21.959E-171.726E-17-16.762970.88091-24.2046001401PbC03 AQ1.302E-071.302E-07-6.885271.000187.2406003305Pb (0H) 4 -21.322E-171.165E-17-16.933820.88091-39.6446001402PbHC03 +3.080E-092.984E-09-8.525270.9688013.2145403300NiOH +1.984E-111.922E-11-10.716330.96880-10.0245403302Ni (OH) 2 Ag8.337E-138.339E-13-12.078901.00018-19.0005403302Ni (OH) 3 -3.427E-163.320E-16-15.478910.96880-29.9865401400NiHCO3 +1.301E-101.261E-08-7.899370.9688012.4845401401NiCO3 AQ1.261E-081.261E-08-7.899371.000186.8705401402Ni (CO3)2-28.039E-127.082E-12-11.149850.8809110.1653301400HCO3 -2.028E-041.964E-04-3.706800.9688010.3973301401H2CO3 AQ1.053E-05-4.977381.0001816.7132113300Cr+34.736E-143.560E-14-13.448530.7518010.03221	6003301	PDOIL 1	2.787 E = 10	2.787E - 10	-9 55480	1 00018	-17 120
6003302PB(0H)3 -1.3132-131.243E-13-12.034010.30080-20.0406003303Pb2OH +31.243E-149.341E-15-14.029590.75180-6.2366003304Pb3(OH)4+21.959E-171.726E-17-16.762970.88091-24.2046001401PbC03 AQ1.302E-07-6.885271.000187.2406003305Pb(OH)4-21.322E-171.165E-17-16.933820.88091-39.6446001402PbHCO3 +3.080E-092.984E-09-8.525270.9688013.2145403300NiOH +1.984E-111.922E-11-10.716330.96880-10.0245403302Ni(OH)2 AQ8.337E-138.339E-13-12.078901.00018-19.0005403302Ni(OH)3 -3.427E-163.320E-16-15.478910.96880-29.9865401400NiHCO3 +1.301E-101.261E-08-7.899370.9688012.4845401401NiCO3 AQ1.261E-081.261E-08-7.899371.000186.8705401402Ni(CO3)2-28.039E-127.082E-12-11.149850.8809110.1653301400HCO3 -2.028E-041.964E-04-3.706800.9688010.3973301401H2CO3 AQ1.053E-051.053E-05-4.977381.0001816.7132113300Cr+34.736E-143.560E-14-13.448530.7518010.0322113301Cr(OH)+28.295E-117.007E-11-10.136250.880915.675	6003301	PD(OH) 2 AQ	1 3158-13	1.274E - 13	-12 89/81	0.96880	-28 046
6003303Fb20h +51.243E +145.44E +15-14.023530.73160-24.2046003304Fb3(OH) 4+21.959E-171.726E-17-16.762970.88091-24.2046001401FbC03 AQ1.302E-071.302E-07-6.885271.000187.2406003305Fb(OH) 4-21.322E-171.165E-17-16.933820.88091-39.6446001402FbHCO3 +3.080E-092.984E-09-8.525270.9688013.2145403300NiOH +1.984E-111.922E-11-10.716330.96880-10.0245403302Ni (OH) 2 AQ8.337E-138.339E-13-12.078901.00018-19.0005403302Ni (OH) 3 -3.427E-163.320E-16-15.478910.96880-29.9865401400NiHCO3 +1.301E-101.261E-10-9.899370.9688012.4845401401NiCO3 AQ1.261E-081.261E-08-7.899371.000186.8705401402Ni (CO3)2-28.039E-127.082E-12-11.149850.8809110.1653301400HCO3 -2.028E-041.964E-04-3.706800.9688010.3973301401H2CO3 AQ1.053E-051.053E-05-4.977381.0001816.7132113300Cr+34.736E-143.560E-14-13.448530.7518010.0322113301Cr (OH) +28.295E-117.007E-11-10.136250.880915.675	6003302	PD(OH) 5 -	1.313E - 13 1.243E - 14	9.3/1E - 15	-14 02959	0.75180	-6.236
6001301 PDS(0H)4+2 1.302E-17 1.302E-17 -10.70297 0.88091 -24.204 6001401 PbC03 AQ 1.302E-07 1.302E-07 -6.88527 1.00018 7.240 6003305 Pb(0H)4 -2 1.322E-17 1.165E-17 -16.93382 0.88091 -39.644 6001402 PbHC03 + 3.080E-09 2.984E-09 -8.52527 0.96880 13.214 5403300 NiOH + 1.984E-11 1.922E-11 -10.71633 0.96880 -10.024 5403301 Ni (OH)2 AQ 8.337E-13 8.339E-13 -12.07890 1.00018 -19.000 5403302 Ni (OH)3 - 3.427E-16 3.320E-16 -15.47891 0.96880 -29.986 5401400 NiHCO3 + 1.301E-10 1.261E-10 -9.89937 0.96880 12.484 5401401 NiCO3 AQ 1.261E-08 1.261E-08 -7.89937 1.00018 6.870 5401402 Ni (CO3)2-2 8.039E-12 7.082E-12 -11.14985 0.88091 10.165 3301400 HCO3 - 2.028E-04 1.964E-04 -3.706	6003303	PD200 +3	1.245E - 14 1.050E - 17	J. J. GE_17	-16 76297	0.75180	-24.204
6001401 FBC03 AQ 1.302E-07 1.302E-07 -0.00327 1.00016 -7240 6003305 Fb(OH) 4 -2 1.322E-17 1.165E-17 -16.93382 0.88091 -39.644 6001402 FbHC03 + 3.080E-09 2.984E-09 -8.52527 0.96880 13.214 5403300 NiOH + 1.984E-11 1.922E-11 -10.71633 0.96880 -10.024 5403301 Ni (OH) 2 AQ 8.337E-13 8.339E-13 -12.07890 1.00018 -19.000 5403302 Ni (OH) 3 - 3.427E-16 3.320E-16 -15.47891 0.96880 -29.986 5401400 NiHCO3 + 1.301E-10 1.261E-10 -9.89937 0.96880 12.484 5401401 NiCO3 AQ 1.261E-08 1.261E-08 -7.89937 1.00018 6.870 5401402 Ni (CO3)2-2 8.039E-12 7.082E-12 -11.14985 0.88091 10.165 3301400 HCO3 - 2.028E-04 1.964E-04 -3.70680 0.96880 10.397 3301401 H2CO3 AQ 1.053E-05 1.053E-05 -4.97738 1.00018	6003304	PD3 (0n) 4+2	1.302E-07	1.720E - 17 1.302E - 07	-6 99527	1 00019	7 240
6003303FB(0h)4F21.322E-171.163E-17-16333820.88091-39.0446001402FbHC03 +3.080E-092.984E-09-8.525270.9688013.2145403300NiOH +1.984E-111.922E-11-10.716330.96880-10.0245403301Ni (OH)2 AQ8.337E-138.339E-13-12.078901.00018-19.0005403302Ni (OH)3 -3.427E-163.320E-16-15.478910.96880-29.9865401400NiHCO3 +1.301E-101.261E-10-9.899370.9688012.4845401401NiCO3 AQ1.261E-081.261E-08-7.899371.000186.8705401402Ni (CO3)2-28.039E-127.082E-12-11.149850.8809110.1653301400HCO3 -2.028E-041.964E-04-3.706800.9688010.3973301401H2CO3 AQ1.053E-051.053E-05-4.977381.0001816.7132113300Cr+34.736E-143.560E-14-13.448530.7518010.0322113301Cr (OH)+28.295E-117.007E-11-10.136250.880915.675	6001401	PDCOJ AQ	1.3026-07	1.302E - 07 1.165E - 17	-16 03302	0.00010	-29 644
5403300NiOH +1.984E-111.922E-11-10.716330.96880-10.0245403301Ni(OH)2AQ8.337E-138.339E-13-12.078901.00018-19.0005403302Ni(OH)3-3.427E-163.320E-16-15.478910.96880-29.9865401400NiHCO3 +1.301E-101.261E-10-9.899370.9688012.4845401401NiCO3 AQ1.261E-081.261E-08-7.899371.000186.8705401402Ni(CO3)2-28.039E-127.082E-12-11.149850.8809110.1653301400HCO3 -2.028E-041.964E-04-3.706800.9688010.3973301401H2CO3 AQ1.053E-051.053E-05-4.977381.0001816.7132113300Cr+34.736E-143.560E-14-13.448530.7518010.0322113301Cr(OH)+28.295E-117.007E-11-10.136250.880915.675	6003305	PD(OH) 4 = 2	1.3226-17	1.105E-17	-10.93302	0.06091	-39.044
5403300 NIOH + 1.984E-11 1.922E-11 -10.71633 0.96880 -10.024 5403301 Ni(OH)2 AQ 8.337E-13 8.339E-13 -12.07890 1.00018 -19.000 5403302 Ni(OH)3 - 3.427E-16 3.320E-16 -15.47891 0.96880 -29.986 5401400 NiHCO3 + 1.301E-10 1.261E-10 -9.89937 0.96880 12.484 5401401 NiCO3 AQ 1.261E-08 1.261E-08 -7.89937 1.00018 6.870 5401402 Ni(CO3)2-2 8.039E-12 7.082E-12 -11.14985 0.88091 10.165 3301400 HCO3 - 2.028E-04 1.964E-04 -3.70680 0.96880 10.397 3301401 H2CO3 AQ 1.053E-05 1.053E-05 -4.97738 1.00018 16.713 2113300 Cr+3 4.736E-14 3.560E-14 -13.44853 0.75180 10.032 2113301 Cr(OH)+2 8.295E-11 7.007E-11 -10.13625 0.88091 5.675	6001402	PDRCUS +	1 004E 11	2.904E-09	-0.52527	0.90000	10 024
5403301 N1 (OH) 2 AQ 8.337E-13 8.339E-13 -12.07890 1.00016 -19.000 5403302 Ni (OH) 3 - 3.427E-16 3.320E-16 -15.47891 0.96880 -29.986 5401400 NiHCO3 + 1.301E-10 1.261E-10 -9.89937 0.96880 12.484 5401401 NiCO3 AQ 1.261E-08 1.261E-08 -7.89937 1.00018 6.870 5401402 Ni (CO3)2-2 8.039E-12 7.082E-12 -11.14985 0.88091 10.165 3301400 HCO3 - 2.028E-04 1.964E-04 -3.70680 0.96880 10.397 3301401 H2CO3 AQ 1.053E-05 1.053E-05 -4.97738 1.00018 16.713 2113300 Cr+3 4.736E-14 3.560E-14 -13.44853 0.75180 10.032 2113301 Cr (OH) +2 8.295E-11 7.307E-11 -10.13625 0.88091 5.675	5403300	NICH +	1.9046-11	1.922E-11	-10.71033	0.90000	-10.024
5403302 N1 (OH) 3 - 3.427E-16 3.320E-16 -15.47891 0.96880 -29.986 5401400 NiHCO3 + 1.301E-10 1.261E-10 -9.89937 0.96880 12.484 5401401 NiCO3 AQ 1.261E-08 1.261E-08 -7.89937 1.00018 6.870 5401402 Ni(CO3)2-2 8.039E-12 7.082E-12 -11.14985 0.88091 10.165 3301400 HCO3 - 2.028E-04 1.964E-04 -3.70680 0.96880 10.397 3301401 H2CO3 AQ 1.053E-05 -4.97738 1.00018 16.713 2113300 Cr+3 4.736E-14 3.560E-14 -13.44853 0.75180 10.032 2113301 Cr(OH)+2 8.295E-11 7.007E-11 -10.13625 0.88091 5.675	5403301	NI (OH) Z AQ	8.33/E-13	8.339E-13	-12.07890	1.00018	-19.000
5401400NIRCO3 +1.301E-101.261E-10-9.899370.9688012.4845401401NiCO3 AQ1.261E-081.261E-08-7.899371.000186.8705401402Ni(CO3)2-28.039E-127.082E-12-11.149850.8809110.1653301400HCO3 -2.028E-041.964E-04-3.706800.9688010.3973301401H2CO3 AQ1.053E-051.053E-05-4.977381.0001816.7132113300Cr+34.736E-143.560E-14-13.448530.7518010.0322113301Cr(OH)+28.295E-117.307E-11-10.136250.880915.675	5403302	NI (UH) 3 -	3.42/8-16	3.32UE-16	-15.4/891	0.96880	-29.986
5401401NICO3 AQ1.201E-081.201E-08-7.899371.000186.8705401402Ni(CO3)2-28.039E-127.082E-12-11.149850.8809110.1653301400HCO3 -2.028E-041.964E-04-3.706800.9688010.3973301401H2CO3 AQ1.053E-051.053E-05-4.977381.0001816.7132113300Cr+34.736E-143.560E-14-13.448530.7518010.0322113301Cr(OH)+28.295E-117.007E-11-10.136250.880915.675	5401400	NIHCO3 +	1.301E-10	1.2016-10	-9.0993/	0.96880	12.484
5401402 N1(CO3)2-2 8.039E-12 7.082E-12 -11.14985 0.88091 10.165 3301400 HCO3 - 2.028E-04 1.964E-04 -3.70680 0.96880 10.397 3301401 H2CO3 AQ 1.053E-05 1.053E-05 -4.97738 1.00018 16.713 2113300 Cr+3 4.736E-14 3.560E-14 -13.44853 0.75180 10.032 2113301 Cr(OH)+2 8.295E-11 7.307E-11 -10.13625 0.88091 5.675	5401401	NICOS AQ	1.201E-08	1.2016-08	-1.8993/	1.00018	0.8/0
3301400 HC03 - 2.028E-04 1.964E-04 -3.70680 0.96880 10.397 3301401 H2C03 AQ 1.053E-05 1.053E-05 -4.97738 1.00018 16.713 2113300 Cr+3 4.736E-14 3.560E-14 -13.44853 0.75180 10.032 2113301 Cr(OH)+2 8.295E-11 7.307E-11 -10.13625 0.88091 5.675	3401402	N1 (CO3) Z-2	8.039E-12	1.082E-12	-11.14985	0.88091	10.165
3301401 H2C03 AQ 1.053E-05 1.053E-05 -4.97/38 1.00018 16.713 2113300 Cr+3 4.736E-14 3.560E-14 -13.44853 0.75180 10.032 2113301 Cr(OH)+2 8.295E-11 7.307E-11 -10.13625 0.88091 5.675	3301400	H003 -	Z.UZ8E-04	1.9048-04	-3.70680	0.96880	10.397
2113300 Cr+3 4.736E-14 3.560E-14 -13.44853 0.75180 10.032 2113301 Cr(OH)+2 8.295E-11 7.307E-11 -10.13625 0.88091 5.675	3301401	HZCO3 AQ	1.053E-05	1.053E-05	-4.9//38	1.00018	10./13
ZIIJJUL CE(OH)+Z 8.Z95E-II /.JU/E-II -IU.IJ6Z5 0.8809I 5.6/5	2113300	CI+3	4./36E-14	3.30UE-14	-13.44853	0.75180	10.032
	2113301	CI (OH) +2	0.Z95E-11	1.30/E-11	-10.13625	0.88091	5.6/5

Type III - SPECIES WITH FIXED ACTIVITY

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2	H20	8.954E-05	-4.048	0.000	0.000
3300021	02 (g)	1.656E-04	-3.781	-84.354	133.830
330	H+1	-4.211E-04	-3.376	7.600	0.000
3301403	CO2 (g)	4.385E-04	-3.358	21.690	-0.530

Type VI	- EXCLUDED S NAME	PECIES (not CALC MOL	include	ed :	in mole 1 G MOL 1	palance) NEW LOGK	DH
1 3301404	E-1 CH4 (g)	3.247E-1 0.000E-0	4 - 1 -1	-13	.489 .427	0.000 40.971	0.000-61.000
						- And open	and the second
	DED	PAI	RT 4 OI	E OI	JTPUT FI	LE	0
	TYPE I	and TYPE II	(disso	olve	ed and ac	dsorbed) s	pecies
Sr+2	100.0	PERCENT	BOUND	IN	SPECIES	# 800	Sr+2
Zn+2	89.4	PERCENT PERCENT	BOUND BOUND	IN IN	SPECIES SPECIES	# 950 #9503300	Zn+2 ZnOH +
	1.6	PERCENT	BOUND	IN	SPECIES	#9503301	Zn(OH)2 AQ
	1.7	PERCENT	BOUND	IN	SPECIES	#9501400	ZnHCO3 +
	5.1	PERCENT	BOUND	TIN	SPECIES	#9501401	ZNCOS AQ
A1+3	1.0	PERCENT	BOUND	IN	SPECIES	# 303301	Al(OH)2 +
	48.6	PERCENT	BOUND	IN	SPECIES	# 303302	Al(OH)4 -
	50.4	PERCENT	BOUND	IN	SPECIES	# 303303	Al (OH) 3 AQ
Ba+2	100.0	PERCENT	BOUND	IN	SPECIES	# 100	Ba+2
Ca+2	99.8	PERCENT	BOUND	IN	SPECIES	# 150	Ca+2
Cd+2	91.6	PERCENT	BOUND	IN	SPECIES	# 160	Cd+2
	1.7	PERCENT	BOUND	IN	SPECIES	#1601400	CdHCO3 +
	6.5	PERCENT	BOUND	IN	SPECIES	#1601401	CdCO3 AQ
Cr(OH)2+	25.8 73.8	PERCENT PERCENT	BOUND BOUND	IN IN	SPECIES SPECIES	# 211 #2113302	Cr(OH)2+ Cr(OH)3 AQ
C11+2	3 1	DERCENT	BOUND	ΤN	SPECTES	# 231	C11+2
CUTZ	4.8	PERCENT	BOUND	IN	SPECIES	#2311400	CuCO3 AO
	1.1	PERCENT	BOUND	IN	SPECIES	#2313300	CuOH +
	90.8	PERCENT	BOUND	IN	SPECIES	#2313301	Cu(OH)2 AQ
Fe+2	99.3	PERCENT	BOUND	IN	SPECIES	# 280	Fe+2
K+1	100.0	PERCENT	BOUND	IN	SPECIES	# 410	K+1
Mg+2	99.8	PERCENT	BOUND	IN	SPECIES	# 460	Mg+2
Na+1	100.0	PERCENT	BOUND	IN	SPECIES	# 500	Na+1
Ni+2	31.9	PERCENT	BOUND	IN	SPECIES	# 540	Ni+2
	67.3	PERCENT	BOUND	IN	SPECIES	#5401401	NiCO3 AQ
Ph+2	14.7	PERCENT	BOUND	TN	SPECIES	# 600	Pb+2
LD IL	10.4	PERCENT	BOUND	IN	SPECIES	#6003300	PbOH +
	72.9	PERCENT	BOUND	IN	SPECIES	#6001401	PbCO3 AQ
	1.7	PERCENT	BOUND	IN	SPECIES	#6001402	PbHCO3 +
E-1							
C03-2	94.6	PERCENT	BOUND	IN	SPECIES	#3301400	HCO3 -
	4.9	PERCENT	BOUND	IN	SPECIES	#3301401	H2CO3 AQ
U±1	0.0 1	DEDOENT	ROUND	TM	CDECTEC	#3301400	HC03 -
ITTI	10.2	PERCENT	BOUND	IN	SPECIES	#3301401	H2CO3 AO
H20	1.5	PERCENT	BOUND	IN	SPECIES	#3300020	OH-
	53.1	PERCENT	BOUND	IN	SPECIES	# 303302	AL(OH) 4 - AL(OH) 3 AO
	3.2	PERCENT	BOUND	IN	SPECIES	#2313301	Cu(OH) 2 AO

LINK NAME DISSOLVED SORBED FRECIPITATED 1DX NAME DISSOLVED SORBED FRECIPITATED 800 Sr+2 5.707E-07 100.0 0.000E-01 0.0 0.000E-01 0.0 30 Al+3 4.818E-06 100.0 0.000E-01 0.0 0.000E-01 0.0 30 Al+3 4.818E-06 100.0 0.000E-01 0.0 0.000E-01 0.0 160 Cat+2 1.297E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 211 Ct+2 3.47E-07 100.0 0.000E-01 0.0 0.000E-01 0.0 216 C+2 5.372E-07 100.0 0.000E-01 0.0 0.000E-01 0.0 210 C+2 1.447E-07 100.0 0.000E-01 0.0 0.000E-01 0.0 210 Mat/2 1.447E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 0.000E-01 0.0 0.000E-01 0.0 <t< th=""><th></th><th></th><th></th><th>PART 5</th><th>of OUI</th><th>PUT F</th><th>ILE</th><th></th><th></th><th></th><th></th><th></th></t<>				PART 5	of OUI	PUT F	ILE					
LIX NAME DISSOLVED SORRED PRECENT MOL/KG PERCENT 800 Sr+2 5.707E-07 100.0 0.000E-01 0.0 0.000E-01 0.0 950 Zn+2 3.066E-07 100.0 0.000E-01 0.0 0.000E-01 0.0 100 Ba+2 1.383E-06 100.0 0.000E-01 0.0 0.000E-01 0.0 100 Ca+2 1.297E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 110 Cr(H)2+2 3.147E-07 100.0 0.000E-01 0.0 0.000E-01 0.0 211 Cr(CH)2+2 3.147E-07 100.0 0.000E-01 0.0 0.000E-01 0.0 200 Fe+2 5.372E-07 100.0 0.000E-01 0.0 0.000E-01 0.0 0.000E-01 0.0 0.000E-01 0.0 500 Na+1 2.08ED-04 100.0 0.000E-01 0.0 0.000E-01 0.0 0.000E-01 0.0 0.000E-01 0.0			EQUILI	BRATED I	MASS D	ISTRIE	SUTION	1				
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	IDX	NAME	DISSO MOL/KG	LVED PERCENI	C MC	SOR DL/KG	BED PER	CENT	MC	PRE)L/E	ECIPITA KG PE	TED. RCENT
$ \begin{array}{c} \text{stu} \text{SF}^2 & \text{S} , \text{Other}^4 & 100.0 & 0,000E-01 & 0.0 & 0,000E-01 & 0.0 \\ \text{o} & 0,000E-01 & 0.0 & 0,00E-01 & 0.0 \\ \text{o} & 0,000E-01 & 0.0 & 0,00E-01 & 0.0 \\ \text{o} & 0,000E-01 & 0.0 & 0,00E-01 & 0.0 \\ \text{o} & 0,000E-01 & 0.0 & 0,00E-01 & 0.0 \\ \text{o} & 0,000E-01 & 0.0 & 0,00E-01 & 0.0 \\ \text{o} & 0,000E-01 & 0.0 & $	0.00	0	E 2025 05	100 -		0.07	1	0 0	0.0	0.0	- 01	0.0
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	800	Sr+2	5.707E-07	100.0	0.0	000E-0	1	0.0	0.0	HOOR	S-01	0.0
30 AL+3 4.816-05 100.0 0.000E-01 0.0 0.000E-01 0.0 0.000E-01 0.0 1000E-01 0.0 160 Ca+2 1.297E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 160 Ca+2 4.715E-09 100.0 0.000E-01 0.0 0.000E-01 0.0 0.000E-01 0.0 211 Cr(0H)2+ 2.790E-08 100.0 0.000E-01 0.0 0.000E-01 0.0 0.000E-01 0.0 211 Cr(0H)2+ 2.5372E-07 100.0 0.000E-01 0.0 0.000E-01	950	Zn+2	3.060E-07	100.0	0.0	000E-0	1	0.0	0.0	1001	5-01	0.0
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	100	AL+3 Ro+2	4.818E-06	100.0		00E-0	1	0.0	0.0	1001	2-01 2-01	0.0
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	150	Ba+Z	1.383E-06	100.0		00E-0	1	0.0	0.0	1001	5 - 01	0.0
$ \begin{array}{c} 100 \\ 101 $	160	Cd+2	1.2976-04	100.0		00E-0	1	0.0	0.0	000	z=01	0.0
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	211	Cr(OH)2+	2 790E-08	100.0		00E-0	1	0.0	0.0	000	2-01	0.0
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	231	$C_{11}+2$	3.147E-07	100.0		DOE-0	1	0.0	0.0	001	z = 01	0.0
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	280	Fe+2	5.372E-07	100.0	0.0	00E-0	1	0.0	0.0	OOF	-01	0.0
460 Mg+2 1.440E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 500 Na+1 2.089E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 600 Pb+2 1.874E-08 100.0 0.000E-01 0.0 0.000E-01 0.0 1 E-1 0.000E-01 0.0 0.000E-01 0.0 0.000E-01 0.0 140 CC3-2 2.144E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 2 H20 1.765E-05 100.0 0.000E-01 0.0 0.000E-01 0	410	K+1	6.647E-05	100.0	0.0	00E-0	1	0.0	0.0	000	E - 01	0.0
500 Na+1 2.088E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 600 Fb+2 1.786E-07 100.0 0.000E-01 0.0 0.000E-01 0.0 140 CO3-2 2.144E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 2 H2O 1.765E-05 100.0 0.000E-01 0.0 0.000E-01 0.0 10 MON-CARBONATE ALKALINITY = 2.409E-07 EQUILIBRIUM DH 7.932E-04 EQUILIBRIUM PH = 7.600 EQUILIBRIUM PH 7.932E-04 EQUILIBRIUM PH = 7.600 EQUILIBRIUM PH 2.0001 1.0001 10.000 140 0.0001 10.000	460	Mg+2	1.440E-04	100.0	0.0	00E-0	1	0.0	0.0	OOE	E-01	0.0
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	500	Na+1	2.088E-04	100.0	0.0	00E-0	1	0.0	0.0	OOF	E-01	0.0
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1 E-1 0.000E-01 0.0 0.000E-01 0.0 0.000E-01 0.0 330 H+1 2.067E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 2 H20 1.765E-05 100.0 0.000E-01 0.0 0.000E-01 0.0 2 H20 1.765E-05 100.0 0.000E-01 0.0 0.000E-01 0.0 2 H20 1.765E-05 100.0 0.000E-01 0.0 0.000E-01 0.0 Sum of CATIONS = 8.277E-04 Sum of ANIONS - CATIONS) / (ANIONS + CATIONS) NON-CARBONATE ALKALINTY = 2.492E-07 EQUILIBRIUM pH = 7.932E-04 EQUILIBRIUM PH = 7.600 EQUILIBRIUM PH = 7.932E-04 EQUILIBRIUM PH = 7.82.67 mv Statration indices and stoichiometry of all minerals ID # NAME Stoichiometry in [brackets] 2003000 ALOH3(A) -0.381 [1.000] 130 [2.000] 2 [2.000] 32 [2.000] 2 2046000 RRUCITE -1.991 [1.000] 1	600	Pb+2	1.786E-07	100.0	0.0	00E-0	1	0.0	0.0	OOE	E-01	0.0
140 C03-2 2.144E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 2 H20 1.765E-05 100.0 0.000E-01 0.0 0.000E-01 0.0 Charge Balance: SPECIATED Sum of CATIONS = 8.277E-04 Sum of ANIONS 2.061E-04 PERCENT DIFERENCE = 6.013E+01 (ANIONS - CATIONS)/(ANIONS + CATIONS) NON-CAREDNATE ALKALINITY = 2.409E-07 EQUILIBRIUM pH = 7.600 EQUILIBRIUM pH = 7.600 EQUILIBRIUM pH = 7.600 EQUILIBRIUM pH = 7.600 EQUILIBRIUM pH = 7.600 2003000 ALOH3(A) -0.381 [1.000] 30 [3.000] 2 [-3.000] 30 5015000 ARGONITE -2.148 [1.000] 150 [1.000] 140 5046000 ARTINITE -2.148 [1.000] 150 [1.000] 140 5046000 ARTINITE -2.148 [1.000] 150 [1.000] 140 2003001 BOEHMITE 1.405 [-3.000] 32 [2.000] 2 [-2.000] 330 5015001 ARGONITE -2.148 [1.000] 150 [1.000] 140 2003001 BOEHMITE 1.405 [-3.000] 330 [2.000] 2 [-2.000] 330 5015002 DIASPORE 3.160 [-3.000] 330 [1.000] 30 [2.000] 2 5015002 DIASPORE 3.160 [-3.000] 330 [1.000] 30 [2.000] 2 5015002 DIASPORE 3.160 [-3.000] 30 [3.000] 2 [-0.000] 330 5015001 ALCITE -5.459 [1.000] 460 [2.000] 2 [-0.000] 330 5015003 OLAZ3 -2.210 [2.000] 30 [3.000] 2 [-0.000] 330 5015003 HUNTITE -1.1.998 [3.000] 460 [1.000] 140 2003003 GIBESITE (C) 1.289 [-3.000] 30 [3.000] 2 [-0.000] 330 5046001 HYDRMAGNESIT -22.31 [5.000] 460 [1.000] 140 [3.000] 2 5046001 MARGNESIT -22.345 [1.000] 460 [1.000] 140 [3.000] 2 5046003 NESQUEHONITE -3.494 [1.000] 500 [1.000] 140 5020000 STDERITE -2.447 [1.000] 460 [1.000] 140 5020000 NATRON -12.343 [2.000] 500 [1.000] 140 502100 CU(O3) -4.924 [1.000] 280 [1.000] 140 502100 CU(O3) -4.924 [1.000] 200 [1.000] 140 502100 CU(O3) -4.924 [1.000] 300 [1.000] 140 5023100 CU(O3) -4.924 [1.000] 300 [1.000] 301 [2.000] 2 2095004 ZN(0H)2 (A) -3.868 [-2.000] 3	1	E-1	0.000E-01	0.0	0.0	00E-0	1	0.0	0.0	OOE	E-01	0.0
330 H+1 2.067E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 2 H2O 1.765E-05 100.0 0.000E-01 0.0 0.000E-01 0.0 Charge Balance: SPECIATED Sum of CATIONS = 6.277E-04 Sum of ANIONS 2.061E-04 PERCENT DIFFERENCE = 6.013E+01 (ANIONS - CATIONS) / (ANIONS + CATIONS) NON-CARBONATE ALKALINTY = 2.409E-07 EQUILIBRIUM IONIC STRENGTH (m) = 7.932E-04 EQUILIBRIUM pe = 13.409 or Eh = 782.67 mv Saturation indices and stoichiometry of all minerals Stoichiometry in [brackets] 2003000 ALOH3(A) -0.381 1.000] 30 [3.000] 2 [-3.000] 330 5015000 ARAGONITE -2.148 1.000] 460 [1.000] 140 2.0000] 2 2046000 ARINITE -1.400 [1.000] 150 [1.000] 10 [2.000] 2 2.000] 2 2.000] 30 [2.000] 2 2.000] 30 [2.000] 2 2.000] 30 [2.000] 2 2.000] 30 [2.000] 2 2.000] 30 [2.000] 30 [2.000] 30 [2.000] 30 [140	CO3-2	2.144E-04	100.0	0.0	00E-0	1	0.0	0.0	OOE	E-01	0.0
2 H2O 1.765E-05 100.0 0.000E-01 0.0 0.000E-01 0.0 Charge Balance: SPECIATED Sum of CATIONS = 8.277E-04 Sum of ANIONS _ CATIONS)/(ANIONS + CATIONS) NON-CARBONATE ALKALINITY = 2.409E-07 EQUILIBRIU TONIC STRENGTH (m) = 7.932E-04 EQUILIBRIUM pH = 7.600 EQUILIBRIUM pH = 7.600 EQUILIBRIUM pH = 7.600 Saturation indices and stoichiometry of all minerals ID # NAME Saturation indices and stoichiometry of all minerals Soloon ARAGONITE -2.148 [1.000] 30 [3.000] 2 [-3.000] 330 5015000 ARAGONITE -9.097 [-3.000] 330 [1.000] 30 [2.000] 2 2003001 BOEHMITE 1.405 [-3.000] 330 [1.000] 30 [2.000] 2 2003000 BOENTE -1.991 [1.000] 160 [2.000] 2 [-2.000] 330 5015001 CALCITE -5.859 [1.000] 460 [2.000] 2 [-6.000] 330 5015002 DLOMMITE -3.940 [1.000] 150 [1.000] 140 2003000 AL203 -2.210 [2.000] 30 [3.000] 2 [-6.000] 330 5046001 HYDRMAGNESIT -2.231 [5.000] 460 [1.000] 140 [3.000] 2 5046001 HYDRMAGNESIT -2.2417 [1.000] 460 [1.000] 140 [3.000] 2 5046002 MAGNESITE -2.447 [1.000] 460 [1.000] 140 [3.000] 2	330	H+1	2.067E-04	100.0	0.0	00E-0	1	0.0	0.0	OOE	E - 01	0.0
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EQUILIBRIUM pe = 13.489 or Eh = 782.67 mv PART 6 of OUTPUT FILE Saturation indices and stoichiometry of all minerals ID # NAME Sat. Index Stoichiometry in [brackets] 2003000 ALOH3(A) -0.381 [1.000] 30 [3.000] 2 [-3.000] 330 5015000 ARAGONITE -2.148 [1.000] 150 [1.000] 140 5046000 BRUCITE -9.097 -2.000] 330 [2.000] 2 [-2.000] 330 2003001 BOEHMITE 1.405 [-3.000] 330 [1.000] 30 [2.000] 2 [-2.000] 320 2046000 BRUCITE -5.859 [1.000] 460 [2.000] 12 [-2.000] 320 2015001 CALCITE -1.991 [1.000] 150 [1.000] 400 [2.000] 2 203003 GIBBSITE (C) 1.289 [-3.000] 330 [1.000] 30 [2.000] 2 5015001 ZDLOMTE -3.940 [1.000] 130 [3.000] 2 300300 AL203 -2.210 [2.000] 30 [3.000] 2 5046001 HYDRMAGNESIT -2.231 [5.000] 460 [4.000] 140 [-2.000] 330 5046002 MAGNESITE -2.447 [1.000] 460 [1.000] 140 [3.000] 2 5046003 NESQUEHONITE -4.850 [1.000] 460 [1.000] 140 50528000 SIDERITE -2.345 [1.000] 231 [1.000] 231 [2.000] 2 5040000 STRONTIANTRE -3.814 [Charge Balance Sum of CATIC PERCENT DIFF NON-CARBONATE EQUILIBRIUM IC EQUILIBRIUM pH	: SPECIATE NS = 8.27 ERENCE = ALKALINITY NIC STRENG	D 7E-04 Su 6.013E+ = TH (m) = =	um of A 01 (AN 2.4 7.9 7.6	NIONS O9E-0 32E-0	2. - CAT 7 4	061E- IONS)	04 /(ANI	ONS	5 + CAI	IONS)
PART 6 of OUTPUT FILE Saturation indices and stoichiometry of all minerals Saturation indices and stoichiometry of all minerals Stoichiometry in [brackets] Source indices and stoichiometry of all minerals Stoichiometry in [brackets]		EQUILIBRIUM pe		=	13.4	89	or Eh	=	782.	67	mv	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $				PART 6 0	f OUTP	UT FI	LE					
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2003000 ALOHS(A) -0.361 [1.000] 30 [3.000] 2 [-3.000] 330 5015000 ARAGNITE -2.148 [1.000] 150 [1.000] 140 5046000 ARTINITE -9.097 [-2.000] 330 [2.000] 460 [1.000] 140 2003001 BOEHMITE 1.405 [-3.000] 330 [1.000] 140 [2.000] 2 [-2.000] 330 2003002 DALCTE -5.859 [1.000] 150 [1.000] 140 [2.000] 2 [2.000] 2 2003002 DALSPORE 3.160 [-3.000] 330 [1.000] 30 [2.000] 2 [2.000] 2 2003003 GIBBSITE (C) 1.289 [-3.000] 330 [1.000] 460 [2.000] 2 2003000 AL203 -2.210 [2.000] 30 [3.000] 2 [-6.000] 330 5046001 HYDRMAGNESIT -22.231 [5.000] 460 [1.000] 140 [-2.000] 30 5046002 MAGNESITE -2.447 [1.000] 460 [1.000] 140 [-0.00] 2 5046003 NESQUEHONITE -4.850 [1.000] 260 [1.000] 140 [1.000] 2 50238000 STRONTIANITE -3.814 <td>2002</td> <td>D # NAME</td> <td>Sat. In</td> <td>ndex</td> <td>St 0001</td> <td>oichi</td> <td>ometr</td> <td>y in</td> <td>[brac</td> <td>ket</td> <td>[S]</td> <td>1 220</td>	2002	D # NAME	Sat. In	ndex	St 0001	oichi	ometr	y in	[brac	ket	[S]	1 220
5046000 ARAGONTIE -9.097 [-2.000] 1300 [1.000] 140 2003001 BOEHMITE 1.405 [-3.000] 330 [1.000] 30 [2.000] 2 2046000 BRUCITE -5.859 [1.000] 460 [2.000] 2 [-2.000] 30 2046000 DRUCITE -1.991 [1.000] 460 [2.000] 2 [-2.000] 30 2045002 DLASPORE 3.160 [-3.000] 30 [1.000] 460 [2.000] 2 5015002 DOLOMITE -3.940 [1.000] 100 [1.000] 30 [2.000] 2 3003000 Al203 -2.210 [2.000] 30 [3.000] 2 [-6.000] 330 5015003 HUNTITE -11.998 [3.000] 460 [1.000] 140 [-2.000] 330 5046002 MAGNESIT -2.2231 [5.000] 500 [1.000] 140 [-2.000] 300 5046003 NESQUEHONITE -4.455 [1.000] 260 [1.000] 140 <td>2003</td> <td>OOO ALOHS (A)</td> <td>-0.38</td> <td></td> <td>1.000]</td> <td>150</td> <td></td> <td>.000]</td> <td>140</td> <td>L</td> <td>-3.000</td> <td>] 330</td>	2003	OOO ALOHS (A)	-0.38		1.000]	150		.000]	140	L	-3.000] 330
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$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2003	003 GIBBSITE (C) 1.289	9 [-	3.000]	330	[1	.000]	30	[3.000] 2
5015003 HUNTITE -11.998 [3.000] 460 [1.000] 150 [4.000] 140 5046001 HYDRMAGNESIT -22.231 [5.000] 460 [4.000] 140 [-2.000] 330 5046002 MAGNESITE -2.447 [1.000] 460 [1.000] 140 [-2.000] 330 5046003 NESQUEHONITE -12.343 [2.000] 500 [1.000] 140 [3.000] 2 5046003 NESQUEHONITE -4.850 [1.000] 460 [1.000] 140 [3.000] 2 5028000 SIDERITE -2.345 [1.000] 280 [1.000] 140 [3.000] 2 5050001 THERMONATR -14.044 [2.000] 500 [1.000] 140 [1.000] 2 5010000 WITHERITE -3.814 [1.000] 231 [1.000] 231 [2.000] 2 5023100 CUC03 -4.924 [1.000] 330 [1.000] 231 [1.000] 231 2023101 TENORITE -0.702 [-2.000] 330 [1.000] 231 [1.000] 2 95000 SMITHSONITE -3.171 [1.000] 950 [2.000] 140 5095001 ZNCO3, 1H20 -2.849 [1.000] 950 [1.000] 950 [2.000] 2 2095001 ZN (OH)2 (A) -3.868 [-2.000] 330 [1.000] 950 [2.000] 2	3003	000 A1203	-2.210] 0	2.000]	30	[3	.000]	2	[-6.000] 330
5046001 HYDRMAGNESIT -22.231 [5.000] 460 [4.000] 140 [-2.000] 330 5046002 MAGNESITE -2.447 [1.000] 460 [1.000] 140 [10.000] 2 5046003 NESQUEHONITE -2.447 [1.000] 460 [1.000] 140 [10.000] 2 5046003 NESQUEHONITE -4.850 [1.000] 460 [1.000] 140 [3.000] 2 5028000 SIDERITE -2.345 [1.000] 280 [1.000] 140 [3.000] 2 5050001 THERMONATR -14.044 [2.000] 500 [1.000] 140 [1.000] 2 5010000 WITHERITE -3.814 [1.000] 100 [1.000] 140 [1.000] 2 5023100 CUC03 -4.924 [1.000] 231 [1.000] 231 [2.000] 2 2023101 TENORITE -0.702 [-2.000] 330 [1.000] 231 [1.000] 2 95000 ZN METAL -59.878 [1.000] 950 [1.000] 140 [1.000] 2 2095001 ZNCO3, 1H20 -2.849 [1.000] 950 [1.000] 140 [1.000] 2 2095001 ZN (0H)2 (A) -3.868 [-2.000] 330 [1.000] 950 [2.000] 2 2095001 ZN (0H)2 (C) -3.618 [-2.000] 330 [1.000] 950 [2.000] 2 </td <td>5015</td> <td>003 HUNTITE</td> <td>-11.998</td> <td>B [</td> <td>3.000]</td> <td>460</td> <td>[1</td> <td>.000]</td> <td>150</td> <td>[</td> <td>4.000</td> <td>] 140</td>	5015	003 HUNTITE	-11.998	B [3.000]	460	[1	.000]	150	[4.000] 140
5046002 MAGNESITE -2.447 [1.000] 460 [1.000] 140 3050000 NATRON -12.343 [2.000] 500 [1.000] 140 [10.000] 2 5046003 NESQUEHONITE -4.850 [1.000] 460 [1.000] 140 [3.000] 2 5028000 SIDERITE -2.345 [1.000] 280 [1.000] 140 [3.000] 2 5080000 STRONTIANITE -3.549 [1.000] 800 [1.000] 140 [1.000] 2 5010000 WITHERITE -3.814 [1.000] 100 [1.000] 140 [1.000] 2 5010000 WITHERITE -3.814 [1.000] 231 [1.000] 240 5023100 CUC03 -4.924 [1.000] 231 [1.000] 231 [1.000] 2 2023101 TENORITE -0.702 [-2.000] 330 [1.000] 231 [1.000] 2 95000 ZN METAL -59.878 [1.000] 950 [2.000] 1 5095001 ZNCO3, 1H20 -2.849 [1.000] 950 [1.000] 140 [1.000] 2 2095000 ZN (OH)2 (A) -3.868 [-2.000] 330 [1.000] 950 [2.000] 2 2095001 ZN (OH)2 (B) -3.168 [-2.000] 330 [1.000] 950 [2.000] 2 2095002 ZN (OH)2 (B) -3.168 [5046	OUL HYDRMAGNES	11 -22.23.	L L	5.000]	460	[4	.000]	140	L	-2.000] 330
3050000 NATRON -12.343 [2.000] 500 [1.000] 140 [10.000] 2 5046003 NESQUEHONITE -4.850 [1.000] 460 [1.000] 140 [3.000] 2 5028000 SIDERITE -2.345 [1.000] 280 [1.000] 140 [3.000] 2 5080000 STRONTIANITE -3.549 [1.000] 800 [1.000] 140 [1.000] 2 5010000 WITHERITE -3.814 [1.000] 100 [1.000] 140 [1.000] 2 5023100 CUC03 -4.924 [1.000] 231 [1.000] 231 [2.000] 2 2023101 TENORITE -0.702 [-2.000] 330 [1.000] 231 [1.000] 2 95000 ZN METAL -59.878 [1.000] 950 [2.000] 140 2 2095001 ZNCO3, 1H20 -2.849 [1.000] 950 [1.000] 140 2 2095000 ZN (OH) 2 (A) -3.868 [-2.000] 330 [1.000] 140 2 2095001 ZN (OH) 2 (B) -3.168 [-2.000] 330 [1.000] 950 [2.000] 2 2095002 ZN (OH) 2 (B) -3.168 [-2.000] 330 [1.000] 950 [2.000] 2	5016	002 MACNEGITE	-2 11	7 r	1 0001	160	r 1	0001	140			
5030000 NATRON 12.343 [1.000] 300 1400 [10.000] 2 5046003 NESQUEHONITE -4.850 [1.000] 460 [1.000] 140 [3.000] 2 5028000 SIDERITE -2.345 [1.000] 280 [1.000] 140 [3.000] 2 505000 STRONTIANITE -3.549 [1.000] 800 [1.000] 140 [1.000] 2 5010000 WITHERITE -3.814 [1.000] 100 [1.000] 140 [1.000] 2 5023100 CUC03 -4.924 [1.000] 231 [1.000] 231 [2.000] 2 2023101 CU(0H)2 -1.722 [-2.000] 330 [1.000] 231 [1.000] 2 95000 ZN METAL -59.878 [1.000] 950 [2.000] 140 5095001 ZNC03, 1H20 -2.849 [1.000] 950 [1.000] 140 5095000 ZN (OH)2 (A) -3.868 [-2.000] 330 [1.000] 140 [1.000] 2 2095000 ZN (OH)2 (B) -3.168 [-2.000] 330 [1.000] 950 [2.000] 2 2095001 ZN (OH)2 (B) -3.168 [-2.000] 330 [1.000] 950 [2.000] 2 2095003	3050	1000 NATRON	-12 34		2 0001	500		.0001	140	Г	10 000	1 2
5028000 SIDERITE -2.345 [1.000] 280 [1.000] 140 5028000 STRONTIANITE -3.549 [1.000] 800 [1.000] 140 5050001 THERMONATR -14.044 [2.000] 500 [1.000] 140 5023100 WITHERITE -3.814 [1.000] 231 [1.000] 140 5023100 CUC03 -4.924 [1.000] 231 [1.000] 231 [2.000] 2 2023101 TENORITE -0.702 [-2.000] 330 [1.000] 231 [1.000] 2 95000 ZN METAL -59.878 [1.000] 950 [2.000] 140 5095001 ZNCO3, 1H20 -2.849 [1.000] 950 [1.000] 140 5095000 ZN (OH)2 (A) -3.868 [-2.000] 330 [1.000] 140 2095000 ZN (OH)2 (A) -3.868 [-2.000] 330 [1.000] 231 [1.000] 2 2095001 ZNCO3, 1H20 -2.849 [1.000] 950 [1.000] 140 2 2095001 ZN(OH)2 (B) -3.168 [-2.000] 330 [1.000] 950 [2.000] 2 2095002 ZN (OH)2 (B) -3.168 [-2.000] 330 [1.000] 950 [2.000] 2 2095003 ZN (OH)2 (G) -3.128 [-2.000] 330 [1.000] 950 [2.000] 2 2	5046	003 NESOUEHONT	TE -4 850		1 0001	460	[1	.0001	140	r	3 000	1 2
5080000 STRONTIANITE -3.549 [1.000] 1.000] 140 508000 STRONTIANITE -14.044 [2.000] 500 [1.000] 140 5010000 WITHERITE -3.814 [1.000] 100 [1.000] 140 5023100 CUC03 -4.924 [1.000] 231 [1.000] 240 2023100 CU(0H)2 -1.722 [-2.000] 330 [1.000] 231 [2.000] 2 2023101 TENORITE -0.702 [-2.000] 330 [1.000] 231 [1.000] 2 95000 ZN METAL -59.878 [1.000] 950 [2.000] 1 5095001 ZNCO3, 1H2O -2.849 [1.000] 950 [1.000] 140 5095001 ZN(OH)2 (A) -3.868 [-2.000] 330 [1.000] 950 [2.000] 2 2095000 ZN (OH)2 (B) -3.168 [-2.000] 330 [1.000] 950 [2.000] 2 2095002 ZN (OH)2 (B) -3.168 [-2.000] <	5028	000 SIDERITE	-2.34	5 [1.0001	280	[1	.0001	140	L	5.000] 2
5050001 THERMONATR -14.044 [2.000] 500 [1.000] 140 [1.000] 2 501000 WITHERITE -3.814 [1.000] 100 [1.000] 140 2000] 2000] 140 2023100 CU(0H)2 -1.722 [-2.000] 330 [1.000] 231 [2.000] 2 2023101 TENORITE -0.702 [-2.000] 330 [1.000] 231 [1.000] 2 95000 ZN METAL -59.878 [1.000] 950 [2.000] 1 5095001 ZNCO3, 1H20 -2.849 [1.000] 950 [1.000] 950 [2.000] 2 2095001 ZN(0H)2 (A) -3.868 [-2.000] 330 [1.000] 950 [2.000] 2 2095001 ZN(0H)2 (C) -3.618 [-2.000] 330 [1.000] 950 [2.000] 2 2095002 ZN(0H)2 (B) -3.168 [-2.000] 330 [1.000] 950 [2.000] 2 2095003 ZN(0H)2 (B)<	5080	000 STRONTIANT	TE -3.54	9 [1.0001	800	r 1	.0001	140			
5010000 WITHERITE -3.814 [1.000] 100 [1.000] 140 5023100 CUC03 -4.924 [1.000] 231 [1.000] 140 2023100 CU(0H)2 -1.722 [-2.000] 330 [1.000] 231 [2.000] 2 2023101 TENORITE -0.702 [-2.000] 330 [1.000] 231 [1.000] 2 95000 ZN METAL -59.878 [1.000] 950 [2.000] 1 5095001 ZNC03, 1H20 -2.849 [1.000] 950 [1.000] 950 [1.000] 140 5095001 ZNC03, 1H20 -2.849 [1.000] 950 [1.000] 950 [2.000] 2 2095000 ZN (OH)2 (A) -3.868 [-2.000] 330 [1.000] 950 [2.000] 2 2095001 ZN (OH)2 (B) -3.1618 [-2.000] 330 [1.000] 950 [2.000] 2 2095002 ZN (OH)2 (B) -3.168 [-2.000] 330 [1.000] 950 [2.000] 2 2095003 ZN (OH)2 (G) -3.128 [-2.000] 330 [1.000] 950 [2.000] 2 2095004 ZN (OH)2 (E) -2.918 [-2.000] 330 [1.000] 950 [2.000] 2	5050	001 THERMONATR	-14.04	4 [2.0001	500	[1	.0001	140	٢	1.000	1 2
5023100 CUC03 -4.924 [1.000] 231 [1.000] 140 2023100 CU(0H)2 -1.722 [-2.000] 330 [1.000] 231 [2.000] 2 2023101 TENORITE -0.702 [-2.000] 330 [1.000] 231 [1.000] 2 2 95000 ZN METAL -59.878 [1.000] 950 [2.000] 1 2 5095000 SMITHSONITE -3.171 [1.000] 950 [1.000] 140 1.000] 2 2095001 ZNCO3, 1H20 -2.849 [1.000] 950 [1.000] 950 [2.000] 2 2095000 ZN (OH)2 (A) -3.868 [-2.000] 330 [1.000] 950 [2.000] 2 2095001 ZN (OH)2 (C) -3.618 [-2.000] 330 [1.000] 950 [2.000] 2 2095002 ZN (OH)2 (B) -3.168 [-2.000] 330 [1.000] 950 [2.000] 2 2095003 ZN (OH)2 (G) -3.128 [-2.000] 330 [1.000] 950 [2.000] 2 2095004 ZN (OH)2 (G) -3.128 [-2.000] 330 [1.000] 950 [2.000] 2 2095004 ZN (OH)2 (E) +2.918 [-2.000] 330 [1.000] 950 [2.000] 2	5010	000 WITHERITE	-3.81	4 Γ	1.0001	100	[1	.0001	140	L.		1 2
2023100 CU(OH)2 -1.722 [-2.000] 330 [1.000] 231 [2.000] 2 2023101 TENORITE -0.702 [-2.000] 330 [1.000] 231 [1.000] 2 95000 ZN METAL -59.878 [1.000] 950 [2.000] 1 5095000 SMITHSONITE -3.171 [1.000] 950 [1.000] 140 5095000 ZN (OH)2 (A) -2.849 [1.000] 950 [1.000] 950 [2.000] 2 2095000 ZN (OH)2 (A) -3.868 [-2.000] 330 [1.000] 950 [2.000] 2 2095001 ZN (OH)2 (C) -3.618 [-2.000] 330 [1.000] 950 [2.000] 2 2095002 ZN (OH)2 (B) -3.168 [-2.000] 330 [1.000] 950 [2.000] 2 2095003 ZN (OH)2 (G) -3.128 [-2.000] 330 [1.000] 950 [2.000] 2 2095004 ZN (OH)2 (G) -3.128 [-2.000] 330 [1.000] 950 [2.000] 2 2095004 ZN (OH)2 (E) +2.918 [-2.000] 330 [1.000] 950 [2.000] 2	5023	100 CUCO3	-4.92	4 [1.000]	231	[1	.000]	140			
2023101 TENORITE -0.702 [-2.000] 330 [1.000] 231 [1.000] 2 95000 ZN METAL -59.878 [1.000] 950 [2.000] 1 5095000 SMITHSONITE -3.171 [1.000] 950 [1.000] 140 5095001 ZNCO3, 1H20 -2.849 [1.000] 950 [1.000] 950 [2.000] 2 2095000 ZN (OH)2 (A) -3.868 [-2.000] 330 [1.000] 950 [2.000] 2 2095001 ZN (OH)2 (C) -3.618 [-2.000] 330 [1.000] 950 [2.000] 2 2095002 ZN (OH)2 (B) -3.168 [-2.000] 330 [1.000] 950 [2.000] 2 2095003 ZN (OH)2 (G) -3.128 [-2.000] 330 [1.000] 950 [2.000] 2 2095004 ZN (OH)2 (G) -3.128 [-2.000] 330 [1.000] 950 [2.000] 2 2095004 ZN (OH)2 (E) +2.918 [-2.000] 330 [1.000] 950 [2.000] 2	2023	100 CU(OH)2	-1.722	2 [-	2.000]	330	[1	.000]	231	[2.000] 2
95000 ZN METAL -59.878 [1.000] 950 [2.000] 1 5095000 SMITHSONITE -3.171 [1.000] 950 [1.000] 140 5095001 ZNCO3, 1H20 -2.849 [1.000] 950 [1.000] 140 [1.000] 2 2095000 ZN (OH)2 (A) -3.868 [-2.000] 330 [1.000] 950 [2.000] 2 2095001 ZN (OH)2 (C) -3.618 [-2.000] 330 [1.000] 950 [2.000] 2 2095002 ZN (OH)2 (B) -3.168 [-2.000] 330 [1.000] 950 [2.000] 2 2095003 ZN (OH)2 (G) -3.128 [-2.000] 330 [1.000] 950 [2.000] 2 2095004 ZN (OH)2 (E) +2.918 [-2.000] 330 [1.000] 950 [2.000] 2	2023	101 TENORITE	-0.702	2 [-	2.000]	330	[1	.000]	231	I	1.000] 2
5095000 SMITHSONITE -3.171 [1.000] 950 [1.000] 140 5095001 ZNCO3, 1H20 -2.849 [1.000] 950 [1.000] 140 [1.000] 2 2095000 ZN(OH)2 (A) -3.868 [-2.000] 330 [1.000] 950 [2.000] 2 2095001 ZN(OH)2 (C) -3.618 [-2.000] 330 [1.000] 950 [2.000] 2 2095002 ZN(OH)2 (B) -3.168 [-2.000] 330 [1.000] 950 [2.000] 2 2095003 ZN(OH)2 (G) -3.128 [-2.000] 330 [1.000] 950 [2.000] 2 2095004 ZN(OH)2 (E) +2.918 [-2.000] 330 [1.000] 950 [2.000] 2	95	000 ZN METAL	-59.878	З [1.000]	950	[2	.000]	1			
5095001 ZNCO3, 1H20 -2.849 [1.000] 950 [1.000] 140 [1.000] 2 2095000 ZN(OH)2 (A) -3.868 [-2.000] 330 [1.000] 950 [2.000] 2 2095001 ZN(OH)2 (C) -3.618 [-2.000] 330 [1.000] 950 [2.000] 2 2095002 ZN(OH)2 (B) -3.168 [-2.000] 330 [1.000] 950 [2.000] 2 2095003 ZN(OH)2 (G) -3.128 [-2.000] 330 [1.000] 950 [2.000] 2 2095004 ZN(OH)2 (E) +2.918 [-2.000] 330 [1.000] 950 [2.000] 2	5095	000 SMITHSONIT	E -3.171	L [1.000]	950	[1	.000]	140			
2095000 ZN (OH) 2 (A) -3.868 [-2.000] 330 [1.000] 950 [2.000] 2 2095001 ZN (OH) 2 (C) -3.618 [-2.000] 330 [1.000] 950 [2.000] 2 2095002 ZN (OH) 2 (B) -3.168 [-2.000] 330 [1.000] 950 [2.000] 2 2095003 ZN (OH) 2 (G) -3.128 [-2.000] 330 [1.000] 950 [2.000] 2 2095004 ZN (OH) 2 (E) +2.918 [-2.000] 330 [1.000] 950 [2.000] 2	5095	001 ZNCO3, 1H2	0 -2.849	9 [1.000]	950	[1	.000]	140	[1.000] 2
2095001 ZN(0H)2 (C) -3.618 [-2.000] 330 [1.000] 950 [2.000] 2 2095002 ZN(0H)2 (B) -3.168 [-2.000] 330 [1.000] 950 [2.000] 2 2095003 ZN(0H)2 (G) -3.128 [-2.000] 330 [1.000] 950 [2.000] 2 2095004 ZN(0H)2 (E) +2.918 [-2.000] 330 [1.000] 950 [2.000] 2	2095	000 ZN(OH)2 (A) -3.868	3 [-	2.000]	330	[1	.000]	950	[2.000] 2
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2095	OUL ZN(OH)2 (C) -3.618	5 [-	2.000]	330	[1	.000]	950	[2.000] 2
205003 ZN(0H)2 (G) -3.128 [-2.000] 330 [1.000] 950 [2.000] $22095004 ZN(0H)2$ (E) -2.918 [-2.000] 330 [1.000] 950 [2.000] 2	2095	002 ZN (OH) Z (B) -3.168		2.000]	330		.000]	950	L	2.000	1 2
	2095	004 ZN(OH)2 (G) -2.918	, L- 3 [-	2.0001	330	[1	.0001	950	Ľ	2.000	1 2

2095005 2095006	ZNO(ACTIVE) ZINCITE	-2.728 -2.871	[-2.000] [-2.000]	330 330	[1.000]	950 950	[1.000] 1.000]	2
16000 16001	CD METAL GAMMA CD	-49.144 -49.246	[1.000] [1.000]	160 160	[2.000] 2.000]	1 1			
5016000	OTAVITE	-1.178	[1.000]	160]	1.000]	140			
2016000	CD(OH)2 (A)	-7.246	[-2.000]	330	[1.000]	160	[2.000]	2
2016001	CD(OH)2 (C)	-6.870	[-2.000]	330	Ε	1.000]	160	[2.000]	2
2016002	MONTEPONITE	-8.693	[-2.000]	330	[1.000]	160	[1.000]	2
60000	PB METAL	-38.876	[1.000]	600	[2.000]	1			
5060000	CERRUSITE	-0.926	[1.000]	600	E	1.000]	140			
2060000	MASSICOT	-5.585	[-2.000]	330	E	1.000]	600	[1.000]	2
2060001	LITHARGE	-5.389	[-2.000]	330	Ε	1.000]	600]	1.000]	2
2060002	PBO, .3H2O	-5.415	[-2.000]	330	[1.000]	600	[1.330]	2
5060001	PB2OCO3	-6.224	[-2.000]	330]	2.000]	600	[1.000]	2
			[1.000]	140						
5060002	PB302C03	-10.392	[-4.000]	330]	3.000]	600	[1.000]	140
			[2.000]	2						
2060003	PLATTNERITE	-0.568	[-4.000]	330	[-2.000]	1	[1.000]	600
			[2.000]	2						
3060000	PB203	-3.733	[-6.000]	330	I	-2.000]	1	[2.000]	600
			[3.000]	2						
3060001	MINIUM	-10.285	[-8.000]	330	[-2.000]	1	[3.000]	600
			[4.000]	2						
2060004	PB(OH)2 (C)	-0.785	[-2.000]	330	[1.000]	600	[2.000]	2
5060003	HYDCERRUSITE	-3.225	[-2.000]	330	[3.000]	600	[2.000]	140
			[2.000]	2						
2060005	PB20 (OH) 2	-11.070	[-4.000]	330	[2.000]	600	[3.000]	2
5054000	NICO3	-8.071	[1.000]	540	[1.000]	140			
2054000	NI (OH) 2	-3.444	[-2.000]	330	[1.000]	540	[2.000]	2
2054001	BUNSENITE	-5.871	[-2.000]	330	[1.000]	540	[1.000]	2
5023101	MALACHITE	-2.462	[2.000]	231	[2.000]	2	[1.000]	140
			[-2.000]	330						
5023102	AZURITE	-5.393	[3.000]	231	[2.000]	2	[2.000]	140
			[-2.000]	330						
2015000	LIME	-22.201	[-2.000]	330	[1.000]	150	[1.000]	2
2015001	PORTLANDITE	-11.856	[-2.000]	330	[1.000]	150]	2.000]	2
2028000	WUSTITE	-2.835	[-2.000]	330	[0.947]	280	[1.000]	2
2046001	PERICLASE	-10.724	[-2.000]	330	[1.000]	460	[1.000]	2
3028001	HERCYNITE	1.361	[-8.000]	330	[1.000]	280	[2.000]	30
			[4.000]	2						
3046000	SPINEL	-5.533	[-8.000]	330	[1.000]	460	[2.000]	30
			[4.000]	2						
3021100	FECR204	8.306	[2.000]	211	E	1.000]	280	E	-4.000]	330
3021101	MGCR204	-2.459	[2.000]	211	I	1.000]	460	[-4.000]	330
3021102	CR203	2.108	[2.000]	211	[-2.000]	330	[-1.000]	2
2021102	CR(OH)3 (A)	0.194	[1.000]	211	[1.000]	2	[-1.000]	330
2021101	CR(OH)3 (C)	-2.358	[1.000]	211	[1.000]	2	[-1.000]	330

		PART	1 of OUTPU	T FILE						
Revuè river water-Site 14 - Run 2										
Entered	CO3 ²⁻ , P _{co2} , P _{o2} ,	fixed pH, S	olids allow	ed to prec	ipitate					
Temperature (Celsius): 19.30 Units of concentration: MG/L Ionic strength to be computed. If specified, carbonate concentration represents total inorganic carbon. Do not automatically terminate if charge imbalance exceeds 30% Precipitation is allowed for all solids in the thermodynamic database and the print option for solids is set to: 1 The maximum number of iterations is: 200 The method used to compute activity coefficients is: Davies equation Intermediate output file										
INPUT DA ID 330 100 150 160 211 231 280 410 460 500 540 600 800 950 1 140 2	INPUT DATA BEFORE TYPE MODIFICATIONS ID NAME ACTIVITY GUESS LOG GUESS ANAL TOTAL 330 H+1 2.512E-08 -7.600 0.000E-01 30 Al+3 4.786E-06 -5.320 1.300E-01 100 Ba+2 1.380E-06 -5.860 1.900E-01 150 Ca+2 1.288E-04 -3.890 5.200E+00 160 Cd+2 4.677E-09 -8.330 5.300E-04 211 Cr(OH)2+ 2.818E-08 -7.550 2.400E-03 231 Cu+2 3.162E-07 -6.570 2.000E-02 280 Fe+2 5.370E-07 -6.270 3.000E-02 410 K+1 6.607E-05 -4.180 2.599E+00 460 Mg+2 1.445E-04 -3.680 4.800E+00 500 Na+1 2.089E-04 -3.680 4.800E+00 540 Ni+2 1.862E-08 -7.730 1.100E-03 600 Pb+2 1.778E-07 -6.240 5.000E-02									
Cha S' P'	rge Balance: UN um of CATIONS= ERCENT DIFFEREN	SPECIATED 8.438E-04 CE = 3.180	Sum of ANIO E+01 (ANIO	NS = 4.366 NS - CATION	5E-04 NS)/(ANIONS -	+ CATIONS)				
Type I ID 330 100 150 160 211 231 280 410 460 500 540 600 800 950 140	- COMPONENTS AS NAME H+1 Al+3 Ba+2 Ca+2 Cd+2 Cd+2 Cd+2 Cr(OH)2+ Cu+2 Fe+2 K+1 Mg+2 Na+1 Ni+2 Pb+2 Sr+2 Zn+2 CO3-2	PART SPECIES IN CALC MOL 2.593E-08 3.537E-16 1.383E-06 1.295E-04 4.319E-09 5.132E-13 9.795E-09 5.194E-07 6.647E-05 1.436E-04 2.088E-04 5.972E-09 2.632E-08 5.707E-07 2.734E-07 3.669E-07	3 of OUTPU SOLUTION ACTIVITY 2.512E-08 2.660E-16 1.219E-06 1.141E-04 3.805E-09 4.972E-13 8.629E-09 4.576E-07 6.440E-05 1.265E-04 2.023E-04 5.262E-09 2.319E-08 5.028E-07 2.409E-07 3.232E-07	T FILE LOG ACTVTY -7.60000 -15.57513 -5.91406 -3.94277 -8.41967 -12.30346 -8.06402 -6.33953 -4.19114 -3.89776 -3.69408 -8.27888 -7.63479 -6.29865 -6.61818 -6.49048	GAMMA GA	NEW LOGK 0.014 0.124 0.055 0.055 0.055 0.014 0.055 0.014 0.055 0.014 0.055 0.014 0.055 0.015 0.055 0.055 0.055				
Type II ID 2113302 2113303 2113304 3300020	- OTHER SPECIE NAME Cr(OH)3 AQ Cr(OH)4- CrO2- OH-	S IN SOLUTI CALC MOL 1.467E-12 5.758E-16 1.461E-15 2.661E-07	ON OR ADSOR ACTIVITY 1.467E-12 5.579E-16 1.416E-15 2.578E-07	BED LOG ACTVTY -11.83347 -15.25347 -14.84906 -6.58865	GAMMA 1.00018 0.96882 0.96882 0.96882	NEW LOGK -7.130 -18.136 -17.732 -14.175				

4603300	MgOH +	5.152E-09	4.991E-09	-8.30180	0.96882	-11.990
4601400	MgCO3 AQ	3.576E-08	3.577E-08	-7.44653	1.00018	2.942
4601401	MgHCO3 +	2.887E-07	2.797E-07	-6.55335	0.96882	11.449
1503300	CaOH +	7.334E-10	7.105E-10	-9.14842	0.96882	-12.792
1501400	CaHCO3 +	2.013E-07	1.951E-07	-6.70985	0.96882	11.337
1501401	CaCO3 AQ	4.656E-08	4.657E-08	-7.33189	1.00018	3.101
5001400	NaCO3 -	9.330E-10	9.039E-10	-9.04386	0.96882	1.154
5001401	NaHCO3 AQ	1.974E-08	1.974E-08	-7.70456	1.00018	10.080
303300	ALOH +2	8.316E-14	7.326E-14	-13.13512	0.88100	-5.105
303301	AI (OH) 2 +	3.456E-11	3.349E-11	-10.47514	0.96882	-10.086
303302	AI (OH) 4 -	1.619E-09	1.568E-09	-8.80458	0.96882	-23.616
303303	AI (UH) 3 AU	1.6/8E-09	1.0/8E-09	-8.77515	1.00018	-16.000
2003300	Feor +	1 100E 15	J. 066E 15	-0.42809	0.90002	-9.0/5
2803301	FeoH2 AO	7 626F-13	7 629F-13	-14.97240 -12.11761	1 00019	-20 070
8003300	SrOH +	8 512F-13	8 247E-13	-12.11/01	0. 96882	-20.970
1003300	BaOH +	1.337F - 12	1.295F - 12	-11 88771	0.96882	-13 560
2311400	CUCO3 AO	1.498E-08	1 498E-08	-7 82450	1 00018	6 730
2311401	$C_{11}(C_{03})_{2-2}$	6 919E-12	6.096E - 12	-11 21497	0 88100	9 885
2313300	CuOH +	3.546E-09	3.435E-09	-8 46403	0.96882	-7.986
2313301	Cu(OH) 2 AO	2.857E-07	2.857E-07	-6.54403	1.00018	-13,680
2313302	Cu(OH)3 -	7.091E-13	6.870E-13	-12.16304	0.96882	-26.885
2313303	Cu(OH) 4 -2	6.180E-18	5.444E-18	-17.26404	0.88100	-39.545
2313304	Cu2(OH)2+2	3.295E-12	2.903E-12	-11.53712	0.88100	-10.554
2311402	CuHCO3 +	7.232E-10	7.007E-10	-9.15450	0.96882	13.014
9503300	ZnOH +	6.985E-09	6.767E-09	-8.16960	0.96882	-9.138
9503301	Zn(OH)2 AQ	4.817E-09	4.817E-09	-8.31719	1.00018	-16.899
9503302	Zn(OH)3 -	6.260E-13	6.065E-13	-12.21719	0.96882	-28.385
9503303	Zn(OH)4 -2	4.343E-18	3.826E-18	-17.41720	0.88100	-41.144
9501400	ZnHCO3 +	5.071E-09	4.913E-09	-8.30865	0.96882	12.414
9501401	ZnCO3 AQ	1.553E-08	1.554E-08	-7.80865	1.00018	5.300
9501402	Zn (CO3) 2-2	1.219E-10	1.074E-10	-9.96913	0.88100	9.685
1601400	Cd (CO3) 3-4	3.540E-22	2.133E-22	-21.67110	0.60242	6.440
1603300	CdOH +	8.452E-12	8.188E-12	-11.08682	0.96882	-10.253
1603301	Cd(OH)2 AQ	2.693E-14	2.694E-14	-13.56968	1.00018	-20.350
1603302	Cd (OH) 3 -	1.242E-19	1.203E-19	-18.91969	0.96882	-33.286
1603303	Cd (OH) 4 -2	4.845E-26	4.269E-26	-25.36969	0.88100	-47.295
1603304	Cd20H +3	2.182E-19	1.640E-19	-18.78504	0.75196	-9.422
1601400	CdHCO3 +	8.010E-11	7.760E-11	-10.11015	0.96882	12.414
1601401	CaCO3 AQ	3.082E-10	3.082E-10	-9.51115	1.00018	5.399
6001400	PD (CO3) 2-2	1.200E-10	1.057E-10	-9.9/5/4	0.88100	10.695
6003300	PDOH +	1.858E-08	1.800E-08	-7.74479	0.96882	-7.696
6003301	PD(OH)Z AQ	2.707E-10 1 215E 12	2.707E-10	-9.55460	1.00010	-17.120
6003303	Pb204 +3	1.313E - 13 1.242E - 14	9 3/2E-15	-11 02958	0.75196	-20.040
6003304	Pb3(04) 4+2	1 959F-17	1.726F - 17	-16 76296	0.88100	-24 204
6001401	Pbc03 A0	1.302E = 07	1.302E = 07	-6.88526	1 00018	7 240
6003305	Pb(OH)4 = 2	1.302E - 17	1.165E - 17	-16 93381	0 88100	-39 644
6001402	PbHCO3 +	3.080E-09	2.984E-09	-8 52526	0.96882	13,214
5403300	NiOH +	1.984E-11	1.922E-11	-10.71632	0.96882	-10.024
5403301	Ni(OH)2 AO	8.337E-13	8.339E-13	-12.07889	1.00018	-19.000
5403302	Ni(OH)3 -	3.427E-16	3.320E-16	-15.47890	0.96882	-29,986
5401400	NiHCO3 +	1.301E-10	1.261E-10	-9.89936	0.96882	12.484
5401401	NiCO3 AQ	1.261E-08	1.261E-08	-7.89936	1.00018	6.870
5401402	Ni (CO3) 2-2	8.039E-12	7.082E-12	-11.14984	0.88100	10.165
3301400	HCO3 -	2.027E-04	1.964E-04	-3.70680	0.96882	10.397
3301401	H2CO3 AQ	1.053E-05	1.053E-05	-4.97738	1.00018	16.713
2113300	Cr+3	3.373E-18	2.537E-18	-17.59574	0.75196	10.032
2113301	Cr(OH)+2	5.910E-15	5.206E-15	-14.28346	0.88100	5.675
TUDO TT	T - SPECIES	WITH FIYED ACT	TUTTY			

TAbe IT	I - PLECIEP	WITH LIVED MOITA	T T T		
ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2	H20	-6.648E-06	-5.177	0.000	0.000
3300021	02 (g)	0.000E-01	0.000	-84.354	133.830
330	H+1	-2.167E-04	-3.664	7.600	0.000
3301403	CO2 (g)	3.880E-06	-5.411	21.690	-0.530

Type	e IV - FINITE D NAME	SOLIDS (pres CALC N	sent at e 10L	quilibrium) LOG MOL 1	NEW LOGK	DH	
3021	100 FECR204	1.395H	E-08	-7.855	0.546	24.860	
2003	002 DIASPORE	4.8151	E-06	-5.317	-7.225	24.630	
			PART 5 0	f OUTPUT FI	LE		
		EQUILI	BRATED MA	ASS DISTRIBU	TION		
IDX	NAME	DISSOI	VED	SORBI	ED	PRECIP	ITATED
		MOL/KG	PERCENT	MOL/KG	PERCENT	MOL/KG	PERCENT
950	Zn+2	3.060E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
600	Pb+2	1.786E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
100	Ba+2	1.383E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	1.297E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
160	Cd+2	4.715E-09	100.0	0.000E-01	0.0	0.000E-01	0.0
211	Cr(OH)2+	1.988E-12	0.0	0.000E-01	0.0	2.790E-08	100.0
231	Cu+2	3.147E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
800	Sr+2	5.707E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	6.647E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	1.440E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	2.088E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
540	Ni+2	1.874E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
30	Al+3	3.331E-09	0.1	0.000E-01	0.0	4.815E-06	99.9
1	E-1	0.000E-01	0.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	2.144E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
280	Fe+2	5.232E-07	97.4	0.000E-01	0.0	1.395E-08	2.6
2	H2O	8.982E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	2.235E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
	Charge Baland Sum of CATJ PERCENT DIE EQUILIBRIUM J EQUILIBRIUM F EQUILIBRIUM F	Ce: SPECIATEI IONS = 8.277 FFERENCE = IONIC STRENGT DH De) 7E-04 Sum 6.049E+0 CH (m) = = =	of ANIONS 1 (ANIONS - 7.920E-04 7.600 13.489 or	2.038E- CATIONS) r Eh =	04 /(ANIONS +) 782.67 mv	CATIONS)

		PART	1 of OUTPU	JT FILE						
Revuè ri	ver water-Site	14 - Run 3								
Enter CO	Enter CO_3^{2-} , P _{co2} , P _{o2} , fixed pH, solids allowed to precipitate									
Fo rodov	nair Mn redox	nair	200 022010	a oo proo	apaodoo					
LE LEGON	pair, mi icuox	Parr								
		10.00								
Tempera	ture (Celsius):	19.30								
Units o	f concentration	: MG/L								
Ionic s	trength to be c	omputed.								
If spec	ified, carbonat	e concentra	tion repres	sents tota	al inorganic	carbon.				
Do not	automatically t	erminate if	charge imb	palance ex	ceeds 30%					
Precipi	tation is allow	ed for all	solids in t	he thermo	dynamic data	abase and				
then	rint option for	solide is	sot to: 1							
The may	imum number of	itorationa	ic. 200							
The max	Indu number or	Iterations	15. 200		D					
The met	nod used to com	pute activi	ty coeffici	lents is:	Davies equa	LION				
Interme	diate output fi	le								
INPUT DA	TA BEFORE TYPE	MODIFICATIO	NS							
ID	NAME	ACTIVITY G	UESS LOC	GUESS	ANAL TOTAL					
330	H+1	2 512	E-08	-7 600	0 000E - 01					
30	71+2	1 706	E 06	-5 220	1 2005-01					
100	AITS	4.700	E-00	-5.520	1.3006-01					
100	Ba+2	1.380	E-06	-5.860	1.900E-01					
150	Ca+2	1.288	E - 04	-3.890	5.200E+00					
160	Cd+2	4.677	E-09	-8.330	5.300E-04					
211	Cr(OH)2+	2.818	E-08	-7.550	2.400E-03					
231	Cu+2	3.162	E - 07	-6.500	2.000E-02					
280	Fe+2	5.370	E - 07	-6.270	3.000E-02					
410	K+1	6 607	E-05	-4 180	2599E+00					
160	Ma+2	1 115	E = 0.0	-3 840	3 5005+00					
400	Ng+2	1.445	E-04	-3.040	J. DOOE+00					
500	Na+1	2.089	E-04	-3.680	4.800E+00					
540	N1+2	1.862	E - 08	-7.730	1.100E-03					
600	Pb+2	1.778	E - 07	-6.750	3.700E-02					
800	Sr+2	5.754	E - 07	-6.240	5.000E-02					
950	Zn+2	3.090	E-07	-6.510	2.000E-02					
1	E-1	1.000	E-16	-16.000	0.000E - 01					
140	CO3-2	1 905	E-06	-5 720	1 310E + 01					
201	E013	1 770	E-21	-20 750	0.000 E - 01					
201	re+5	1.770	E-21	-20.750	0.000E-01					
2	H20	1.000.	E+00	0.000	0.000E-01					
Cha	rge Balance: UN	SPECIATED								
S	um of CATIONS=	8.438E-04	Sum of ANIC	NS = 4.3	366E-04					
P	ERCENT DIFFEREN	CE = 3.180	E+01 (ANIC	DNS - CAT	IONS) / (ANIONS	S + CATIONS)				
		PART	3 of OUTPI	TT FTLE						
TIMO	- COMPONENTS AS	CDECTEC IN	COLUTION		1					
Type T	- COMPONENTS AS	SPECIES IN	DOLUTION		70037 0738887	NEL TOCK				
ID	NAME	CALC MOL	ACTIVITY	LOG ACT	VII GAMMA	NEW LOGK				
330	H+1	2.593E-08	2.512E-08	-7.600	0.9688	4 0.014				
30	A1+3	3.537E-16	2.660E-16	-15.575	513 0.75209	9 0.124				
100	Ba+2	1.383E-06	1.219E-06	-5.914	402 0.8810	0.055				
150	Ca+2	1.295E-04	1.141E-04	-3.942	273 0.8810	7 0.055				
160	Cd+2	4.319E-09	3.805E-09	-8.419	964 0.8810	7 0.055				
211	Cr(0H) 2+	6 361F-10	6 162F-10	-9 210	0.0010	0.014				
211	CI (OI) 2+	0.3016-10	0.1026-10	-9.210	0.9000					
231	Cu+2	9.794E-09	8.629E-09	-8.064	102 0.8810	0.055				
280	Fe+2	1.438E-25	1.267E-25	-24.89	0.8810	0.055				
410	K+1	6.647E-05	6.440E-05	-4.191	0.96884	4 0.014				
460	Mg+2	1.436E-04	1.266E-04	-3.89	773 0.8810	7 0.055				
500	Na+1	2.088E-04	2.023E-04	-3.694	107 0.96884	4 0.014				
540	Ni+2	5.972E-09	5.262E-09	-8 275	387 0 8810	7 0 055				
600	Pb+2	2 6325-09	2 3105-00	_7 63	178 0 8810	7 0.055				
000	Cr12	5 7075 07	5 0200 07	6.000		7 0.055				
000	DITZ Relo	J. 70/E-07	J. UZOE-07	-0.298		0.035				
950	211+2	2.134E-07	2.409E-07	-6.618	0.8810	0.055				
281	re+3	3.468E-25	2.608E-25	-24.583	0.7520	9 0.124				
140	C03-2	3.669E-07	3.232E-07	-6.490	0.8810	0.055				

Type II	- OTHER SPE	CIES IN SOLUTI	ON OR ADSON	RBED		
ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
2113302	Cr(OH) 3 AQ	1.818E-09	1.819E-09	-8.74025	1.00018	-7.130
2113303	Cr(OH)4-	7.137E-13	6.914E-13	-12.16026	0.96884	-18.136
2113304	Cr02-	1.811E-12	1.755E-12	-11.75585	0.96884	-17.732
3300020	OH-	2.661E-07	2.578E-07	-6.58865	0.96884	-14.175
4603300	MgOH +	5.152E-09	4.992E-09	-8.30177	0.96884	-11.990
4601400	MgCO3 AQ	3.576E-08	3.577E-08	-7.44649	1.00018	2.942
4601401	MGHCU3 +	2.88/E-0/	Z. 197E-07	-0.33331	0.96884	12.449
1501400	CaHCO3 +	2.013E-07	1.951E-07	-6 70981	0.90004	11 337
1501401	CaCO3 AO	4.657E-08	4.657E-08	-7 33185	1,00018	3 101
5001400	NaCO3 -	9.330E-10	9.040E-10	-9.04385	0.96884	1.154
5001401	NaHCO3 AO	1.974E-08	1.974E-08	-7.70455	1.00018	10.080
303300	AlOH +2	8.315E-14	7.326E-14	-13.13512	0.88107	-5.105
303301	Al(OH)2 +	3.456E-11	3.349E-11	-10.47514	0.96884	-10.086
303302	Al(OH)4 -	1.619E-09	1.568E-09	-8.80458	0.96884	-23.616
303303	Al(OH)3 AQ	1.678E-09	1.678E-09	-8.77515	1.00018	-16.000
2803300	FeOH +	1.066E-27	1.033E-27	-26.98589	0.96884	-9.675
2803301	FeOH3 -1	3.045E-34	2.950E-34	-33.53021	0.96884	-31.419
2803302	FeOH2 AQ	2.111E-31	2.111E-31	-30.67541	1.00018	-20.978
2813300	FeOH +2	5.405E-20	4.762E-20	-19.32223	0.88107	-2.284
2813301	FeOH2 +	9.122E-16	8.83/E-16	-15.05368	0.96884	-5.656
2813302	FEORS AV	4.133E-16	4.133E-16 1 6/6E-16	-15.38369 -15.79370	1.00018	-13.600
2813304	Fe2(OH)2+4	1.090E-10 1.288E-37	7 759F - 38	-37 11020	0.90004	-2 923
2813305	Fe3(OH)4+5	3.079E-50	1.395E-50	-49 85531	0 45322	-6 161
8003300	SrOH +	8.513E-13	8.247E-13	-12.08369	0.96884	-13.371
1003300	BaOH +	1.337E-12	1.295E-12	-11.88767	0.96884	-13.560
2311400	CuCO3 AQ	1.498E-08	1.498E-08	-7.82449	1.00018	6.730
2311401	Cu(CO3)2-2	6.919E-12	6.096E-12	-11.21497	0.88107	9.885
2313300	CuOH +	3.546E-09	3.435E-09	-8.46402	0.96884	-7.986
2313301	Cu(OH)2 AQ	2.857E-07	2.857E-07	-6.54403	1.00018	-13.680
2313302	Cu(OH)3 -	7.091E-13	6.870E-13	-12.16304	0.96884	-26.885
2313303	Cu(OH) 4 -2	6.179E-18	5.444E-18	-17.26404	0.88107	-39.545
2313304	Cu2(OH)Z+Z	3.295E-12	2.903E-12	-11.53/11	0.88107	-10.554
2511402	ZnOH +	6 985E-10	6.769E-09	-9.15450	0.96884	13.014
9503301	Zn (OH) 2 AO	4 817E-09	4 818E-09	-8 31716	1 00018	-16 899
9503302	Zn (OH) 3 -	6.260E-13	6.065E - 13	-12,21717	0.96884	-28.385
9503303	Zn (OH) 4 -2	4.343E-18	3.827E-18	-17.41717	0.88107	-41.144
9501400	ZnHCO3 +	5.071E-09	4.913E-09	-8.30862	0.96884	12.414
9501401	ZnCO3 AQ	1.553E-08	1.554E-08	-7.80862	1.00018	5.300
9501402	Zn(CO3)2-2	1.219E-10	1.074E-10	-9.96910	0.88107	9.685
1601400	Cd(CO3)3-4	3.539E-22	2.133E-22	-21.67107	0.60261	6.440
1603300	CdOH +	8.452E-12	8.189E-12	-11.08679	0.96884	-10.253
1603301	Cd(OH)2 AQ	2.693E-14	2.694E-14	-13.56965	1.00018	-20.350
1603302	Cd(OH)3 - Cd(OH)4 - 2	1.242E-19	1.203E-19	-18.91966	0.96884	-33.286
1603304	Cd(OH) 4 - 2	4.845E-20 2 191E-10	4.209E-20 1 641E-19	-23.36966	0.88107	-47.295
1601400	CdHCO3 +	8 010E-11	7.760E - 11	-10 11012	0.96884	12 414
1601401	CdCO3 AO	3.082E-10	3.082E - 10	-9.51111	1,00018	5.399
6001400	Pb(CO3)2-2	1.200E-10	1.057E-10	-9.97574	0.88107	10.695
6003300	PbOH +	1.858E-08	1.800E-08	-7.74479	0.96884	-7.696
6003301	Pb(OH)2 AQ	2.787E-10	2.787E-10	-9.55479	1,00018	-17.120
6003302	Pb(OH)3 -	1.315E-13	1.274E-13	-12.89480	0.96884	-28.046
6003303	Pb2OH +3	1.242E-14	9.342E-15	-14.02957	0.75209	-6.236
6003304	Pb3(OH)4+2	1.959E-17	1.726E-17	-16.76294	0.88107	-24.204
6001401	PbCO3 AQ	1.302E-07	1.302E-07	-6.88526	1.00018	7.240
6003305	Pb(OH) 4 -2	1.322E-17	1.165E-17	-16.93381	0.88107	-39.644
6001402	PDHC03 +	3.080E-09	2.984E-09	-8.52526	0.96884	13.214
5403300	NICH +	1.904E-11 0.320E-12	1.922E-11	-10./1631	0.96884	-10.024
5403301	Ni(OH) 3 -	0.330E-13 3 A27E-16	3 3208-13	-15 17000	T.00018	-19.000
5401400	NiHCO3 +	1.301E-10	1.261E - 10	-9 89935	0.96884	12 484
5401401	NiCO3 AO	1.261E-08	1.261E-08	-7.89935	1.00018	6.870
5401402	Ni(CO3)2-2	8.038E-12	7.082E-12	-11.14983	0.88107	10.165

3301400 HCO3 - 3301401 H2CO3 AQ 2113300 Cr+3 2113301 Cr(OH)+2		2.027E 1.053E 4.180E 7.324E	2.027E-04 1.964E 1.053E-05 1.053E 4.180E-15 3.144E 7.324E-12 6.453E		-3. -4. -14. -11.	70680 97738 50252 19024	0.96884 1.00018 0.75209 0.88107	10.397 16.713 10.031 5.675	
Typ	e II. D 2	H20	ES WITH FIXED CALC M -7.166E	CALC MOL -7.166E-06		NE	W LOGK	DH 0.000	
2802	330	re+2/re+. H+1	3 -5.3/2E -2 157F	-07	-6.270		7 600	-10.000	
3301	403	CO2 (q)	3.885E	-06	-5.411	2	1.690	-0.530	
3300	021	O2 (g)	-1.343E	-07	-6.872	- 8	34.354	133.830	
Тур	e IV	- FINITE	SOLIDS (prese	ent at e	quilibriu				
I	D	NAME	CALC MO	DL	LOG MOL	NE	W LOGK	DH	
3028	100	HEMATITE	2.686E-	-07	-6.571		3.567	30.845	
2003 3021	102	CR203	4.815E- 1.272E-	-06	-5.317	-	3.220	24.630	
			1	PART 5 0	f OUTPUT	FILE	2		
			EQUILIB	RATED MA	ASS DISTR	IBUT	ION		
IDX NAME DIS		DISSOL	/ED	SC	ORBEI)	PRECIPI	TATED	
			MOL/KG 1	PERCENT	MOL/KO	G E	PERCENT	MOL/KG	PERCENT
800 600	Sr+2 Pb+2		5.707E-07 1.786E-07	100.0	0.000E- 0.000E-	-01 -01	0.0	0.000E-01 0.000E-01	0.0
100	Ba+2	2	1.383E-06	100.0	0.000E-	-01	0.0	0.000E-01	0.0
150	Ca+2	2	1.297E-04	100.0	0.000E-	-01	0.0	0.000E-01	0.0
160	Cd+2		4.715E-09	100.0	0.000E-	-01	0.0	0.000E-01	0.0
540	N1+2	2	1.874E-08	100.0	0.000E-	-01	0.0	0.000E-01	0.0
231	Cu+2		3.14/E-07	100.0	0.000E-	-01	0.0	0.000E-01	0.0
410	K+1		6.647E-05	100.0	0.000E-	-01	0.0	0.000E-01	0.0
460	Ma+2		1.440E-04	100.0	0.000E-	-01	0.0	0.000E - 01	0.0
500	Na+1		2.088E-04	100.0	0.000E-	-01	0.0	0.000E-01	0.0
211	Cr (C	DH) 2+	2.464E-09	8.8	0.000E-	-01	0.0	2.544E-08	91.2
280	Fe+2	2	1.448E-25	100.0	0.000E-	-01	0.0	0.000E-01	0.0
30	A1+3	3	3.331E-09	0.1	0.000E-	-01	0.0	4.815E-06	99.9
140	C03-	-2	2.144E-04	100.0	0.000E-	-01	0.0	0.000E-01	0.0
1	E-1		0.000E-01	0.0	0.000E-	-01	0.0	0.000E-01	0.0
281	Fe+:	3	1.495E-15	0.0	0.000E-	-01	0.0	5.372E-07	100.0
330	H+1 H20		2.235E-04 8.961E-07	100.0	0.000E-	-01	0.0	0.000E-01	0.0
	Char Su PE EQUI	rge Balanc m of CATI RCENT DIE LIBRIUM I	ce: SPECIATED CONS = 8.2668 FFERENCE = 6 CONIC STRENGTS	C-04 Sum 5.045E+0 1 (m) =	of ANION 1 (ANIONS 7.910E-	15 3 - C -04	2.037E- ATIONS)	04 /(ANIONS + (CATIONS)
	EQUI	LIBRIUM P	рН	=	7.600				
	EQUI	LIBRIUM P	De	=	13.489	or	Eh =	782.67 mv	

0.051

0.000

0.88980

1.00000

PART 1 of OUTPUT FILE Revuè river water-Site 14 - Run 4 Entered CO3²⁻, P_{CO2}, P₀₂, fixed pH, Fe redox pair, Mn redox pair, solids allowed to precipitate Adsorption Temperature (Celsius): 19.30 Units of concentration: MG/L Ionic strength to be computed. If specified, carbonate concentration represents total inorganic carbon. Do not automatically terminate if charge imbalance exceeds 30% Precipitation is allowed for all solids in the thermodynamic database and the print option for solids is set to: 1 The maximum number of iterations is: 200 The method used to compute activity coefficients is: Davies equation Intermediate output file Adsorption model: Diffuse Layer Number of adsorbing surfaces: 1 INPUT DATA BEFORE TYPE MODIFICATIONS ANAL TOTAL ID NAME ACTIVITY GUESS LOG GUESS -7.600 0.000E-01 330 H+1 2.512E-08 30 Al+3 100 Ba+2 4.786E-06 -5.320 1.300E-01 1.380E-06 -5.860 1.900E-01 150 Ca+2 1.288E-04 -3.890 5.200E+00 160 Cd+2 4.677E-09 -8.330 5.300E-04 2.818E-08 211 Cr(OH)2+ -7.550 2.400E-03 231 Cu+2 3.162E-07 -6.500 2.000E-02 280 Fe+2 5.370E-07 -6.270 3.000E-02 2.599E+00 410 K+1 6.607E-05 -4.180 3.500E+00 460 Mg+2 1.445E-04 -3.840 500 2.089E-04 Na+1 -3.680 4.800E+00 1.862E-08 540 Ni+2 -7.730 1.100E-03 1.778E-07 -6.750 600 Pb+2 3.700E-02 800 Sr+2 5.754E-07 -6.240 5.000E-02 3.090E-07 950 2n+2-6.510 2.000E-02 1 E-1 1.000E-16 -16.000 0.000E-01 140 CO3-2 1.905E-06 -5.720 1.310E+01 0.000E-01 281 Fe+3 1.778E-21 -20.750 813 ADS1PSIO 811 ADS1TYP1 0.000 1.000E+00 0.000E-01 1.905E-04 1.922E-04 812 ADS1TYP2 7.762E-03 -2.110 7.690E-03 1.000E+00 0.000 2 H2O 0.000E-01 Charge Balance: UNSPECIATED Sum of CATIONS= 8.438E-04 Sum of ANIONS = 4.366E-04 PERCENT DIFFERENCE = 3.180E+01 (ANIONS - CATIONS)/(ANIONS + CATIONS) PART 3 of OUTPUT FILE Type I - COMPONENTS AS SPECIES IN SOLUTION NAME CALC MOL ACTIVITY LOG ACTVTY GAMMA NEW LOGK ID 330 H+1 30 Al+3 2.586E-082.512E-08-7.600000.971233.459E-162.660E-16-15.575130.768984.101E-073.649E-07-6.437870.88980 0.013 0.114 0.051 100 Ba+2 150 Ca+2 6.986E-05 6.216E-05 -4.20649 0.88980 0.051 160 Cd+2 1.546E-12 1.376E-12 -11.86154 0.88980 0.051 6.345E-10 6.162E-10 3.061E-13 2.724E-13 Cr(OH)2+ 211 -9.21025 0.97123 0.013 0.88980 0.051 231 Cu+2 -12.56487 1.424E-25 1.267E-25 0.051 280 Fe+2 -24.89733 0.88980 410 K+1 6.647E-05 6.456E-05 -4.19006 0.97123 0.013 1.436E-04 1.278E-04 2.088E-04 2.028E-04 -3.89344 -3.69300 0.051 0.013 460 Mg+2 0.88980 500 Na+1 0.97123 1.065E-11 9.481E-12 0.88980 540 Ni+2 -11.02315 0.051 -14.55275 600 Pb+2 3.147E-15 2.801E-15 0.88980 0.051 0.88980

-6.29432 -10.60397

-3.97864

 800
 Sr+2
 5.707E-07
 5.078E-07

 950
 Zn+2
 2.797E-11
 2.489E-11

 811
 ADS1TYP1
 1.050E-04
 1.050E-04

140	CO3-2	3.633E-07	3.232E-07	-6.49048	0.88980	0.051
281	Fe+3	3.392E-25	2.608E-25	-24.58367	0.76898	0.114
812	ADS1TYP2	5.897E-03	5.897E-03	-2.22936	1.00000	0.000
muno TT	OTUED ODECT	TN COLUMN	ON OR ADROP	DED		
Type II	- OTHER SPECT	CALC MOL	DON OR ADSOR	LOC ACTVTY	CAMMA	NEW LOCK
0121000	-CO2Rat	4.757E - 10	A = 757E = 10	_9 32262	1 00000	-7 200
2112202	-302Da+	1 0105-00	1 0105-00	-9.52202	1.00015	-7.130
2113302	$Cr(OH) \Lambda -$	7 110E - 13	6.91/F - 13	-12 16026	0 97123	-18 137
2113303	Cr(Or) -	1 8065-12	1.755E - 12	-11 75585	0.97123	-17 733
2300020	04-	2 6555-07	2578F - 07	-6 58865	0 97123	-14 176
4603300	MaOH +	5 190E-09	5 041E-09	-8 29749	0 97123	-11 991
4601400	MgCO3 AO	3.612E - 08	3 612E-08	-7 44221	1 00015	2 942
4601401	MaHCO3 +	2 908E-07	2 825E-07	-6 54903	0 97123	11 448
1503300	CaOH +	3.986E-10	3.871E-10	-9.41214	0.97123	-12,793
1501400	CaHCO3 +	1.094E - 07	1.063E - 07	-6.97357	0.97123	11.336
1501401	CaCO3 AO	2.537E-08	2.537E-08	-7.59561	1.00015	3.101
5001400	NaCO3 -	9.330E-10	9.062E-10	-9.04278	0.97123	1.153
5001401	NaHCO3 AO	1.979E-08	1.979E-08	-7.70348	1.00015	10.080
303300	AlOH +2	8.233E-14	7.326E-14	-13.13512	0.88980	-5.109
303301	Al(OH)2 +	3.448E-11	3.349E-11	-10.47514	0.97123	-10.087
303302	Al (OH) 4 -	1.615E-09	1.568E-09	-8.80458	0.97123	-23.617
303303	Al(OH)3 AQ	1.678E-09	1.678E-09	-8.77515	1.00015	-16.000
2803300	FeOH +	1.064E-27	1.033E-27	-26.98589	0.97123	-9.676
2803301	FeOH3 -1	3.037E-34	2.950E-34	-33.53021	0.97123	-31.420
2803302	FeOH2 AQ	2.111E-31	2.111E-31	-30.67542	1.00015	-20.978
2813300	FeOH +2	5.351E-20	4.762E-20	-19.32223	0.88980	-2.288
2813301	FeOH2 +	9.099E-16	8.837E-16	-15.05368	0.97123	-5.657
2813302	FeOH3 AQ	4.133E-16	4.133E-16	-15.38369	1.00015	-13.600
2813303	FeOH4 -	1.694E-16	1.646E-16	-15.78369	0.97123	-21.587
2813304	Fe2(OH)2+4	1.238E-37	7.759E-38	-37.11021	0.62687	-2.940
2813305	Fe3(OH)4+5	2.895E-50	1.395E-50	-49.85531	0.48205	-6.187
8003300	SrOH +	8.576E-13	8.329E-13	-12.07940	0.97123	-13.372
1003300	BaOH +	3.992E-13	3.877E-13	-12.41152	0.97123	-13.561
2311400	CuCO3 AQ	4.727E-13	4.728E-13	-12.32534	1.00015	6.730
2311401	Cu (CO3) 2-2	2.162E-16	1.924E-16	-15.71582	0.88980	9.881
2313300	CUOH +	1.116E-13	1.084E-13	-12.96487	0.97123	-7.987
2313301	Cu(OH) Z AQ	9.01/E-12	9.018E-12	-11.04488	1.00015	-13.680
2313302	Cu(OH) 3 =	2.232E-17	2.108E-17	-10.00389	0.97123	-20.880
2313303	$Cu(On)_4 = 2$	3 2505-21	2 0025-21	-20 53881	0.88980	-10 559
2313304	Cu2(OR)2+2	2 277E-14	2.092E-21 2.211E-14	-20.55001	0.00900	13 013
9503300	ZDON +	7 199F-13	6.002F - 13	-12 15539	0.97123	-9 139
9503300	Zn(OH) 2 AO	4 977E - 13	4978E-13	-12 30298	1 00015	-16 899
9503302	Zn(OH) = Zn(OH) = -	6.452E - 17	6.266E-17	-16 20299	0 97123	-28 386
9503303	Zn(OH) 4 -2	4.443E-22	3 954E-22	-21,40300	0.88980	-41.148
9501400	ZnHCO3 +	5.227E-13	5.076E-13	-12,29445	0.97123	12.413
9501401	ZnCO3 AO	1.605E-12	1.605E-12	-11.79445	1.00015	5.300
9501402	Zn(CO3)2-2	1.247E-14	1.109E-14	-13.95493	0.88980	9.681
1601400	Cd(CO3)3-4	1.230E-25	7.710E-26	-25.11297	0.62687	6.423
1603300	CdOH +	3.048E-15	2.960E-15	-14.52869	0.97123	-10.254
1603301	Cd(OH)2 AO	9.736E-18	9.738E-18	-17.01155	1.00015	-20.350
1603302	Cd(OH)3 -	4.478E-23	4.350E-23	-22.36156	0.97123	-33.287
1603303	Cd(OH)4 -2	1.734E-29	1.543E-29	-28.81156	0.88980	-47.299
1603304	Cd20H +3	2.788E-26	2.144E-26	-25.66878	0.76898	-9.432
1601400	CdHCO3 +	2.888E-14	2.805E-14	-13.55202	0.97123	12.413
1601401	CdCO3 AQ	1.114E-13	1.114E-13	-12.95301	1.00015	5.399
6001400	Pb(CO3)2-2	1.435E-17	1.277E-17	-16.89370	0.88980	10.691
6003300	PbOH +	2.238E-15	2.174E-15	-14.66276	0.97123	-7.697
6003301	Pb(OH)2 AQ	3.366E-17	3.367E-17	-16.47276	1.00015	-17.120
6003302	Pb(OH)3 -	1.585E-20	1.539E-20	-19.81277	0.97123	-28.047
6003303	Pb20H +3	1.772E-28	1.363E-28	-27.86551	0.76898	-6.246
6003304	Pb3(OH)4+2	3.419E-38	3.042E-38	-37.51685	0.88980	-24.208
6001401	PbCO3 AQ	1.573E-14	1.573E-14	-13.80323	1.00015	7.240
6003305	Pb(OH)4 -2	1.581E-24	1.407E-24	-23.85178	0.88980	-39.648
6001402	PbHCO3 +	3.711E-16	3.604E-16	-15.44323	0.97123	13.213
5403300	NiOH +	3.565E-14	3.463E-14	-13.46059	0.97123	-10.025
5403301	Ni(OH)2 AQ	1.502E-15	1.503E-15	-14.82317	1.00015	-19.000

5403302 5401400 5401401 5401402 3301400 2113300 2113301 8123301 8123302 8113302 8113302 8129500 8129500 8121600 8122310 8122310 8122400 8125400 8116000	Ni (OH) 3 - NiHCO3 + NiCO3 AQ Ni (CO3) 2-2 HCO3 - H2CO3 AQ Cr+3 Cr (OH) +2 =SO2- =SO2H2+ =SO1- =SO1H2+ =SO1Zn+ =SO1Zn+ =SO1Zn+ =SO1Cd+ =SO1Cd+ =SO1Cu+ =SO1Cu+ =SO1Ni+ =SO2Ni+ =SO1Pb+	6.159E-19 2.339E-13 2.271E-11 1.434E-14 2.022E-04 1.053E-05 4.089E-15 7.252E-12 9.297E-04 8.569E-04 1.526E-05 1.526E-05 1.774E-08 2.882E-07 1.206E-10 4.593E-09 2.392E-07 7.552E-08 1.661E-08 2.088E-09 1.782E-07	5.9 2.2 2.2 1.2 1.9 1.0 3.1 6.4 9.2 8.5 1.6 4.5 1.5 1.5 1.5 2.8 1.2 4.5 2.3 7.5 1.6 2.0 1.7	82E 772E 64E 53E 53E 697E 698 698 698 606 606 60 60 60 60 60 60 60 60 60 60 6	-19 -13 -11 -04 -05 -15 -12 -04 -05 -04 -05 -05 -08 -07 -08 -07 -08 -09 -07 -08 -09 -07		8.22317 2.64363 3.64363 3.89411 3.70680 4.97738 4.50252 1.19024 3.03166 3.06706 4.78094 4.81634 7.75104 6.54032 9.91860 8.33789 6.62122 7.12193 7.77950 8.68022 6.74910	0.97123 0.97123 1.00015 0.88980 0.97123 1.00015 0.76898 0.88980 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000	-29.987 12.483 6.870 10.161 10.396 16.713 10.022 5.671 -8.930 7.290 -1.990 0.970 -2.900 0.430 2.850 0.600 0.150 -2.500 4.710
8126000	=SO2Pb+	3.892E-10	3.8	92E-	-10	- 9	9.40981	1.00000	0.300
8121500	=SO2Ca+	6.116E-06	6.1	16E-	-06	- 1	0.21355	1.00000	-5.850
8111000	=SOIHCa++	5.364E-05 9 729E-07	9.7	04E-	-05	- 4	6 01191	1.00000	4.970
Type III ID 330 3301403 3300021 2802810 Type IV ID 3028100 2003002 3021102	I - SPECIES W NAME H2O H+1 CO2 (g) O2 (g) Fe+2/Fe+3 - FINITE SOI NAME HEMATITE DIASPORE CR2O3	VITH FIXED AC CALC MOL -6.580E-06 -1.363E-04 4.681E-06 -1.343E-07 -5.372E-07 -5.372E-07 CIDS (present CALC MOL 2.686E-07 4.815E-06 1.272E-08	at eq	LOC -5 -6 -6 -6 -6 -6 -6 -6 -6 -7	G MOL .182 .866 .330 .872 .270 .270 .105riu G MOL .571 .317 .895	1 um) P	NEW LOGK 0.000 7.600 21.690 -84.354 13.175 	DH 0.000 -0.530 133.830 -10.000 DH 30.845 24.630 12.125	
		030	m 4 -	5 01	Implim	DTT			
	PERC	CENTAGE DISTR	IBUTIO	DN (OF COM	IPON	JE VENTS AMO	NG	
	TYPE I	and TYPE II	(disso	olve	ed and	ad	dsorbed)	species	
ADC1 TVD2									
RUSITIEZ	76.7 12.1 11.1	PERCENT PERCENT PERCENT	BOUND BOUND BOUND	IN IN IN	SPECI SPECI SPECI	ES ES	# 812 #8123301 #8123302	ADS1TYP2 =S02- =S02H2+	
Ba+2	29.6 70.3	PERCENT PERCENT	BOUND BOUND	IN IN	SPECI SPECI	ES	# 100 #8111000	Ba+2 =SO1HBa++	
Ca+2	53.8 4.7 41.3	PERCENT PERCENT PERCENT	BOUND BOUND BOUND	IN IN IN	SPECI SPECI SPECI	ES	# 150 #8121500 #8111500	Ca+2 =S02Ca+ =S01HCa++	
Cd+2	2.6	PERCENT	BOUND	IN	SPECI	ES	#8121600 #8111600	=S02Cd+	
Zn+2									
Cu+2	5.8 94.2	PERCENT PERCENT	BOUND BOUND	IN IN	SPECI SPECI	ES	#8129500 #8119500	=SO2Zn+ =SO1Zn+	
	76.0 24.0	PERCENT PERCENT	BOUND BOUND	IN IN	SPECI SPECI	ES	#8112310 #8122310	=S01Cu+ =S02Cu+	
ADSTIANT									
	54.7	PERCENT	BOUND	IN	SPECI	ES	# 811	ADS1TYP1	

	8.6	PERCENT	BOUND	IN	SPECIES	#8113301	=S01-
	7.9	PERCENT	BOUND	IN	SPECIES	#8113302	=S01H2+
	27.9	PERCENT	BOUND	IN	SPECIES	#8111500	=SO1HCa++
K+1							
	100.0	PERCENT	BOUND	IN	SPECIES	# 410	K+1
Mg+2							
	99.8	PERCENT	BOUND	IN	SPECIES	# 460	Mg+2
Na+1							
	100.0	PERCENT	BOUND	IN	SPECIES	# 500	Na+1
Ni+2							to the second second
	88.7	PERCENT	BOUND	IN	SPECIES	#8115400	=SO1Ni+
	11.1	PERCENT	BOUND	IN	SPECIES	#8125400	=SO2Ni+
Pb+2							
	99.8	PERCENT	BOUND	IN	SPECIES	#8116000	=SO1Pb+
Sr+2						100 M	24
	100.0	PERCENT	BOUND	IN	SPECIES	# 800	Sr+2
Cr(OH)2+							
	25.8	PERCENT	BOUND	IN	SPECIES	# 211	Cr(OH)2+
	73.8	PERCENT	BOUND	IN	SPECIES	#2113302	Cr(OH)3 AQ
A1+3							
	1.0	PERCENT	BOUND	IN	SPECIES	# 303301	A1(OH)2 +
	48.5	PERCENT	BOUND	IN	SPECIES	# 303302	Al(OH)4 -
	50.4	PERCENT	BOUND	IN	SPECIES	# 303303	Al(OH)3 AQ
CO3-2							
	94.7	PERCENT	BOUND	IN	SPECIES	#3301400	HCO3 -
	4.9	PERCENT	BOUND	IN	SPECIES	#3301401	H2CO3 AQ
Fe+2							
	99.3	PERCENT	BOUND	IN	SPECIES	# 280	Fe+2
E-1							
Fe+3							
	61.0	PERCENT	BOUND	IN	SPECIES	#2813301	FeOH2 +
	27.7	PERCENT	BOUND	IN	SPECIES	#2813302	FeOH3 AQ
	11.4	PERCENT	BOUND	IN	SPECIES	#2813303	FeOH4 -
H+1							
	142.0	PERCENT	BOUND	IN	SPECIES	#3301400	HCO3 -
	14.8	PERCENT	BOUND	IN	SPECIES	#3301401	H2CO3 AQ
	601.5	PERCENT	BOUND	IN	SPECIES	#8123302	=SO2H2+
	10.7	PERCENT	BOUND	IN	SPECIES	#8113302	=SO1H2+
H20							
	24.0	PERCENT	BOUND	IN	SPECIES	#3300020	OH-
	1.6	PERCENT	BOUND	IN	SPECIES	#8129500	=SO2Zn+
	26.0	PERCENT	BOUND	IN	SPECIES	#8119500	=SO1Zn+
	21.6	PERCENT	BOUND	IN	SPECIES	#8112310	=SO1Cu+
	6.8	PERCENT	BOUND	IN	SPECIES	#8122310	=SO2Cu+
	1.5	PERCENT	BOUND	IN	SPECIES	#8115400	=SO1Ni+
	16.1	PERCENT	BOUND	IN	SPECIES	#8116000	=SO1Pb+

PART 5 of OUTPUT FILE _

I MILL -	OT O	OTFOT TITT	
 EQUILIBRATED	MASS	DISTRIBUTIO	N

IDX	NAME	DISSO	LVED	SORBI	ED	PRECIP	ITATED
		MOL/KG	PERCENT	MOL/KG	PERCENT	MOL/KG	PERCENT
100	Ba+2	4.101E-07	29.6	9.734E-07	70.4	0.000E-01	0.0
150	Ca+2	6.999E-05	53.9	5.975E-05	46.1	0.000E-01	0.0
160	Cd+2	1.689E-12	0.0	4.714E-09	100.0	0.000E-01	0.0
950	Zn+2	3.133E-11	0.0	3.059E-07	100.0	0.000E-01	0.0
231	Cu+2	9.930E-12	0.0	3.147E-07	100.0	0.000E-01	0.0
410	K+1	6.647E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	1.440E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	2.088E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
540	Ni+2	3.365E-11	0.2	1.870E-08	99.8	0.000E-01	0.0
600	Pb+2	2.153E-14	0.0	1.786E-07	100.0	0.000E-01	0.0
800	Sr+2	5.707E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
211	Cr(OH)2+	2.463E-09	8.8	0.000E-01	0.0	2.544E-08	91.2
30	A1+3	3.327E-09	0.1	0.000E-01	0.0	4.815E-06	99.9
140	CO3-2	2.136E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
280	Fe+2	1.434E-25	100.0	0.000E-01	0.0	0.000E-01	0.0

1 281 330 2	E-1 Fe+3 H+1 H2O	3	0.000E-01 L.493E-15 2.235E-04 2.845E-07	0 0 156 25	.0 .0 .9 .7	0.0 0.0 -8.1 8.2	00E-0 00E-0 01E-0 27E-0	01 01 05 07	0.0 0.0 -56.9 74.3	0.0 5.3 0.0	000H 372H 000H	E-01 E-07 E-01 E-01	0.0 100.0 0.0 0.0
	Chai Si PH EQUI EQUI EQUI	rge Balance: m of CATIONS ERCENT DIFFER LLIBRIUM ION LLIBRIUM PH LLIBRIUM PE	SPECIATED S = 1.693E RENCE = 1 IC STRENGTH	-03 .912 (m)	Sum E+01 = =	of A (AN 6.6 7.6 13.4	NIONS 10NS 88E-(00 89	5 - C. 04 or	1.150E- ATIONS) Eh =	03 / (AN: 782	EONS	S + CAI mv	IONS)
***	* Pai	cameters For	Adsorbent	Numb	er 1	***	*			0100	-		
El	ectro	ostatic Varia	ables: psi psi	0 = b =	0.03	0620		sig	0 = 0.0 b = 0.0	01960			
Ad	sorbe	ent Concentra	psi ation (g/l)	d =	0.00	20000		sig	d = 0.0	00000)		
Sp	ecif	ic Surface A	rea (sq. me	ters	/g):	60	0.00						
			P	ART	6 of	OUT	PUT I	FILE					
Satu	ratio	on indices an	nd stoichio	metr	y of	all	mine	eral	s t mu in	[hra	alcot	Fal	
200	3000	ALOH3 (A)	-3.542	ex [1.	0001	30	rome [3.0001	2	Lkei	-3.000	330
501	5000	ARAGONITE	-2.411	[1.	000]	150	Ē	1.000]	140			
504	6000	ARTINITE	-9.088	[-2.	000]	330	[2.000]	460	[1.000)] 140
200	3001	BOEHMITE	-1.755	[-3.	000]	330	[1.000]	30	[2.000)] 2
204	6000	BRUCITE	-5.855]	1.	000]	460]	2.000]	2]	-2.000)] 330
501	5001	CALCITE	-2.255	[1.	000]	150	[1.000]	140	r	2 000	1 0
200	5002	DIASPORE	-4 199	L	-3.	0000	150	L	1 0001	460	L	2.000) 140
202	8100	FERRIHYDRITH	E -6.675	[-3.	000]	330	Ĺ	1.000]	281	Ĩ	3.000)] 2
202	8101	FE3 (OH) 8	-33.487	[-8.	000]	330	[2.000]	281	[1.000)] 280
200	3003	GIBBSITE (C)	-1.871	L L	-3.	0001	330	I	1.0001	30	F	3.000	2
300	3000	A1203	-8.530	[2.	000]	30	Ē	3.000]	2	Ĩ	-6.000)] 330
202	8102	GOETHITE	-2.491	[-3.	000]	330]	1.000]	281	[2.000)] 2
302	8100	HEMATITE	0.000	L	-6.	000]	330	L	2.000]	281	l	3.000)] 140
504	6001	HYDRMAGNESI	r -22.209	[5.	000]	460	Ľ	4.000]	140	[-2.000)] 330
	01.01		0.050	[6.	000]	2	r	0 0001	0.01		2 000	
302	8101	MAGHEMITE	-9.953	L	-6.	0001	330	L	2.000]	281	l	3.000)] 2
302	80002	MAGNESITE	-17.723	ſ	-8.	000]	330	Ľ	2.000]	281	[1.000	280
				[4.	000]	2						
305	0000	NATRON	-12.341	[2.	000]	500	[1.000]	140	[10.000)] 2
504	8000	STDERTTE	-20.914	L	1.	0001	280	L	1.0001	140	L	5.000)] 2
508	0000	STRONTIANITH	E -3.545	C	1.	000]	800	[1.000]	140			
505	0001	THERMONATR	-14.042	[2.	000]	500	[1.000]	140	[1.000)] 2
501	0000	WITHERITE	-4.338	l	1.	000]	231	L	1.000]	140			
202	3100	CU(OH) 2	-6.223	ſ	-2.	000]	330	Ľ	1.000]	231	[2.000	2 2
202	3101	TENORITE	-5.203	Ĩ	-2.	000]	330	Ĺ	1.000]	231	I	1.000)] 2
302	3100	CUPRICFERIT	-7.365	[-8.	000]	330	[1.000]	231]	2.000)] 281
9	5000	ZN METAL	-63.863	L T	4.	0001	950	ſ	2.0001	1			
509	5000	SMITHSONITE	-7.157	[1.	000]	950	[1.000]	140			
509	5001	ZNCO3, 1H20	-6.834	[1.	000]	950]	1.000]	140]	1.000	2
209	5000	ZN(OH) 2 (A) ZN(OH) 2 (C)	-7.854	L	-2.	0000	330	L	1 0001	950	ſ	2.000	1 2
209	5002	ZN (OH) 2 (B)	-7.154	E	-2.	000]	330	Ľ	1.000]	950	Ĺ	2.000)] 2
209	5003	ZN(OH)2 (G)	-7.114	[-2.	000]	330	Ľ	1.000]	950	I	2.000)] 2
209	5004	ZN(OH)2(E)	-6.904	[-2.	000]	330	[1.000]	950	[2.000	2
209	5005	ZINCITE	-6.856	L	-2.	0001	330	L	1,0001	950	L	1.000) 2
1	6000	CD METAL	-52.586	[1.	000]	160	Ĺ	2.000]	1	L		
1	6001	GAMMA CD	-52.688	[1.	000]	160	[2.000]	1			
501	6000	OTAVITE	-4.620	[1.	000]	160	L	1.000]	140			

2016000 2016001 2016002 60000	CD(OH)2 (A) CD(OH)2 (C) MONTEPONITE PB METAL	-10.688 -10.312 -12.135 -45.794		-2.000] -2.000] -2.000] 1.000]	330 330 330 600	[[[1.000] 1.000] 1.000] 2.000]	160 160 160 1	[[[2.000] 2.000] 1.000]	2 2 2
5060000 2060000 2060001	CERRUSITE MASSICOT LITHARGE	-7.844 -12.502 -12.307	[[[1.000] -2.000] -2.000]	600 330 330	[[[1.000] 1.000] 1.000]	140 600 600	[1.000]	222
5060001	PB0, .3H20 PB20C03	-20.060	[[-2.000]	330 330 140	[2.000]	600	[1.000]	2
5060002	PB302C03	-31.146	[-4.000] 2.000]	330 2]	3.000]	600	[1.000]	140
2060003	PLATTNERITE	-7.486	[-4.000] 2.000]	330 2	[-2.000]	1]	1.000]	600
3060000	PB203	-17.568	[-6.000] 3.000]	330 2	[-2.000]	1	[2.000]	600
3060001	MINIUM	-31.039	[-8.000] 4.000]	330 2]	-2.000]	1	[3.000]	600
2060004 5060003	PB(OH)2 (C) HYDCERRUSITE	-7.703 -23.979	[[[-2.000] -2.000] 2.0001	330 330 2	[[1.000] 3.000]	600 600	[[2.000] 2.000]	2 140
2060005	PB20(OH)2 NICO3	-24.906 -10.816	[-4.000]	330 540]	2.000]	600 140]	3.000]	2
2054000	NI (OH) 2	-6.188	[-2.000]	330	Ĩ	1.000]	540	[2.000]	2
2054001	BUNSENITE	-8.615	[-2.000]	330	[1.000]	540]	1.000]	2
5023101	MALACHITE	-11.463	[2.000] -2.000]	231 330	[2.000]	2	[1.000]	140
5023102	AZURITE	-18.895	[3.000]	231 330]	2.000]	2	[2.000]	140
2015000	LIME	-22.464	[-2.000]	330	[1.000]	150]	1.000]	
2015001	PORTLANDITE	-12.120	[-2.000]	330	[1.000]	150	[2.000]	2
2028000	WUSTITE	-20.420	[-2.000]	330]	0.947]	280]	1.000]	2
2046001	PERICLASE	-10.720	L	-2.000]	330	L	1.000]	460	L	1.000]	2
3028001	HERCYNITE	-23.529	L	-8.000]	330	L	1.000]	280	L	2.000]	30
			L	4.000]	2						~ ~
3046000	SPINEL	-11.849	[-8.000] 4.000]	330	l	1.000]	460	l	2.000]	30
3046001	MAG-FERRITE	-9.978	[-8.000]	330 2]	1.000]	460]	2.000]	281
3028102	LEPIDOCROCIT	-3.155	[-3.000]	330	[1.000]	281	[2.000]	2
3021100	FECR204	-12.371	[2.000]	211]	1.000]	280]	-4.000]	330
3021101	MGCR204	-4.563	[2.000]	211	I	1.000]	460	[-4.000]	330
3021102	CR203	0.000	[2.000]	211	[-2.000]	330	[-1.000]	2
2021102	CR (OH) 3 (A)	-0.860	[1.0001	211	Ī	1.000]	2]	-1.000]	330
2021101	CR (OH) 3 (C)	-3.412	[1.000]	211]	1.000]	2	[-1.000]	330
APPENDIX II

EFFECT OF pH CHANGES IN METALS ADSORPTION AND PRECIPITATION IN THE WATER OF THE CHICAMBA DAM (SITE 14): Output files of modelling with the Minteqa2 Program

Extended output files of the site 14 water quality modelling with different pH values. The modelling was undertaken with the geochemical speciation program MINTEQA2 only for site 14 in order to see what would be the influence of pH changes in the water quality supplied to Chimoio City from the Chicamba Dam. pH values of 6.0, 6.5, 7.0, 7.6 (actual water pH), 8.0 and 8.5 were introduced in the model after the four runs were undertaken. The output file has been reduced.

1 - Modelling with pH = 6.0

		PART 1 of	OUTPUT FILE _				
Entered adsorptio	PCO ₂ , PO ₂ , fi on	xed pH, solids allo	wed to preci	pitate, Fe	redox	pair	and
Tempera Units o Ionic s Carbona Do not Precipi The max The met Interme Adsorpt Number	ture (Celsius f concentrati trength to be te concentrat automatically tation is all rint option f imum number of hod used to of diate output ion model: Di of adsorbing	<pre>b): 19.30 con: MG/L e computed. dion represents carbo r terminate if charge owed for all solids for solids is set to of iterations is: 200 compute activity coeffile ffuse Layer surfaces: 1</pre>	onate alkalin e imbalance e in the therm : 1 0 fficients is:	ity. xceeds 30% odynamic da Davies equ	tabase	and	
INPUT DA ID 330 30 100 150 160 211 231 280 410 460 500 540 600 800 950 1 140 281 813 811	TA BEFORE TYP NAME H+1 Al+3 Ba+2 Ca+2 Cd+2 Cd+2 Cr(OH)2+ Cu+2 Fe+2 K+1 Mg+2 Na+1 Ni+2 Pb+2 Sr+2 Zn+2 E-1 CO3-2 Fe+3 ADS1PSIO ADS1TYP1 PD22	PE MODIFICATIONS ACTIVITY GUESS 1.000E-06 4.786E-06 1.380E-06 1.288E-04 4.677E-09 2.818E-08 3.162E-07 5.370E-07 6.607E-05 1.445E-04 2.089E-04 1.862E-08 1.778E-07 5.754E-07 3.090E-07 1.000E-16 2.188E-04 1.778E-21 1.000E+00 1.905E-04	LOG GUESS -6.000 -5.320 -5.860 -3.890 -8.330 -7.550 -6.500 -6.270 -4.180 -3.840 -3.840 -3.680 -7.730 -6.750 -6.240 -6.510 -16.000 -3.660 -20.750 0.000 -3.720	ANAL TOTAL 0.000E-01 1.300E-01 1.900E-01 5.200E+00 5.300E-04 2.400E-03 2.000E-02 3.000E-02 2.599E+00 3.500E+00 4.800E+00 1.100E-03 3.700E-02 2.000E-02 2.000E-02 0.000E-01 1.310E+01 0.000E-01 1.922E-04			

Charge Balance: UNSPECIATED Sum of CATIONS= 8.438E-04 Sum of ANIONS = 4.366E-04 PERCENT DIFFERENCE = 3.180E+01 (ANIONS - CATIONS)/(ANIONS + CATIONS)

		PART	3 of OUTPU	T FILE		
Type I	- COMPONENTS AS	SPECIES IN	SOLUTION			
ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
330	H+1	1.030E-06	1.000E-06	-6.00000	0.97077	0.013
30	A1+3	2.192E-11	1.678E-11	-10.77513	0.76565	0.116
100	Ba+2	1.379E-06	1.225E-06	-5.91199	0.88809	0.052
150	Ca+2	1.296E-04	1.151E-04	-3.93896	0.88809	0.052
160	Cd+2	1.090E-09	9.678E-10	-9.01420	0.88809	0.052
211	Cr(OH)2+	1.814E-08	1.761E-08	-7.75414	0.97077	0.013
231	Cu+2	2.986E-10	2.652E-10	-9.57639	0.88809	0.052
280	Fe+2	2.261E-22	2.008E-22	-21.69733	0.88809	0.052
410	K+1	6.647E-05	6.453E-05	-4.19026	0.97077	0.013
460	Ma+2	1.440E-04	1.278E-04	-3,89330	0.88809	0.052
500	Na+1	2.088E-04	2.027E-04	-3,69317	0.97077	0.013
540	Ni+2	6 529E-09	5 799E-09	-8 23668	0 88809	0 052
600	Pb+2	2 866E-12	2545E-12	-11 59427	0.88809	0.052
800	Sr+2	5,707E-07	5.068E - 07	-6 29516	0.88809	0.052
950	7n+2	2 3865-08	2 1195-08	-7 67380	0.88809	0.052
811		1 4635-04	1 4635-04	-3 83177	1 00000	0.000
140	CO3-2	2 2065-10	2 0305-10	-0.60040	0.00000	0.000
201	CO3-2	2.2906-10	1 6465-20	-9.09040	0.00009	0.052
201		Z.149E-20	1.040E-20	-19.70307	1.00000	0.110
012	ADSITIEZ	J.000E-03	J.000E-03	-2.23003	1.00000	0.000
TYPE TT	- OTHER SPECIE	S TN SOLUTIO	N OR ADSOR	BED		
TD	NAME	CALC MOL	ACTIVITY		CAMMA	NEW LOCK
8121000	-SO2Bat	3 961E-14	3 9615-14	_13 10223	1 00000	-7 200
2112202	-502Bar	1 2065-00	1 306E-00	-13.40225	1.00016	-7.200
2113302	Cr(OH) A	1.300E-09	1.3006-09	12 00414	1.00010	10 127
2113303	Cr(Or)4-	1.200E-14	2 1645 14	-13.90415	0.97077	-10.137
3300020	04-	5.239E-14 6.672E-00	5.104E-14 6 177E-00	-13.49974	0.97077	-11.133
1602300	Maou I	1. 205E 10	1 267E 10	-0.10000	0.97077	-14.170
4603300	MgOH +	1.305E-10	1.20/E-10	-9.89734	0.97077	-11.991
4601400	MgCOS AQ	Z.ZOUE-11	Z.200E-11	-10.04207	1.00016	2.942
4601401	Mgrcus +	1.055E 11	1.0906-09	-0.14009	0.97077	10 702
1503300	CaUGO2	1.855E-11	1.8016-11	-10.74461	0.97077	-12.793
1501400	CarCO3 +	5.092E-09	4.943E-09	-8.30603	0.97077	11.336
1501401	Cacos AQ	2.964E-11	2.904E-11	-10.52807	1.00016	3.101
5001400	NaCO3 -	5.888E-13	5.716E-13	-12.24294	0.97077	1.154
5001401	NaHCO3 AQ	4.969E-10	4.970E-10	-9.30364	1.00016	10.080
303300	AIOH +2	1.307E-10	1.161E-10	-9.93512	0.88809	-5.108
303301	A1(OH)2 +	1.3/3E-09	1.333E-09	-8.87514	0.97077	-10.087
303302	A1(OH)4 -	4.058E-11	3.939E-11	-10.40458	0.97077	-23.617
303303	Al(OH)3 AQ	1.678E-09	1.678E-09	-8.77515	1.00016	-16.000
2803300	FeOH +	4.236E-26	4.112E-26	-25.38589	0.97077	-9.676
2803301	FeOH3 -1	7.633E-36	7.410E-36	-35.13021	0.97077	-31.420
2803302	FeOH2 AQ	2.111E-31	2.111E-31	-30.67542	1.00016	-20.978
2813300	FeOH +2	8.498E-17	7.547E-17	-16.12223	0.88809	-2.287
2813301	FeOH2 +	3.624E-14	3.518E-14	-13.45368	0.97077	-5.657
2813302	FeOH3 AQ	4.133E-16	4.133E-16	-15.38369	1.00016	-13.600
2813303	FeOH4 -	4.258E-18	4.133E-18	-17.38369	0.97077	-21.587
2813304	Fe2(OH)2+4	3.133E-31	1.949E-31	-30.71021	0.62205	-2.937
2813305	Fe3 (OH) 4+5	2.930E-42	1.395E-42	-41.85532	0.47627	-6.182
8003300	SrOH +	2.151E-14	2.088E-14	-13.68024	0.97077	-13.372
1003300	BaOH +	3.367E-14	3.269E-14	-13.48563	0.97077	-13.561
2311400	CuCO3 AQ	2.904E-13	2.905E-13	-12.53687	1.00016	6.730
2311401	Cu(CO3)2-2	8.398E-20	7.459E-20	-19.12734	0.88809	9.882
2313300	CuOH +	2.732E-12	2.652E-12	-11.57640	0.97077	-7.987
2313301	Cu(OH)2 AQ	5.540E-12	5.541E-12	-11.25640	1.00016	-13.680
2313302	Cu(OH)3 -	3.447E-19	3.347E-19	-18.47541	0.97077	-26.886
2313303	Cu(OH) 4 -2	7.501E-26	6.662E-26	-25.17641	0.88809	-39.548
2313304	Cu2 (OH) 2+2	1.948E-18	1.730E-18	-17.76186	0.88809	-10.558

2311402	CuHCO3 +	5.572E-13	5.409E-13	-12.26687	0.97077	13.013
9503300	ZnOH +	1.541E-11	1.495E-11	-10.82522	0.97077	-9.139
9503301	Zn(OH)2 AQ	2.674E-13	2.674E-13	-12.57281	1.00016	-16.899
9503302	Zn(OH)3 -	8.711E-19	8.456E-19	-18.07282	0.97077	-28.386
9503303	Zn(OH)4 -2	1.509E-25	1.340E-25	-24.87282	0.88809	-41.147
9501400	ZnHCO3 +	1.118E-11	1.086E-11	-10.96428	0.97077	12.413
9501401	ZnCO3 AO	8.623E-13	8.624E-13	-12.06428	1.00016	5.300
9501402	Zn (CO3) 2-2	4.234E-18	3.760E-18	-17,42476	0.88809	9,682
1601400	Cd(CO3)3-4	2.190E-32	1.363E-32	-31,86563	0.62205	6.426
1603300	CdOH +	5.389E-14	5.232E-14	-13,28135	0.97077	-10.254
1603301	Cd(0H)2 A0	4 322E-18	4 323E-18	-17 36421	1.00016	-20 350
1603302	Cd(OH)3 -	4.997E - 25	4.850E-25	-24.31422	0.97077	-33,287
1603303	Cd(OH)4 = 2	4 868E-33	4 323E-33	-32 36422	0.88809	-47 298
1603304	Cd20H + 3	3 482E-22	2 666E-22	-21.57410	0.76565	-9 430
1601400	CdHCO3 +	5 108E-13	4 958E-13	-12 30468	0 97077	12 413
1601401	CdCO3 AO	4 946E-14	4.947E - 14	-13, 30568	1.00016	5 399
6001400	Ph(CO3)2-2	5.204E-21	4.621E-21	-20 33522	0 88809	10 692
6003300	PhOH +	5.112F - 14	4.963E - 14	-13 30427	0.97077	-7 697
6003301	Ph(OH) 2 TO	1.930E - 17	1.931E = 17	-16 71429	1 00016	-17 120
6003302	PD(OH)2 AQ	2 2835-22	2 217E - 22	-21 65428	0 97077	-28 047
6003303	Pb20H +3	3 6935-24	2.2175 22	-23 54854	0.76565	-6 244
6003304	Pb2(04) 4+2	1 0245-25	0.0015-36	-35 04140	0.90909	-24 207
6001401	PDS (OR) 4+2	1.024E-33	9.091E-30	-14 04474	1 00016	7 240
6001401	PDCOS AQ	5.721E-20	5.000E-20	-27 20320	0.00010	-39 647
6003303	PD(0A)4 -2	9.75E-15	9.090E-20	-21.29329	0.00009	13 213
6001402	PDRCOS +	6.47JE-13	5.227E-13	-12.00474	0.97077	10 025
5403300	NICH +	5.400E-15	5.320E-15	15 22660	1 00016	-10.025
5403301	NI (OH) 2 AQ	5.7906-10	5.790E-10	-13.23009	1.00010	-19.000
5403302	NI(OH)S -	J.975E-21	J. 190E-21	-20.23009	0.97077	-29.907
5401400	NINCOS +	3.395E-12	3.490E-12	-11.45715	1.00016	6 970
5401401	NICOS AQ	8.700E-12 2.400E-19	0.707E-12 2.107E-19	-17 50763	1.00010	10 162
2201402	NI (COS) 2-2	5.4996-10	J.10/E-10	-17.30703	0.00009	10.102
3301400	HC03 -	5.083E-06	4.934E-00	-5.30080	1.00016	16 712
3301401	HZCOS AQ	1.053E-05	1.053E-05	-4.97730	1.00016	10.713
2113300	Cr+3	1.860E-10	1.424E-10	-9.84641	0.76565	10.024
2113301	CP(OH)+2	8.208E-09	7.343E-09	-0.13413	1.00000	5.672
8123301	=502-	7.399E-04	1.399E-04	-3.13085	1.00000	-8.930
8123302	=502H2+	1.070E-03	1.070E-05	-2.97045	1.00000	7.290
8113301	=501-	1.841E-05	1.841E-05	-4.73497	1.00000	-8.930
8113302	=SOIH2+	2.663E-05	2.663E-05	-4.5/45/	1.00000	1.290
8129500	=SO2Zn+	1.191E-08	1.191E-08	-7.92425	1.00000	-1.990
8119500	=SOIZn+	2.702E-07	2.702E-07	-6.56837	1.00000	0.970
8121600	=SO2Cd+	6.689E-11	6.689E-11	-10.1/465	1.00000	-2.900
8111600	=SO1Cd+	3.558E-09	3.558E-09	-8.44877	1.00000	0.430
8112310	=SO1Cu+	2.565E-07	2.565E-07	-6.59096	1.00000	2.850
8122310	=SO2Cu+	5.796E-08	5.796E-08	-7.23684	1.00000	0.600
8115400	=SOINi+	1.119E-08	1.119E-08	-7.95125	1.00000	0.150
8125400	=SO2Ni+	1.007E-09	1.007E-09	-8.99713	1.00000	-2.500
8116000	=SO1Pb+	1.783E-07	1.783E-07	-6.74884	1.00000	4.710
8126000	=SO2Pb+	2.788E-10	2.788E-10	-9.55472	1.00000	0.300
8121500	=SO2Ca+	8.925E-09	8.925E-09	-8.04940	1.00000	-5.850
8111500	=SO1HCa++	1.370E-07	1.370E-07	-6.86332	1.00000	4.970
8111000	=SO1HBa++	4.505E-09	4.505E-09	-8.34635	1.00000	5.460
Type II ID 2	I - SPECIES NAME H2O	WITH FIXED ACT CALC MOL 1.917E-04	IVITY LOG MOL -3.717	NEW LOGK 0.000	DH 0.000	
330	H+1	-7.550E-04	-3.122	6.000	0.000	
3301403	CO2 (g)	4.325E-04	-3.364	21.690	-0.530	
3300021	02 (g)	1.148E-04	-3.940	-84.354	133.830	
2802810	Fe+2/Fe+3	-5.372E-07	-6.270	13.175	-10.000	

Type IV -	- FINITE SOLID	S (present	at equ	il:	ibrium)			
ID	NAME	CALC MOL		LOC	G MOL 1	NE	V LOGK	DH
3028100	HEMATITE	2.686E-0	7	-6	.571	-	3.567	30.845
2003002	DTASPORE	4.815E-0	5	-5	.317	'	7.225	24.630
2000001			-					
		PZ	ART 4	of (OUTPUT F	TL	C.	
	PERCE	NTAGE DIST	RIBUTI	DN (OF COMPO	NE	TS AMONG	
	TYPE I at	nd TYPE II	(disso	olve	ed and a	dso	orbed) sp	ecies
ADS1PSTO			(, -F	
110011010	315 0	PERCENT	BOUND	TN	SPECTES	# 8	3123302	=502H2+
	7 8	PERCENT	BOUND	TN	SPECIES	#5	3113302	=501H2+
ADS1TYD2	1.0	1 DI(ODI(1	DOOLD		DIHOIHO	"	110002	501112
ADDITIT	76 5	DEDCENT	BOUND	TM	SDECTES	#	812	ADG1TVD2
	9.6	DEDCENT	ROUND	TN	SPECIES	# 9	123301	-502-
	13.0	DEDCENT	BOUND	TN	SPECIES	# 9	2123302	-502
Dat2	15.5	FERCENT	DOOND	TIN	DEPCIED	π¢	123302	-502112+
Datz	00 7	DEDCENT	POUND	TN	ODECTES	#	100	Pot 2
0-12	55.1	PERCENT	DUUND	TN	SPECIES	#	100	Datz
Ca+2	00 0	DEDCENT	DOUND	TN	ODECTEC	ш	1 5 0	0-10
G 1 + 0	99.9	PERCENT	BOOND	ΤN	SPECIES	Ŧ	150	Ca+2
Ca+2	00.1		DOUND			п	1.00	a 1. a
	23.1	PERCENT	BOUND	IN	SPECIES	#	160	Cd+2
	1.4	PERCENT	BOUND	IN	SPECIES	#8	3121600	=SO2Cd+
	75.5	PERCENT	BOUND	IN	SPECIES	#8	3111600	=SO1Cd+
Cr(OH)2+								
	65.0	PERCENT	BOUND	IN	SPECIES	#	211	Cr(OH)2+
	4.7	PERCENT	BOUND	IN	SPECIES	#2	2113302	Cr(OH) 3 AQ
	29.6	PERCENT	BOUND	IN	SPECIES	#2	2113301	Cr(OH)+2
Cu+2								
	81.5	PERCENT	BOUND	IN	SPECIES	#8	3112310	=SO1Cu+
	18.4	PERCENT	BOUND	IN	SPECIES	#8	3122310	=SO2Cu+
ADS1TYP1								
	76.1	PERCENT	BOUND	IN	SPECIES	#	811	ADS1TYP1
	9.6	PERCENT	BOUND	IN	SPECIES	#8	3113301	=S01-
	13.9	PERCENT	BOUND	IN	SPECIES	#8	3113302	=SO1H2+
K+1								
	100.0	PERCENT	BOUND	IN	SPECIES	#	410	K+1
Ma+2								
	100.0	PERCENT	BOUND	IN	SPECIES	#	460	Mg+2
Na+1								5
	100.0	PERCENT	BOUND	TN	SPECIES	#	500	Na+1
Ni+2	20010							
111.1	34.8	PERCENT	BOUND	TN	SPECIES	#	540	Ni+2
	59 7	PERCENT	BOUND	TN	SPECIES	# 5	3115400	=SO1Ni+
	5.4	PERCENT	BOUND	TN	SPECIES	# 5	3125400	=SO2Ni+
Ph+2	5.1	LERCERT	DoonD	111	DIDOILD	"	120100	DOLLI
1012	99 8	PERCENT	BOUND	TN	SPECTES	# 9	116000	=SO1Pb+
Sr+2	99.0	FERCENT	DOOND	TIA	DIECIED	π	0110000	-501101
SI TZ	100 0	DEDCENT	POUND	TN	ODECTES	#	000	S ~+ 3
7212	100.0	PERCENT	BOUND	TIV	SPECIES	#	800	51+2
611+2	7 0	DEDORM	DOUND	TH	apported	п	0.5.0	R
	7.8	PERCENT	BOUND	IN	SPECIES	#	950	Zn+2
	3.9	PERCENT	BOUND	IN	SPECIES	#2	3129500	=SO2Zn+
	88.3	PERCENT	BOUND	IN	SPECIES	#8	3119500	=SOIZn+
A1+3								
	4.0	PERCENT	BOUND	IN	SPECIES	#	303300	AloH +2
	42.3	PERCENT	BOUND	IN	SPECIES	#	303301	Al(OH)2 +
	1.3	PERCENT	BOUND	IN	SPECIES	#	303302	Al(OH)4 -
	51.7	PERCENT	BOUND	IN	SPECIES	#	303303	Al(OH)3 AQ
Fe+2								
	100.0	PERCENT	BOUND	IN	SPECIES	#	280	Fe+2
CO3-2								
	32.5	PERCENT	BOUND	IN	SPECIES	#3	3301400	HCO3 -
	67.4	PERCENT	BOUND	IN	SPECIES	#3	301401	H2CO3 AQ
H+1								
	1.4	PERCENT	BOUND	IN	SPECIES	#3	3301400	HCO3 -

	5.8	PERCENT	BOUND	IN	SPECIES	#3301401	H2CO3 AQ	
	293.1	PERCENT	BOUND	IN	SPECIES	#8123302	=SO2H2+	
	7.3	PERCENT	BOUND	IN	SPECIES	#8113302	=S01H2+	
E-1								
Fe+3								
	98.6	PERCENT	BOUND	IN	SPECIES	#2813301	FeOH2 +	
	1.1	PERCENT	BOUND	IN	SPECIES	#2813302	FeOH3 AQ	
H20								
	1.5	PERCENT	BOUND	IN	SPECIES	#8129500	=SO2Zn+	
	33.8	PERCENT	BOUND	IN	SPECIES	#8119500	=SO1Zn+	
	32.1	PERCENT	BOUND	IN	SPECIES	#8112310	=SO1Cu+	
	7.3	PERCENT	BOUND	IN	SPECIES	#8122310	=SO2Cu+	
	1.4	PERCENT	BOUND	IN	SPECIES	#8115400	=SO1Ni+	
	22.3	PERCENT	BOUND	IN	SPECIES	#8116000	=SO1Pb+	
		P.	ART 5 c	of (DUTPUT F	ILE		
		EQUILIBR	ATED M	ASS	DISTRIB	UTION		
IDX	NAME	DISSOLVE	D		SORBI	ED	PRECIP	TATED
		MOL/KG P	ERCENT		MOL/KG	PERCENT	MOL/KG	PERCENT

100	Ba+2	1.379E-06	99.7	4.505E-09	0.3	0.000E-01	0.0			
150	Ca+2	1.296E-04	99.9	1.459E-07	0.1	0.000E-01	0.0			
160	Cd+2	1.090E-09	23.1	3.625E-09	76.9	0.000E-01	0.0			
211	Cr(OH)2+	2.790E-08	100.0	0.000E-01	0.0	0.000E-01	0.0			
231	Cu+2	3.078E-10	0.1	3.144E-07	99.9	0.000E-01	0.0			
410	K+1	6.647E-05	100.0	0.000E-01	0.0	0.000E-01	0.0			
460	Mg+2	1.440E-04	100.0	0.000E-01	0.0	0.000E-01	0.0			
500	Na+1	2.088E-04	100.0	0.000E-01	0.0	0.000E-01	0.0			
540	Ni+2	6.542E-09	34.9	1.219E-08	65.1	0.000E-01	0.0			
600	Pb+2	2.935E-12	0.0	1.786E-07	100.0	0.000E-01	0.0			
800	Sr+2	5.707E-07	100.0	0.000E-01	0.0	0.000E-01	0.0			
950	Zn+2	2.389E-08	7.8	2.821E-07	92.2	0.000E-01	0.0			
30	A1+3	3.244E-09	0.1	0.000E-01	0.0	4.815E-06	99.9			
280	Fe+2	2.261E-22	100.0	0.000E-01	0.0	0.000E-01	0.0			
140	CO3-2	1.563E-05	100.0	0.000E-01	L 0.0	0.000E-01	0.0			
330	H+1	2.718E-05	7.4	3.380E-04	92.6	0.000E-01	0.0			
1	E-1	0.000E-01	0.0	0.000E-01	L 0.0	0.000E-01	0.0			
281	Fe+3	3.674E-14	0.0	0.000E-01	0.0	5.372E-07	100.0			
2	H2O	7.590E-09	1.0	7.909E-07	99.0	0.000E-01	0.0			
	Sum of CAT PERCENT DI NON-CARBONAT EQUILIBRIUM EQUILIBRIUM EQUILIBRIUM	IONS = 1.926E FFERENCE = 4 E ALKALINITY IONIC STRENGTH pH pe	C-03 Sum .322E+03 H (m) = = = =	of ANIONS (ANIONS -1.023E-06 6.918E-04 6.000 15.089	7.634E- - CATIONS	04)/(ANIONS + 875.51 mv	CATIONS)			
****	*** DIFFUSE Li * Parameters 1	AYER ADSORPTIC For Adsorbent	N MODEL	*******		15000				
도그	ectrostatic va	ariables: psi	b = 0.1	L//81 S	sigu = 0.0	12880				
		psi	a = 0.00		sigd = 0.0	00000				
Ad	sorbent Conce	psi ntration (g/l)	a = 0.00	12	siga = 0.0	00000				
Sp	ecific Surface	e Area (sq. me	eters/g)	600.00						
		PA	RT 6 of	OUTPUT FII	E					
Satu	ration indice:	s and stoichic	metry of	E all miner	als	[]]				
	ID # NAME Sat. Index Stoichiometry in [brackets]									

TD #	NAME	Sat. Index		SLO.	TCUTC	mer	ry ru fr	JIACK	els	5 J	
2003000	ALOH3 (A)	-3.542]	1.000]	30	[3.000]	2]	-3.000]	330
5015000	ARAGONITE	-5.344]	1.000]	150	[1.000]	140			
5046000	ARTINITE	-15.488]	-2.000]	330	[2.000]	460]	1.000]	140
			Γ	5.000]	2						

2003001	BOEHMITE	-1.755	[-3.000]	330	[1.000]	30	[2.000]	2
2046000	BRUCITE	-9.054	[1.000]	460	[2.000]	2	[-2.000]	330
5015001	CALCITE	-5.187	[1.000]	150]	1.000]	140			
2003002	DIASPORE	0.000	[-3.000]	330	[1.000]	30	[2.000]	2
5015002	DOLOMITE	-10.332	[1.000]	150	[1.000]	460	[2.000]	140
2028100	FERRIHYDRITE	-6.675	[-3.000]	330	ĺ	1.000]	281	[3.000]	2
2028101	FE3(OH)8	-33.487	[-8.000]	330	[2.000]	281	[1.000]	280
			[8.000]	2						
2003003	GIBBSITE (C)	-1.871	[-3.000]	330	[1.000]	30	l	3.000]	2
3003000	A1203	-8.530	[2.000]	30	[3.000]	2	L	-6.000]	330
2028102	GOETHITE	-2.491	[-3.000]	330	[1.000]	281]	2.000]	2
3028100	HEMATITE	0.000	[-6.000]	330	[2.000]	281	[3.000]	2
5015003	HUNTITE	-24.781	[3.000]	460	[1.000]	150	[4.000]	140
5046001	HYDRMAGNESIT	-38.208	[5.000]	460	[4.000]	140	[-2.000]	330
		0.050	[6.000]	2		0 0001	001		2 2 2 2 2 3	0
3028101	MAGHEMITE	-9.953	l	-6.000]	330	L	2.000]	281	L	3.000]	2
5046002	MAGNESITE	-5.643	l	1.000]	460	l	1.000]	140		1 0001	0.00
3028000	MAGNETITE	-17.723	[-8.000]	330	L	2.000]	281	L	1.000]	280
			l	4.000]	2		1 0001	1.10		10 0001	0
3050000	NATRON	-15.541	l	2.000]	500	L	1.000]	140	L	10.000]	2
5046003	NESQUEHONITE	-8.045	l	1.000]	460	L	1.000]	140	L	3.000]	2
5028000	SIDERITE	-20.914	l	1.000]	280	L	1.000]	140			
5080000	STRONTIANITE	-6.745	L	1.000]	800	l	1.000]	140	r	1 0001	0
5050001	THERMONATR	-17.242	l	2.000]	500	l	1.000]	140	L	1.000]	2
5010000	WITHERITE	-7.012	l	1.000]	100	l	1.000]	140			
5023100	CUCO3	-9.637	l	1.000]	231	L	1.000]	140	r	0 0001	0
2023100	CU (OH) 2	-6.434	l	-2.000]	330	L	1.000]	231	L	2.000]	2
2023101	TENORITE	-5.414	L	-2.000]	330	L	1.000]	231	L	1.000]	2
3023100	CUPRICEERIT	-1.576	L	-8.000]	330	L	1.000]	231	L	2.000]	281
05000		64 100	l	4.000]	2	r	0 0001	1			
95000	ZN METAL	-64.133	L	1.000]	950	L	2.000]	L			
5095000	SMITHSONITE	-7.427	l	1.000]	950	l	1.000]	140		1 0001	0
5095001	ZNCO3, 1H2O	-7.104	L	1.000]	950	L	1.000]	140	L	1.000]	2
2095000	ZN (OH) 2 (A)	-8.124	l	-2.000]	330	L	1.000]	950	L	2.000]	2
2095001	ZN (OH) 2 (C)	-7.874	l	-2.000]	330	L	1.000]	950	L	2.000]	2
2095002	ZN (OH) 2 (B)	-7.424	l	-2.000]	330	l	1.000]	950	L	2.000]	2
2095003	ZN (OH) 2 (G)	-7.384	l	-2.000]	330	L	1.000]	950	L	2.000]	2
2095004	ZN (OH) 2 (E)	-7.174	[-2.000]	330	L	1.000]	950	L	2.000]	2
2095005	ZNO (ACTIVE)	-6.984	l	-2.000]	330	L	1.000]	950	L	1.000]	2
TD # 1	NAME Cot	Tradem		Chaishi	omotiv		in Change	leat al			
	NAME Sat.	Index		Stoichi	ometi	ry	in [brac	Kets	r	1 0001	0
2095006	ZINCITE	-7.120	L	-2.000]	330	L	1.000]	950	L	1.000]	2
16000	CD METAL	-52.938	L	1.000]	160	L	2.000]	1			
16001	GAMMA CD	-53.040	L	1.000]	160	L	2.000]	140			
5016000	OTAVITE OD (OU) 2 (D)	-4.973	l	1.000]	100	L	1.000]	140	r	0 0001	2
2016000	CD(OH) Z (A)	-11.041	L	-2.000]	330	L	1.000]	160	L	2.000]	20
2016001	CD(OH)2 (C)	-10.004	L	-2.000]	220	L	1.000]	160	L	2.000]	2
2016002	MONTEPONITE	-12.488	L	-2.000]	330	L	1.000]	100	L	1.000]	2
60000	PB METAL	-40.036	L	1.000]	600	L	2.000]	140			
3060000	CERRUSITE	-0.005	L	1.000]	220	L	1.000]	140	r	1 0001	2
2060000	MASSICOT	-12.744	l	-2.000]	330	1 r	1.000]	600	L	1.000]	2
2060001	LITHARGE	-12.548	L	-2.000]	330	L	1.000]	600	L	1.000]	2
2060002	PB0, .3H20	-12.574	L	-2.000]	330	L	1.000]	600	L	1.330]	2
2060001	PBZUCUS	-20.543	L	-2.000]	330	L	2.000]	600	L	1.000]	Z
5060002	DD302003	-21 071	L	-4.0001	220	r	2 0001	600	Г	1 0001	140
5060002	PBSUZCUS	-31.0/1	L	-4.000]	330	L	3.000]	600	L	1.000]	140
2060002	סד מיייאוביס דייב	-7 720	l	_1 0001	330	Г	-2 0001	1	Г	1 0001	600
2000003	PLATINERITE	-1.120	l	-4.000]	330	L	-2.000]	Т	L	1.000]	000
3060000	DD203	-10 050	L	-6.0001	220	r	-2 0001	1	r	2 0001	600
3000000	EDZUJ	-10.032	L	-0.000]	230	L	-2.000]	T	L	2.000]	000
3060001	MINITIM	-31 764	L	-8 0001	330	r	-2 0001	1	r	3 0001	600
2000001	TITITOM	-31./04	L	4 0001	220	L	-2.000]	T	L	5.000]	000
2060004	PB (OH) 2 (C)	-7 911	L	-2 0001	330	Г	1 0001	600	Г	2 0001	2
5060004	HYDOFREIGTTE	-21 701	Ĺ	-2 0001	230	L r	3 0001	600	L	2 0001	140
3000003	111 DODIVIODI LE	29.104	L	2.000]	220	L	5.000]	000	L	2.000]	140

			ſ	2.000]	2						
2060005	PB20 (OH) 2	-25.389]	-4.000]	330	[2.000]	600]	3.000]	2
5054000	NICO3	-11.229]	1.000]	540]	1.000]	140			
2054000	NI (OH) 2	-6.602	[-2.000]	330	[1.000]	540]	2.000]	2
2054001	BUNSENITE	-9.028	[-2.000]	330	[1.000]	540	[1.000]	2
5023101	MALACHITE	-11.886	[2.000]	231	[2.000]	2	I	1.000]	140
			[-2.000]	330						
5023102	AZURITE	-19.530	[3.000]	231	[2.000]	2	[2.000]	140
			[-2.000]	330						
2015000	LIME	-25.397]	-2.000]	330	[1.000]	150]	1.000]	2
2015001	PORTLANDITE	-15.052	[-2.000]	330	[1.000]	150	[2.000]	2
2028000	WUSTITE	-20.589]	-2.000]	330	I	0.947]	280	I	1.000]	2
2046001	PERICLASE	-13.920	Į	-2.000]	330	[1.000]	460	[1.000]	2
3028001	HERCYNITE	-23.529	[-8.000]	330	[1.000]	280	[2.000]	30
			[4.000]	2						
3046000	SPINEL	-15.049	[-8.000]	330	[1.000]	460	[2.000]	30
			[4.000]	2						
3046001	MAG-FERRITE	-13.178]	-8.000]	330	[1.000]	460	[2.000]	281
			[4.000]	2						
3028102	LEPIDOCROCIT	-3.155	[-3.000]	330	(1.000]	281	E	2.000]	2
3021100	FECR204	-12.659	[2.000]	211	[1.000]	280	£	-4.000]	330
3021101	MGCR204	-8.051	[2.000]	211	[1.000]	460	[-4.000]	330
3021102	CR203	-0.288	ĺ	2.000]	211	[-2.000]	330	[-1.000]	2
2021102	CR (OH) 3 (A)	-1.004	[1.000]	211	[1.000]	2	[-1.000]	330
2021101	CR (OH) 3 (C)	-3.556	[1.000]	211	[1.000]	2	[-1.000]	330

2 – Modelling with pH = 6.5

		PART	1 of OUTPU	JT FILE				
Revuè ri	ver water-Si	te 14 - $pH = 6$	5.5					
Entered	PCO_2 , PO_2 , f	ixed pH, solid	is allowed	to precip	pitate,	Fe red	ox pair	and
adsorpti	on							
Tempera	ture (Celsiu	(s): 19.30						
Units d	of concentrat	ion: MG/L						
Ionic s	strength to b	e computed.						
Carbona	te concentra	tion represent	s carbonate	e alkalin	ity.	-		
Do not	automaticall	y terminate if	charge imb	balance e	xceeds	30%		
Precipi	tation is al	lowed for all	solids in t	the therm	odynami	c databa	ase and	
the p	print option	for solids is	set to: 1					
The may	imum number	of iterations	is: 200					
The met	hod used to	compute activi	ty coeffici	lents is:	Davies	equation	on	
Interme	diate output	file						
Adsorpt	ion model: D	offuse Layer						
Number	of adsorbing	surfaces: 1						
	TA PERADE TV	DE MODIFICATIO	NC					
INFUI DE	NAME	PE MODIFICATIO		CHECO	ANDT T	OTAT		
10	NAME UL1	ACTIVITI G	E 07	GUESS	ANAL I	E 01		
30	V173	1 796	E-06	-0.300	1 200	E-01		
100	RITJ Rat2	4.700	E-06	-5.960	1 900	E-01		
150	Ca+2	1 288	E-00	-3.800	5 200	E-01		
160	Cd+2	4 677	E-09	-8.330	5 300	E = 0.4		
211	Cr(0H)2+	2 818	E-08	-7.550	2 400	E-03		
231	C1 (011) 2 + C11 + 2	3 162	E = 0.7	-6.500	2 000	E-02		
280	Fe+2	5 370	E = 07	-6.270	3 000	E = 02		
410	K+1	6.607	E-05	-4.180	2.599	E+00		
460	Ma+2	1.445	E = 0.4	-3.840	3.500	E+00		
500	Na+1	2 089	E = 04	-3 680	4 800	E+00		
540	Ni+2	1.862	E-08	-7.730	1.100	E-03		
600	Pb+2	1.778	E = 0.7	-6.750	3.700	E = 02		
800	Sr+2	5.754	E - 07	-6.240	5.000	E - 02		
950	Zn+2	3.090	E - 07	-6.510	2.000	E = 02		
1	E-1	1.000	E-16	-16.000	0.000	E-01		
140	C03-2	2.188	E-04	-3.660	1.310	E+01		
281	Fe+3	1.778	E-21	-20.750	0.000	E-01		
813	ADS1PSIO	1.000	E+00	0.000	0.0001	E-01		
811	ADS1TYP1	1.905	E-04	-3.720	1.922	E - 04		
812	ADS1TYP2	7.762	E-03	-2.110	7.6901	E-03		
2	H20	1.000	E+00	0.000	0.0001	E-01		
Cha	rge Balance:	UNSPECIATED						
S	um of CATION	S= 8.438E-04	Sum of ANIC	NS = 4.3	366E-04			
F	PERCENT DIFFE	RENCE = 3.180	E+01 (ANIC	DNS - CAT	IONS)/(2	ANIONS -	+ CATION	IS)
			2 6 011777					
The second	COMPONENTS	PART	3 OF OUTPU	T FILE				
Type I	- COMPONENTS	AS SPECIES IN	SOLUTION	100 200	70737	0710/7		0.017
10	NAME U.1	CALC MOL	ACTIVITY	LOG ACT	000 0	JAMMA	NEW I	JOGK
330		3.238E-07	3.16ZE-07	-6.50	510 0	.9/0/1	0.0	10
100	AL+S Roll2	0.935E-13	5.307E-13	-12.27	DIG 0	. 76525	0.1	10
150	Dat 2	1.346E-06	1.195E-06	-5.92	255 0	.88788	0.0	152
150	Cd+2	1.205E-04	1.141E-04	-3.94	215 0	. 88 / 88	0.0	52
211	Cr(OH)21	7 9975-10	7 7505 00	-9.0/0	025 0	00/00	0.0	122
221	C_{11+2}	3 2445-11	2 800E 11	-0.11	158 0	. 9/0/1	0.0	150
201	Fot2	2.244E-11 2.261E-22	2.000E-11	-10.540		00700	0.0	52
110	K+1	2.201E-23	2.000E-23	-22.09	122 0	07071	0.0	122
410	Ma+2	1 1305-04	1 430E-04 1 279E-04 - 2 90242 0 997071 0.01					152
500	Na+1	2 0885-04	2 0275-04	-3.69	319 0	97071	0.0	113
540	Ni+2	1 0205-04	9 1335-10	-0.02	0.27 0	99700	0.0	152
540		1.0296-09	7.1226-10	-9.03	0	.00/00	0.0	52

600	Pb+2	3.114E-13	2.765E-13	-12.55837	0.88788	0.052
800	Sr+2	5.707E-07	5.067E-07	-6.29524	0.88788	0.052
950	2n+2	2.786E-09	2.473E-09	-8,60669	0.88788	0.052
811	ADS1TYP1	1.459E - 04	1 459E - 04	-3.83605	1.00000	0.000
140	CO3-2	2 2975-09	2 0395-09	-8 69048	0 88788	0.052
201	CO3-2	2.297E-09	2.039E-09	-0.09040	0.76525	0.052
281	re+3	6.800E-22	5.204E-22	-21.28367	1.00000	0.110
812	ADSITIPZ	5.895E-03	5.895E-03	-2.22949	1.00000	0.000
Type II	- OTHER SPEC	IES IN SOLUTI	ON OR ADSOR	BED	C710/7	NEW TOOK
TD	NAME	CALC MOL	ACTIVITY	LOG ACTVII	GAMMA	NEW LOGK
8121000	=SO2Ba+	1.045E-12	1.045E-12	-11.98085	1.00000	-7.200
2113302	Cr(OH)3 AQ	1.818E-09	1.819E-09	-8.74025	1.00016	-7.130
2113303	Cr(OH)4-	5.658E-14	5.492E-14	-13.26026	0.97071	-18.137
2113304	Cr02-	1.436E-13	1.394E-13	-12.85585	0.97071	-17.733
3300020	OH-	2.110E-08	2.048E-08	-7.68865	0.97071	-14.176
4603300	MgOH +	4.125E-10	4.004E-10	-9.39748	0.97071	-11.991
4601400	MgCO3 AQ	2.279E-10	2.279E-10	-9.64220	1.00016	2.942
4601401	MgHCO3 +	2.311E-08	2.244E-08	-7.64902	0.97071	11.448
1503300	CaOH +	5.814E-11	5.644E-11	-10.24840	0.97071	-12.793
1501400	CaHCO3 +	1.596E-08	1.549E-08	-7.80983	0.97071	11.336
1501401	CaCO3 AQ	2.938E-10	2.939E-10	-9.53187	1.00016	3.101
5001400	NaCO3 -	5.888E-12	5.715E-12	-11.24297	0.97071	1.154
5001401	NaHCO3 AQ	1.571E-09	1.572E-09	-8.80367	1.00016	10.080
303300	AlOH +2	1.308E-11	1.161E-11	-10.93512	0.88788	-5.108
303301	Al(OH)2 +	4.343E-10	4.216E-10	-9.37514	0.97071	-10.087
303302	Al(OH)4 -	1.283E-10	1.246E-10	-9.90458	0.97071	-23.617
303303	Al(OH)3 AQ	1.678E-09	1.678E-09	-8.77515	1.00016	-16.000
2803300	FeOH +	1.340E-26	1.300E-26	-25.88589	0.97071	-9.676
2803301	FeOH3 -1	2.414E-35	2.343E-35	-34.63021	0.97071	-31.420
2803302	FeOH2 AQ	2.111E-31	2.111E-31	-30.67542	1.00016	-20.978
2813300	FeOH +2	8.500E-18	7.547E-18	-17.12223	0.88788	-2.287
2813301	FeOH2 +	1.146E-14	1.113E-14	-13.95368	0.97071	-5.657
2813302	FeOH3 AQ	4.133E-16	4.133E-16	-15.38369	1.00016	-13.600
2813303	FeOH4 -	1.347E-17	1.307E-17	-16.88369	0.97071	-21.587
2813304	Fe2(OH)2+4	3.136E-33	1.949E-33	-32.71021	0.62148	-2.936
2813305	Fe3(OH)4+5	9.278E-45	4.413E-45	-44.35532	0.47558	-6.182
8003300	SrOH +	6.801E-14	6.602E-14	-13.18032	0.97071	-13.372
1003300	BaOH +	1.039E-13	1.009E-13	-12.99620	0.97071	-13.561
2311400	CuCO3 AQ	3.154E-13	3.155E-13	-12.50106	1.00016	6.730
2311401	Cu(CO3)2-2	9.122E-19	8.100E-19	-18.09153	0.88788	9.882
2313300	CuOH +	9.383E-13	9.108E-13	-12.04059	0.97071	-7.987
2313301	Cu(OH)2 AQ	6.016E-12	6.017E-12	-11.22059	1.00016	-13.680
2313302	Cu(OH)3 -	1.184E-18	1.149E-18	-17.93960	0.97071	-26.886
2313303	Cu(OH) 4 -2	8.148E-25	7.234E-25	-24.14060	0.88788	-39.548
2313304	Cu2 (OH) 2+2	2.298E-19	2.041E-19	-18.69024	0.88788	-10.557
2311402	CuHCO3 +	1.914E-13	1.858E-13	-12.73106	0.97071	13.013
9503300	ZnOH +	5.686E-12	5.519E-12	-11.25811	0.97071	-9.139
9503301	Zn(OH)2 AO	3.121E-13	3.121E-13	-12.50570	1.00016	-16.899
9503302	Zn(OH)3 -	3.215E-18	3.121E-18	-17.50571	0.97071	-28.386
9503303	Zn(OH)4 - 2	1.762E - 24	1.564E - 24	-23.80572	0.88788	-41,147
9501400	ZnHCO3 +	4.128E-12	4.007E - 12	-11.39717	0,97071	12,413
9501401	ZnCO3 AO	1.006E - 12	1.007E - 12	-11 99717	1,00016	5.300
9501402	Zn(CO3)2-2	4.943E-17	4 389E-17	-16 35764	0.88788	9 682
1601400	Cd(CO3) 3-4	2.999F-30	1.864E-30	-29 72956	0.62148	6 427
1603300	CdOH +	2.331E - 14	2.263 E = 1.0	-13 64528	0 97071	-10 254
1603301	Cd(OH) 2 NO	5 9125-19	5 91/1-19	_17 22014	1 00016	-20 250
1603302	Cd(0H)2 -	2 1625-10	2 0005-24	-23 67015	0 07071	-33 207
1602202		6 660E 22	5 01/E 22	-23.0/013	0.9/0/1	-17 200
1602204	Cd204 +2	2 062E 22	1 5705 00	-31.22013	0.00/00	-47.298
1601400	Cduco2	2.0026-23	1.J/0E-23	-22.00190	0.10020	-9.430
1601400	Carcos +	2.210E-13	2.145E-13	-12.00801	0.9/0/1	12.413
1001401	Cacos AQ	0.700E-14	0./0/E-14	-13.16961	1.00016	5.399
6001400	PD(CO3)2-2	5.654E-20	5.020E-20	-19.29933	0.88/88	10.692
6003300	PDOH +	1./56E-14	1.705E-14	-13./6838	0.9/0/1	-7.697
6003301	PD(OH)2 AQ	2.09/E-17	2.097E-17	-16.67838	1.00016	-17.120

6003302	Pb(OH)3 -	7.844E-22	7.614E-22	-21.11839	0.97071	-28.047
6003303	Pb20H +3	1.379E-25	1.055E-25	-24.97675	0.76525	-6.244
6003304	Pb3 (OH) 4+2	1.312E-36	1.165E-36	-35.93371	0.88788	-24.207
6001401	PbCO3 AQ	9.797E-15	9.798E-15	-14.00885	1.00016	7.240
6003305	Pb(OH)4 -2	6.227E-27	5.528E-27	-26.25740	0.88788	-39.647
6001402	PbHCO3 +	2.911E-15	2.826E-15	-14.54885	0.97071	13.213
5403300	NiOH +	2.730E-13	2.650E-13	-12.57681	0.97071	-10.025
5403301	Ni(OH)2 AO	9.132E-16	9.133E-16	-15.03939	1.00016	-19.000
5403302	Ni(OH)3 -	2.975E-20	2.888E-20	-19.53939	0.97071	-29.987
5401400	NiHCO3 +	1.791E-12	1.738E-12	-11.75985	0.97071	12.483
5401401	NiCO3 AO	1.381E-11	1.381E-11	-10.85985	1.00016	6.870
5401402	Ni (CO3) 2-2	5.512E-17	4.894E-17	-16.31033	0.88788	10.162
3301400	HCO3 -	1.607E-05	1.560E-05	-4.80680	0.97071	10.397
3301401	H2C03 A0	1.053E-05	1.053E-05	-4.97738	1.00016	16.713
2113300	Cr+3	8.197E-12	6.273E-12	-11,20252	0.76525	10.024
2113301	Cr(OH) + 2	1.152E - 09	1.023E - 09	-8,99024	0.88788	5.672
8123301	=502-	8.034E-04	8.034E - 04	-3.09508	1.00000	-8,930
8123302	= SO2H2+	9.911E - 04	9.911E - 04	-3.00389	1.00000	7,290
8113301	=501-	1.988E-05	1.988E-05	-4.70164	1.00000	-8,930
8113302	=S01H2+	2.452E - 05	2.452E - 05	-4.61046	1.00000	7,290
8129500	=SO2Zn+	1.286E-08	1.286E-08	-7.89059	1.00000	-1,990
8119500	=SO1Zn+	2,903E-07	2.903E-07	-6.53716	1.00000	0.970
8121600	=SO2Cd+	8.472E-11	8.472E-11	-10.07203	1.00000	-2,900
8111600	=SO1Cd+	4.481E-09	4.481E-09	-8.34859	1.00000	0.430
8112310	=SO1Cu+	2.564E-07	2.564E-07	-6.59104	1.00000	2.850
8122310	=SO2Cu+	5.828E-08	5.828E-08	-7.23448	1.00000	0.600
8115400	=SO1Ni+	1.622E-08	1.622E-08	-7.78984	1.00000	0.150
8125400	=SO2Ni+	1.468E-09	1.468E-09	-8.83327	1.00000	-2.500
8116000	=SO1Pb+	1.783E-07	1.783E-07	-6.74884	1.00000	4.710
8126000	=SO2Pb+	2.804E-10	2.804E-10	-9.55227	1.00000	0.300
8121500	=SO2Ca+	8.191E-08	8.191E-08	-7.08664	1.00000	-5.850
8111500	=SO1HCa++	1.154E-06	1.154E-06	-5.93762	1.00000	4.970
8111000	=SO1HBa++	3.738E-08	3.738E-08	-7.42742	1.00000	5.460
Type II. ID	I - SPECIES W NAME	ITH FIXED ACT CALC MOL	IVITY LOG MOL	NEW LOGK	DH	
2	H20	1.806E-04	-3.743	0.000	0.000	
330	H+1	-5.967E-04	-3.224	6.500	0.000	
3301403	CO2 (g)	4.208E-04	-3.376	21.690	-0.530	
3300021	O2 (g)	1.144E-04	-3.941	-84.354	133.830	
2802810	Fe+2/Fe+3	-5.372E-07	-6.270	13.175	-10.000	
Type IV	- FINITE SOL	IDS (present a	at equilibriu	m)		
3028100	HEMATITE	2.686E - 07	-6 571	3 567	30 845	
2003002	DTASPORE	4.816E-06	-5.317	-7 225	24 630	
3021102	CR2O3	8.467E-09	-8.072	3.220	12,125	
0021102	01/200	0.10/11 05	0.072	5.220	12.120	
		PAR	r 4 of OUTPUT	FILE		
	PERC	ENTAGE DISTRI	BUTION OF COM	IPONENTS AMOI	NG .	
ADS1PSIO	TYPE I	and TYPE II (c	dissolved and	adsorbed)	species	
	506.6	PERCENT BO	JUND IN SPECI	ES #8123302	=SO2H2+	
	12.5	PERCENT BO	JUND IN SPECI	ES #8113302	=S01H2+	
ND01mvD0	1.2	PERCENT BO	JUND IN SPECI	ES #8111500	=SOIHCa++	
ADSTTIP2	76 7	DEDOEME D	VIND TH OPPOT	EC # 010	A DO 1 MUDO	
	10.1	PERCENT BO	JUND IN SPECI	ED # 0100001	ADSTTYP2	
	10.4	DEDCENT BO	DUND IN SPECI	EO #0123301	-502-	
Ba+2	12.9	LEVCENT R	JOND IN SECT	H0123302	-50242+	
-4.2	97.3	PERCENT BO	OUND IN SPECT	ES # 100	Ba+2	
	2.7	PERCENT BO	DUND IN SPECI	ES #8111000	=SO1HBa++	

Ca+2	· · · ·							
G.1.0	99.0	PERCENT	BOUND	IN	SPECIES	#	150	Ca+2
Ca+2	3 2	PERCENT	BOUND	TN	SPECIES	#	160	Cd+2
	1.8	PERCENT	BOUND	TN	SPECIES	#8121	600	=SO2Cd+
	95.0	PERCENT	BOUND	TN	SPECIES	#8111	600	=SO1Cd+
7n+2	50.0	1 Brioblin	2001.2					
	4.2	PERCENT	BOUND	IN	SPECIES	#8129	9500	=SO2Zn+
	94.9	PERCENT	BOUND	IN	SPECIES	#8119	9500	=SO1Zn+
Cu+2								
	81.5	PERCENT	BOUND	IN	SPECIES	#8112	2310	=SO1Cu+
	18.5	PERCENT	BOUND	IN	SPECIES	#8122	2310	=SO2Cu+
ADS1TYP1								
	75.9	PERCENT	BOUND	IN	SPECIES	#	811	ADS1TYP1
	10.3	PERCENT	BOUND	IN	SPECIES	#8113	3301	=S01-
	12.8	PERCENT	BOUND	IN	SPECIES	#8113	3302	=SO1H2+
K+1							110	**. 7
	100.0	PERCENT	BOUND	IN	SPECIES	#	410	K+1
Mg+2	100 0	DEDOENE	DOUND	TN	ODECTEC	щ	160	Marto
No.11	100.0	PERCENT	BOOND	TIN	SPECIES	#	400	Mg+2
Nati	100 0	DEDCENT	BOUND	TN	SDECTES	#	500	Na+1
Ni+2	100.0	FERCENT	DOOND	TIA	DIDCIDD	π	500	Nati
N1+Z	5 5	PERCENT	BOUND	TN	SPECTES	#	540	Ni+2
	86.6	PERCENT	BOUND	IN	SPECIES	#8115	5400	=SO1Ni+
	7.8	PERCENT	BOUND	IN	SPECIES	#8125	5400	=SO2Ni+
Pb+2								
	99.8	PERCENT	BOUND	IN	SPECIES	#8116	5000	=SO1Pb+
Sr+2								
	100.0	PERCENT	BOUND	IN	SPECIES	#	800	Sr+2
Cr(OH)2+								
	72.8	PERCENT	BOUND	IN	SPECIES	#	211	Cr(OH)2+
	16.6	PERCENT	BOUND	IN	SPECIES	#2113	3302	Cr(OH)3 AQ
	10.5	PERCENT	BOUND	IN	SPECIES	#2113	3301	Cr(OH)+2
A1+3								
	19.3	PERCENT	BOUND	IN	SPECIES	# 303	3301	Al(OH)2 +
	5.7	PERCENT	BOUND	IN	SPECIES	# 303	3302	AI (OH) 4 -
0 0 0	14.4	PERCENT	ROOND	IN	SPECIES	# 30.	3303	AI(OH)3 AQ
03-2	60 2	DEDCENT	POUND	TN	ODECTES	#2201	1400	4003 -
	30.5	PERCENT	BOUND	TN	SPECIES	#330.	1400	H2CO3 A0
Fo+2	39.5	FERCENT	DOOND	TIN	DEFCIED	#330.	LAOT	M2COJ AQ
1012	99 9	PERCENT	BOUND	TN	SPECIES	#	280	Fe+2
E-1	55.5	I BROBRI	DOOND	111	0100100	n	200	10.1
Fe+3								
	96.3	PERCENT	BOUND	IN	SPECIES	#2813	3301	FeOH2 +
	3.5	PERCENT	BOUND	IN	SPECIES	#2813	3302	FeOH3 AQ
H+1								
	7.0	PERCENT	BOUND	IN	SPECIES	#3301	1400	HCO3 -
	9.2	PERCENT	BOUND	IN	SPECIES	#3303	L401	H2CO3 AQ
	432.9	PERCENT	BOUND	IN	SPECIES	#8123	3302	=SO2H2+
	10.7	PERCENT	BOUND	IN	SPECIES	#8113	3302	=SO1H2+
H20								
	2.5	PERCENT	BOUND	IN	SPECIES	#3300	020	OH-
	1.5	PERCENT	BOUND	IN	SPECIES	#8129	9500	=S022n+
	34.3	PERCENT	BOUND	IN	SPECIES	#8119	9500	=S012n+
	30.3	PERCENT	BOUND	IN	SPECIES	#0100	2310	=501Cu+
	0.9	PERCENT	BOUND	TN	SPECIES	#0122	5400	-502Cu+
	21 0	PERCENT	BOUND	IN	SPECIES	#011:	5400	-SOIN1+
	21.0	EDRCENT	DOUND	TIN	DLECTED	#OTT (0000	-DOILDT

			PART 5 c	of OUTPUT FI	LE		
-		EQUILI	BRATED M	ASS DISTRIBU	JTION		
TDX	NAME	DISSOL	VED	SORBE	D	PRECIPI	TATED
1011		MOL/KG	PERCENT	MOL/KG	PERCENT	MOL/KG	PERCENT
100	Ba+2	1.346E-06	97.3	3.738E-08	2.7	0.000E-01	0.0
150	Ca+2	1.285E-04	99.0	1.236E-06	1.0	0.000E-01	0.0
160	Cd+2	1.494E-10	3.2	4.566E-09	96.8	0.000E-01	0.0
950	Zn+2	2.797E-09	0.9	3.032E-07	99.1	0.000E-01	0.0
231	Cu+2	3.990E-11	0.0	3.147E-07	100.0	0.000E-01	0.0
410	K+1	6.647E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Ma+2	1.440E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	2.088E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
540	Ni+2	1.045E-09	5.6	1.769E-08	94.4	0.000E-01	0.0
600	Pb+2	3.417E-13	0.0	1.786E-07	100.0	0.000E-01	0.0
800	Sr+2	5.707E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
211	Cr(OH)2+	1.097E-08	39.3	0.000E-01	0.0	1.693E-08	60.7
30	A1+3	2.254E-09	0.0	0.000E-01	0.0	4.816E-06	100.0
140	C03-2	2.665E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
280	Fe+2	2.262E-23	100.0	0.000E-01	0.0	0.000E-01	0.0
1	E-1	0.000E-01	0.0	0.000E-01	0.0	0.000E-01	0.0
281	Fe+3	1.190E-14	0.0	0.000E-01	0.0	5.372E-07	100.0
330	H+1	3.748E-05	16.4	1.914E-04	83.6	0.000E-01	0.0
2	H20	2.867E-08	3.4	8.187E-07	96.6	0.000E-01	0.0
Cha	rge Balance	: SPECIATED					
	Sum of Ci	ATIONS = 1.843	E-03 Sum	of ANIONS	8.394E-0	04	
	PERCENT	DIFFERENCE =	3.742E+01	(ANIONS -	CATIONS)	/(ANIONS +	CATIONS)
	NON-CARBON	ATE ALKALINITY	=	-3.046E-07			
	EQUILIBRIU	M IONIC STRENGT	H(m) =	6.946E-04			
	EQUILIBRIU	M pH	=	6.500			
	EQUILIBRIU	M pe	=	14.589 or	Eh =	846.50 mv	
****	*** DIFFUSE	LAYER ADSORPTI	ON MODEL	* * * * * * * *			
* * *	* Parameter:	s For Adsorbent	Number 1	****			
El	ectrostatic	Variables: ps	i0 = 0.09	0776 si	g0 = 0.00	09143	
		ps	ib = 0.00	00000 si	gb = 0.00	00000	
		ps	id = 0.00	00000 si	gd = 0.00	00000	
Ad	sorbent Cond	centration (g/l): 3.44	2			
Sp	ecific Surfa	ace Area (sq. m	eters/g):	600.00			

		PAF	RT 6	of OUTP	UT F	ILE					
Saturation	n indices and	stoichiome	etry	of all n	mine	rals	3				
ID #	NAME	Sat. Index	X	Sto	ichio	omet	ry in [bracl	ket:	5]	
2003000	ALOH3(A)	-3.542]	1.000]	30	[3.000]	2	I	-3.000]	330
5015000	ARAGONITE	-4.348]	1.000]	150	[1.000]	140			
5046000	ARTINITE	-13.488]	-2.000]	330	[2.000]	460]	1.000]	140
			[5.000]	2						
2003001	BOEHMITE	-1.755	[-3.000]	330	[1.000]	30]	2.000]	2
2046000	BRUCITE	-8.055	[1.000]	460	[2.000]	2	[-2.000]	330
5015001	CALCITE	-4.191	J	1.000]	150	I	1.000]	140			
2003002	DIASPORE	0.000	[-3.000]	330	[1.000]	30	I	2.000]	2
5015002	DOLOMITE	-8.336	[1.000]	150	I	1.000]	460	I	2.000]	140
2028100	FERRIHYDRITE	-6.675	[-3.000]	330	[1.000]	281	[3.000]	2
2028101	FE3(OH)8	-33.487]	-8.000]	330	[2.000]	281	[1.000]	280
]	8.000]	2						
2003003	GIBBSITE (C)	-1.871]	-3.000]	330	[1.000]	30	[3.000]	2
3003000	A1203	-8.530	[2.000]	30]	3.000]	2	[-6.000]	330
2028102	GOETHITE	-2.491	[-3.000]	330	[1.000]	281]	2.000]	2
3028100	HEMATITE	0.000]	-6.000]	330	[2.000]	281]	3.000]	2
5015003	HUNTITE	-20.785	[3.000]	460	I	1.000]	150]	4.000]	140
5046001	HYDRMAGNESIT	-33.209	[5.000]	460	I	4.000]	140]	-2.000]	330
]	6.000]	2						
3028101	MAGHEMITE	-9.953	[-6.000]	330]	2.000]	281	[3.000]	2

5046002	MAGNESITE	-4.643	[1.000]	460	[1.000]	140			
3028000	MAGNETITE	-17.723	[-8.000]	330	I	2.000]	281]	1.000]	280
			Г	4,0001	2						
3050000	NATRON	-11 511	r r	2 0001	500	٢	1 0001	140	ſ	10 0001	2
5050000	NAIRON	7.040	L	2.000]	100	r	1.000]	140	r	2 0001	2
5046003	NESQUEHONITE	-7.046	L	1.000]	400	l	1.000]	140	L	5.000]	2
5028000	SIDERITE	-20.914	L	1.000]	280	L	1.000]	140			
5080000	STRONTIANITE	-5.746	[1.000]	800	[1.000]	140			
5050001	THERMONATR	-16.242	[2.000]	500	Į	1.000]	140	[1.000]	2
5010000	WITHERITE	-6.023	Γ	1.000]	100]	1.000]	140			
5023100	CUCO3	-9,601	ſ	1,0001	231	ſ	1.0001	140			
2022100	CU (OU) 2	6 200	r	-2 0001	330	r	1 0001	231	Г	2 0001	2
2023100	CU (UR) Z	-0.390	L	2.000]	220	L	1.000]	201	L r	1.000]	2
2023101	TENORITE	-5.378	L	-2.000]	330	L	1.000	231	L	1.000]	2
3023100	CUPRICFERIT	-7.541	[-8.000]	330	[1.000]	231	Ĺ	2.000]	281
			[4.000]	2						
95000	ZN METAL	-64.066	J	1.000]	950]	2.000]	1			
5095000	SMITHSONITE	-7.359	Г	1.0001	950	ſ	1.0001	140			
5095001	ZNCO3 1H20	-7 037	r	1 0001	950	ſ	1 0001	140	٢	1,0001	2
20050001	ZN (OU) 2 (A)	-9 057	L L	-2 0001	330	r	1 0001	950	r	2 0001	2
2095000	2N(OH) 2 (A)	-0.037	L	-2.000]	220	L	1,000]	050	L	2.000]	20
2095001	ZN (OH) 2 (C)	-7.807	L	-2.000]	330	L	1.000]	950	L	2.000]	2
2095002	ZN (OH) 2 (B)	-7.357	[-2.000]	330	[1.000]	950	L	2.000]	2
2095003	ZN (OH) 2 (G)	-7.317	[-2.000]	330	[1.000]	950	[2.000]	2
2095004	ZN(OH)2 (E)	-7.107	[-2.000]	330	[1.000]	950	[2.000]	2
2095005	ZNO (ACTIVE)	-6.917	ſ	-2.0001	330	Γ	1.0001	950	ſ	1.0001	2
	/										
TD #	NAME Sa	t Index		Stoic	niome	tri	in [hr	acket	- 5]		
10 #	ATNOTED DA	7 050	r	2 0001	220	- L L J	1 0001	050	L C L	1 0001	2
2095006	ZINCITE	-7.059	L	-2.000]	330	L	1.000]	950	L	1.000]	Z
16000	CD METAL	-52.802	L	1.000]	160	L	2.000]	1			
16001	GAMMA CD	-52.904	[1.000]	160	[2.000]	1			
5016000	OTAVITE	-4.837	[1.000]	160]	1.000]	140			
2016000	CD(OH)2 (A)	-10.905	[-2.0001	330	Γ	1.000]	160]	2.000]	2
2016001	CD(OH) 2 (C)	-10.528	ſ	-2,0001	330	ſ	1.0001	160	ſ	2.0001	2
2016002	MONTEDONITE	-12 352	r	-2 0001	330	r	1 0001	160	r	1 0001	2
2010002	MONIEPONIIE	-12.332	L	1 0001	550	L	2.000]	100	L	1.000]	2
60000	PB METAL	-46.000	L	1.000]	600	L	2.000]	1 4 0			
5060000	CERRUSITE	-8.049	L	1.000]	600	L	1.000]	140			
2060000	MASSICOT	-12.708	[-2.000]	330	[1.000]	600	[1.000]	2
2060001	LITHARGE	-12.512	[-2.000]	330]	1.000]	600	I	1.000]	2
2060002	PBO, .3H2O	-12.538	[-2.000]	330	[1.000]	600	I	1.330]	2
5060001	PB20C03	-20.471	ſ	-2.0001	330	ſ	2.0001	600	ſ	1,0001	2
0000001	1220000	20.112	ſ	1 0001	140	L	2.000]		L	2.0001	
500000	DD202002	21 762	L	1.000]	220	r	2 0001	600	Г	1 0001	140
5060002	PB302C03	-31.703	L	-4.000]	330	L	3.000]	600	L	1.000]	140
			L	2.000]	2						
2060003	PLATTNERITE	-7.692	[-4.000]	330]	-2.000]	1	[1.000]	600
			[2.000]	2						
3060000	PB203	-17.980	[-6.000]	330	[-2.000]	1	[2.000]	600
			1	3.0001	2						
3060001	MINITIM	-31 656	r	-8 0001	330	٢	-2 0001	1	٦	3 0001	600
5000001	111141 011	51.050	L L	4 0001	200	L	2.000]	-	L	0.000]	000
000000	DD (OUL) O (C)	7 000	L	4.000]	220	r	1 0001	600	r	2 0001	2
2060004	PB(OH)2 (C)	-7.908	L	-2.000]	330	L	1.000]	600	L	2.000]	2
5060003	HYDCERRUSITE	-24.596	L	-2.000]	330	[3.000]	600	L	2.000]	140
			[2.000]	2						
2060005	PB20 (OH) 2	-25.317	I	-4.000]	330	[2.000]	600]	3.000]	2
5054000	NICO3	-11.032	T.	1.0001	540	ſ	1.0001	140			
2054000	NT (OH) 2	-6 404	ſ	-2 0001	330	Г	1 0001	540	Г	2 0001	2
2054000	DUNCENTE	0 0 2 1	L T	-2.0001	220	L L	1 0001	540	r	1 0001	2
2034001	DUNSENTIE	-0.031	L	-2.000]	001	L	1.000]	040	L r	1.000]	140
5023101	MALACHITE	-11.815	L	2.000]	231	L	2.000]	2	L	1.000]	140
			Į	-2.000]	330						
5023102	AZURITE	-19.422	[3.000]	231	[2.000]	2	[2.000]	140
			[-2.000]	330						
2015000	LIME	-24.401	ſ	-2.0001	330	Γ	1.0001	150	Γ	1.0001	2
2015001	PORTLANDITE	-14 056	Г	-2 0001	330	ſ	1,0001	150	ſ	2.0001	2
20220001	WIICHTHE	-20 526	L r	-2 0001	330	r	0 0471	280	r	1 0001	2
2028000	WUSITIE	-20.550	L	-2.000]	220	L	0.947]	200	L	1.000]	2
2046001	PERICLASE	-12.920	[-2.000]	330	L	1.000]	460	L	1.000]	2
3028001	HERCYNITE	-23.529	[-8.000]	330	[1.000]	280	[2.000]	30
			[4.000]	2						
3046000	SPINEL	-14.049	[-8.000]	330	[1.000]	460	[2.000]	30

3046001	MAG-FERRITE	-12.178	[[[4.000] -8.000] 4.000]	2 330 2	[1.000]	460	[2.000]	281
3028102	LEPIDOCROCIT	-3.155]	-3.000]	330	[1.000]	281]	2.000]	2
3021100	FECR204	-12.371	[2.000]	211	I	1.000]	280]	-4.000]	330
3021101	MGCR204	-6.763	[2.000]	211	3	1.000]	460	[-4.000]	330
3021102	CR203	0.000	[2.000]	211	I	-2.000]	330	[-1.000]	2
2021102	CR (OH) 3 (A)	-0.860	[1.000]	211	J	1.000]	2	I	-1.000]	330
2021101	CR (OH) 3 (C)	-3.412	[1.000]	211	[1.000]	2	[-1.000]	330

3 - Modelling with pH = 7.0

		PART	1 of OUTPU	JT FILE				
Revuè ri	ver water-Site	14 - pH = 7	.0	_				
Entered	PCO2, PO2, fixe	ed pH, solid	ls allowed	to precip	pitate,	Fe red	lox pair	and
adsorpti	on							
	turne (Coloina)	. 10 20						
Tempera	ture (Celsius)	: 19.30						
Units o	trongth to bo	n: MG/L						
lonic s	trength to be	computed.			:			
Carbona	te concentration	on represent	s carbonate	alkalin	rty.	200		
Do not	automatically	terminate if	charge int	be there	adunami	JUS a datab	and and	
Precipi	tation is allo	wed for all	solids in t	ine therm	odynami	C Ualab	ase and	
une p	int option to	itorationa	set to: I					
The max	had wood to go		IS: 200	onte ici	Dattion	omisti	on	
Ine met	diate output f	ilo	cy coerrici	Lenico 15.	Davies	equati	011	
Adsorpt	ion model: Dif	fuse Laver						
Number	of adsorbing s	urfaces. 1						
INPUT DA	TA BEFORE TYPE	MODIFICATIO	NS					
ID	NAME	ACTIVITY G	UESS LOG	G GUESS	ANAL T	OTAL		
330	H+1	1.000	E-07	-7.000	0.000	E-01		
30	A1+3	4.786	E-06	-5.320	1.300	E-01		
100	Ba+2	1.380	E-06	-5.860	1.900	E-01		
150	Ca+2	1.288	E-04	-3.890	5.200	E+00		
160	Cd+2	4.677	E-09	-8.330	5.300	E-04		
211	Cr(OH)2+	2.818	E-08	-7.550	2.400	E-03		
231	Cu+2	3.162	E-07	-6.500	2.000	E-02		
280	Fe+2	5.370	E-07	-6.270	3.000	E-02		
410	K+1	6.607	E-05	-4.180	2.599	E+00		
460	Mg+Z	1.445	E-04	-3.840	3.500	E+00		
500	Na+1	2.089	E-04	-3.680	4.800	E+00		
540	NITZ Db+2	1.002	E-00	-7.750	2 700	E-03		
800	PD+2 Sr+2	5 754	E-07	-6.750	5.000	E-02		
950	51+2 7n+2	3 000	E-07	-6.510	2 000	E-02 E-02		
950	ZII+Z F_1	1 000	E-07 E-16	-16,000	2.000	E-02 E-01		
140	CO3-2	2 188	E = 0.4	-3 660	1 310	E+01		
281	Fet3	1.778	E-21	-20.750	0.000	E = 01		
813	ADS1PSTO	1 000	E+00	0 000	0 000	E-01		
811	ADS1TYP1	1,905	E = 0.4	-3.720	1,922	E - 04		
812	ADS1TYP2	7.762	E-03	-2.110	7.690	E-03		
2	H20	1.000	E+00	0.000	0.000	E-01		
Cha	rge Balance: Ul	NSPECIATED						
S	um of CATIONS=	8.438E-04	Sum of ANIC	NS = 4.1	366E-04			101
P	ERCENT DIFFERE	NCE = 3.180	E+UI (ANIC	DNS - CAT	IONS)/(.	ANIONS	+ CATIO	NS)
		PART	3 of OUTPU	JT FILE				
Type II	- OTHER SPECIES	S IN SOLUTIO	N OR ADSORE	BED				
ID	NAME	CALC MOL	ACTIVITY	LOG ACT	VTY	GAMMA	NEW	LOGK
8121000	=SO2Ba+	2.449E-11	2.449E-11	-10.61	101 1	.00000	-7.3	200
2113302	Cr(OH)3 AQ	1.818E-09	1.819E-09	-8.74	025 1	.00016	-7.1	130
2113303	Cr(OH)4-	1.789E-13	1.737E-13	-12.76	026 0	.97072	-18.	137
2113304	Cr02-	4.540E-13	4.407E-13	-12.35	585 0	.97072	-17.	733
3300020	OH-	6.672E-08	6.477E-08	-7.18	865 0	.97072	-14.1	176
4603300	MgOH +	1.304E-09	1.266E-09	-8.89	763 0	.97072	-11.	991
4601400	MgCO3 AQ	2.278E-09	2.278E-09	-8.64	236 1	.00016	2.	942
4601401	MgHCO3 +	7.307E-08	7.093E-08	-7.14	918 0	.97072	11.	148
1503300	CaOH +	1.714E-10	1.664E-10	-9.77	885 0	.97072	-12.	793
1501400	CaHCO3 +	4.706E-08	4.568E-08	-7.34	028 0	.97072	11.3	336
1501401	CaCO3 AQ	2.739E-09	2.740E-09	-8.56	232 1	.00016	3.	101
5001400	NaCO3 -	5.887E-11	5.715E-11	-10.24	297 0	.97072	1.1	154

5001401	NaHCO3 AQ	4.969E-09	4.970E-09	-8.30368	1.00016	10.080
303300	AlOH +2	1.308E-12	1.161E-12	-11.93512	0.88793	-5.108
303301	Al(OH)2 +	1.373E-10	1.333E-10	-9.87514	0.97072	-10.087
303302	Al(OH)4 -	4.058E-10	3.939E-10	-9.40458	0.97072	-23.617
303303	Al(OH)3 AQ	1.678E-09	1.678E-09	-8.77515	1.00016	-16.000
2803300	FeOH +	4.237E-27	4.113E-27	-26.38589	0.97072	-9.676
2803301	FeOH3 -1	7.633E-35	7.410E-35	-34.13021	0.97072	-31.420
2803302	FeOH2 AO	2.111E-31	2.111E-31	-30.67542	1.00016	-20.978
2813300	FeOH +2	8.499E-19	7.547E-19	-18.12223	0.88793	-2.287
2813301	FeOH2 +	3.624E-15	3.518E-15	-14,45368	0.97072	-5.657
2813302	FOOHS AO	4 133E-16	4 133E-16	-15,38369	1.00016	-13,600
2813303	FeOH4 -	4 258E-17	4 133E-17	-16.38369	0.97072	-21.587
2813304	Fo2 (OH) 2+4	3 1358-35	1 949F-35	-34 71021	0.62160	-2 936
2013304	Fo3 (OH) 4+5	2 9335-17	1.395E - 17	-46 85532	0 47573	-6 182
2013303	res (on) 415	2.555E-47 2.151E-13	2.099E - 13	-12 68032	0.97072	-13 372
1003300	BOOH +	2.1316-13	2.000E - 13	-12.57664	0.97072	-13 561
2211400	Baun +	2.751E-13 2.461E-12	2.031E-13	-12.07004	1 00016	6 730
2311400	CUCOS AQ	3.401E-13	3.401E-13	-12.40070	1.00010	0.730
2311401	Cu(CO3)Z=Z	1.001E-17	8.88/E-18	-17.05124	0.00/93	9.002
2313300	CUOH +	3.256E-13	3.160E-13	-12.50029	0.97072	-7.987
2313301	Cu(OH) Z AQ	6.601E-12	6.602E-12	-11.18029	1.00016	-13.680
2313302	Cu(OH)3 -	4.108E-18	3.987E-18	-17.39930	0.97072	-26.886
2313303	Cu(OH) 4 -2	8.940E-24	7.938E-24	-23.10031	0.88793	-39.548
2313304	Cu2 (OH) 2+2	2.767E-20	2.457E-20	-19.60964	0.88793	-10.557
2311402	CuHCO3 +	6.640E-14	6.445E-14	-13.19076	0.97072	13.013
9503300	ZnOH +	2.002E-12	1.943E-12	-11.71152	0.97072	-9.139
9503301	Zn(OH)2 AQ	3.474E-13	3.474E - 13	-12.45911	1.00016	-16.899
9503302	Zn(OH)3 -	1.132E-17	1.099E-17	-16.95912	0.97072	-28.386
9503303	Zn(OH)4 -2	1.961E-23	1.741E-23	-22.75912	0.88793	-41.147
9501400	ZnHCO3 +	1.453E-12	1.411E - 12	-11.85058	0.97072	12.413
9501401	ZnCO3 AQ	1.120E-12	1.121E-12	-11.95057	1.00016	5.300
9501402	Zn(CO3)2-2	5.503E-16	4.886E-16	-15.31105	0.88793	9.682
1601400	Cd(CO3)3-4	3.411E-28	2.120E-28	-27.67364	0.62160	6.426
1603300	CdOH +	8.386E-15	8.140E-15	-14.08935	0.97072	-10.254
1603301	Cd(OH)2 AQ	6.725E-18	6.726E-18	-17.17222	1.00016	-20.350
1603302	Cd(OH)3 -	7.775E-24	7.547E-24	-23.12222	0.97072	-33.287
1603303	Cd(OH)4 -2	7.575E-31	6.726E-31	-30.17223	0.88793	-47.298
1603304	Cd20H +3	8.434E-25	6.455E-25	-24.19011	0.76533	-9.430
1601400	CdHCO3 +	7.947E-14	7.715E-14	-13.11268	0.97072	12.413
1601401	CdCO3 AQ	7.696E-14	7.697E-14	-13.11368	1.00016	5.399
6001400	Pb(CO3)2-2	6.254E-19	5.553E-19	-18.25547	0.88793	10.692
6003300	PbOH +	6.143E-15	5.963E-15	-14.22452	0.97072	-7.697
6003301	Pb(OH)2 AQ	2.320E-17	2.320E-17	-16.63453	1.00016	-17.120
6003302	Pb(OH)3 -	2.744E-21	2.664E-21	-20.57454	0.97072	-28.047
6003303	Pb2OH +3	5.335E-27	4.083E-27	-26.38904	0.76533	-6.244
6003304	Pb3 (OH) 4+2	1.776E-37	1.577E-37	-36.80215	0.88793	-24.207
6001401	PbCO3 AQ	1.084E-14	1.084E-14	-13.96499	1.00016	7.240
6003305	Pb(OH)4 -2	6.888E-26	6.116E-26	-25.21354	0.88793	-39.647
6001402	PbHCO3 +	1.018E-15	9.886E-16	-15.00500	0.97072	13.213
5403300	NiOH +	1.000E-13	9.710E-14	-13.01280	0.97072	-10.025
5403301	Ni(OH)2 AO	1.058E-15	1.058E-15	-14.97538	1.00016	-19.000
5403302	Ni(OH)3 -	1.090E-19	1.058E-19	-18.97539	0.97072	-29.987
5401400	NiHCO3 +	6.562E-13	6.370E-13	-12.19584	0.97072	12.483
5401401	NiCO3 AO	1.600E - 11	1.600E - 11	-10.79584	1.00016	6.870
5401402	Ni (CO3) 2-2	6.387E - 16	5.671E-16	-15,24632	0.88793	10,162
3301400	HC03 -	5 083E-05	4 934E-05	-4 30680	0 97072	10.397
3301401	H2CO3 AO	1.053E-05	1.053E-05	-4 97738	1 00016	16 713
2113300	(r+3	2 5928-13	1 984F-13	-12,70252	0.76533	10 024
2113300	Cr(OH)+2	1 1528-10	1.023F - 10	-9 99021	0.88793	5 672
8123301	=\$02-	8 5105-04	8 5105-04	-3 06961	1 00000	_8 930
8123301	=502424	9 36AF-04	9 361F-04	-3 02955	1 00000	7 200
0112201	-502112+	2 0160-04	2 0165-05	-1 605/1	1 00000	_0 020
0112202	-301-	2.0101-05	2 2165-05	-4.09041	1 00000	-0.930
0120500	-501127	1 2525 00	1 3535 00	_7 0606F	1 00000	-1 000
0129300	-9012211	2 0215 07	2 9215 07	-6 52115	1 00000	-1.990
9121600	-90204	0 104E-11	0 10/F-11	-10 04076	1 00000	-2 000
OTSTOND	-DUZCUT	J. 1046-11	J. IU46-II	10.040/0	1.00000	2.300

8111600 8112310 8122310 8115400 8125400 8116000 8126000 8121500 8111500 8111000	=S01Cd+ =S01Cu+ =S02Cu+ =S01Ni+ =S02Ni+ =S01Pb+ =S02Pb+ =S02Ca+ =S01HCa++ =S01HBa++	4.607E-09 2.543E-07 6.042E-08 1.699E-08 1.607E-09 1.783E-07 2.930E-10 7.215E-07 9.183E-06 2.650E-07	4.607E-09 2.543E-07 6.042E-08 1.699E-08 1.607E-09 1.783E-07 2.930E-10 7.215E-07 9.183E-06 2.650E-07	-8.33655 -6.59463 -7.21883 -7.76972 -8.79392 -6.74887 -9.53307 -6.14175 -5.03701 -6.57681	1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000 1.00000	0.430 2.850 0.600 0.150 -2.500 4.710 0.300 -5.850 4.970 5.460
Type II:	I - SPECIES WIT	H FIXED ACT	IVITY			
ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH	
2	H2O	1.457E-04	-3.836	0.000	0.000	
3301403	CO2 (g)	3.856E-04	-3.414	21.690	-0.530	
3300021	O2 (g)	1.143E-04	-3.942	-84.354	133.830	
2802810	Fe+2/Fe+3	-5.372E-07	-6.270	13.175	-10.000	
Type IV	- FINITE SOLIE	S (present	at equilibrium	n)	511	
1D 3028100	NAME	CALC MOL	LOG MOL	NEW LOGK	DH 30 845	
2003002	DIASPORE	4.816E-06	-5.317	-7.225	24.630	
3021102	CR203	1.172E-08	-7.931	3.220	12.125	
		DAD		FTTF		
	PERCEN	TAGE DISTRI	BUTION OF COME	PONENTS AMON	1G	
	TYPE I an	d TYPE II (dissolved and	adsorbed) s	species	
ADS1PSIO	075 0	DEDOEME D	OUND IN ODEOTI	40102200	0001101	
	20.7	PERCENT B	OUND IN SPECIE	LS #8123302	=S02H2+ =S01H2+	
	17.2	PERCENT B	OUND IN SPECIE	S #8111500	=SO1HCa++	
ADS1TYP2						
	76.7	PERCENT B	OUND IN SPECIE	S # 812	ADS1TYP2	
	12.2	PERCENT B	OUND IN SPECIE	S #8123302	=S02H2+	
Ba+2						
	80.8	PERCENT B	OUND IN SPECIE	S # 100	Ba+2	
Ca+2	19.2	PERCENT B	OUND IN SPECIE	12 #8111000	=SOIHBa++	
ou · L	92.3	PERCENT B	OUND IN SPECIE	CS # 150	Ca+2	
	7.1	PERCENT B	OUND IN SPECIE	CS #8111500	=SO1HCa++	
Cd+2	1 0	DEDCENT D	OUND IN ODECTE	rg #0121600	-90204+	
	97.7	PERCENT B	OUND IN SPECIE	S #8121600	=S01Cd+	
Zn+2						
	4.4	PERCENT B	OUND IN SPECIE	LS #8129500	=SO2Zn+	
C_{11+2}	95.5	PERCENT B	OUND IN SPECIE	22 #8119200	=5012n+	
ou.L	80.8	PERCENT B	OUND IN SPECIE	LS #8112310	=SO1Cu+	
	19.2	PERCENT B	OUND IN SPECIE	CS #8122310	=SO2Cu+	
ADS1TYP1	72 7	DEDCENT D	OUND IN SPECIE	rg # 911		
	10.5	PERCENT B	OUND IN SPECIE	LS #8113301	=S01-	
	11.5	PERCENT B	OUND IN SPECIE	S #8113302	=SO1H2+	
**. 1	4.8	PERCENT BO	UND IN SPECIES	8 #8111500	=SO1HCa++	
K+1	100.0	PERCENT R	OUND IN SPECIE	S # 410	K+1	
Mg+2	200.0	Langent D	COND IN DEBOIL			
	99.9	PERCENT B	OUND IN SPECIE	LS # 460	Mg+2	
Na+1	100 0	DEDCENT D	OUND IN OPECTE	R # 500	Na+1	
Ni+2	100.0	LEVONI D	OOND IN SECT	π 300	NATI	

	90.7	PERCENT	BOUND	IN	SPECIES	#8115400	=SO1Ni+
	8.6	PERCENT	BOUND	IN	SPECIES	#8125400	=SO2Ni+
Pb+2							
	99.8	PERCENT	BOUND	IN	SPECIES	#8116000	=SO1Pb+
Sr+2							
	100.0	PERCENT	BOUND	IN	SPECIES	# 800	Sr+2
Cr(OH)2+							
	56.6	PERCENT	BOUND	IN	SPECIES	# 211	Cr(OH)2+
	40.8	PERCENT	BOUND	IN	SPECIES	#2113302	Cr(OH)3 AQ
	2.6	PERCENT	BOUND	IN	SPECIES	#2113301	Cr(OH)+2
A1+3							
	6.2	PERCENT	BOUND	IN	SPECIES	# 303301	Al(OH)2 +
	18.3	PERCENT	BOUND	IN	SPECIES	# 303302	Al(OH)4 -
	75.5	PERCENT	BOUND	IN	SPECIES	# 303303	Al(OH)3 AQ
CO3-2							
	82.6	PERCENT	BOUND	IN	SPECIES	#3301400	HCO3 -
	17.1	PERCENT	BOUND	IN	SPECIES	#3301401	H2CO3 AQ
Fe+2							
	99.8	PERCENT	BOUND	IN	SPECIES	# 280	Fe+2
E-1							
Fe+3							
	88.8	PERCENT	BOUND	IN	SPECIES	#2813301	FeOH2 +
	10.1	PERCENT	BOUND	IN	SPECIES	#2813302	FeOH3 AQ
	1.0	PERCENT	BOUND	IN	SPECIES	#2813303	FeOH4 -
H+1							
	32.4	PERCENT I	BOUND	IN S	SPECIES #	\$3301400	HCO3 -
	13.4	PERCENT	BOUND	IN	SPECIES	#3301401	H2CO3 AQ
	596.5	PERCENT	BOUND	IN	SPECIES	#8123302	=SO2H2+
	14.1	PERCENT	BOUND	IN	SPECIES	#8113302	=S01H2+
H20							
	7.4	PERCENT	BOUND	IN	SPECIES	#3300020	OH-
	1.5	PERCENT	BOUND	IN	SPECIES	#8129500	=SO2Zn+
	32.5	PERCENT	BOUND	IN	SPECIES	#8119500	=SO1Zn+
	28.3	PERCENT	BOUND	IN	SPECIES	#8112310	=SO1Cu+
	6.7	PERCENT	BOUND	IN	SPECIES	#8122310	=SO2Cu+
	1.9	PERCENT	BOUND	IN	SPECIES	#8115400	=SO1Ni+
	19.8	PERCENT	BOUND	IN	SPECIES	#8116000	=SO1Pb+

PART 5 of OUTPUT FILE _____

IDX	NAME	DISSOL	VED	SORBE	D	PRECIPI	TATED
		MOL/KG	PERCENT	MOL/KG	PERCENT	MOL/KG	PERCENT
100	Ba+2	1.118E-06	80.8	2.650E-07	19.2	0.000E-01	0.0
150	Ca+2	1.198E-04	92.4	9.905E-06	7.6	0.000E-01	0.0
160	Cd+2	1.712E-11	0.4	4.698E-09	99.6	0.000E-01	0.0
950	Zn+2	3.150E-10	0.1	3.056E-07	99.9	0.000E-01	0.0
231	Cu+2	1.090E-11	0.0	3.147E-07	100.0	0.000E-01	0.0
410	K+1	6.647E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	1.440E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	2.088E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
540	Ni+2	1.360E-10	0.7	1.860E-08	99.3	0.000E-01	0.0
600	Pb+2	5.247E-14	0.0	1.786E-07	100.0	0.000E-01	0.0
800	Sr+2	5.707E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
211	Cr(OH)2+	4.462E-09	16.0	0.000E-01	0.0	2.344E-08	84.0
30	A1+3	2.222E-09	0.0	0.000E-01	0.0	4.816E-06	100.0
140	CO3-2	6.151E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
280	Fe+2	2.265E-24	100.0	0.000E-01	0.0	0.000E-01	0.0
1	E-1	0.000E-01	0.0	0.000E-01	0.0	0.000E-01	0.0
281	Fe+3	4.081E-15	0.0	0.000E-01	0.0	5.372E-07	100.0
330	H+1	7.205E-05	45.9	8.494E-05	54.1	0.000E-01	0.0
2	H20	7.685E-08	8.5	8.223E-07	91.5	0.000E-01	0.0

Charge Balance: SPECIATED Sum of CATIONS = 1.785E-03 Sum of ANIONS 9.230E-04 PERCENT DIFFERENCE = 3.184E+01 (ANIONS - CATIONS)/(ANIONS + CATIONS) = -3.613E - 08NON-CARBONATE ALKALINITY EQUILIBRIUM IONIC STRENGTH (m) = 6.940E-04 = 7.000 EQUILIBRIUM pH = 14.089 EQUILIBRIUM pe or Eh = 817.49 mv****** DIFFUSE LAYER ADSORPTION MODEL ******* sig0 = 0.004996 sigb = 0.0000 **** Parameters For Adsorbent Number 1 **** Electrostatic Variables: psi0 = 0.063218 psib = 0.000000psid = 0.000000sigd = 0.000000Adsorbent Concentration (g/l): 3.442 Specific Surface Area (sq. meters/q): 600.00 PART 6 of OUTPUT FILE Saturation indices and stoichiometry of all minerals ID # NAME Sat. Index Stoichiometry in [brackets] [1.000] 30 [3.000] 2 [-3.000] 330 [1.000] 150 [1.000] 140 -3.542 -3.378 2003000 ALOH3(A) 5015000 ARAGONITE 5046000 ARTINITE -11.488[-2.000] 330 [2.000] 460 [1.000] 140 [5.000] 2 2003001 BOEHMITE 2046000 BRUCITE -1.755 [-3.000] 330 [1.000] 30 [2.000] 2 -7.055 [1.000] 460 [2.000] 2 [-2.000] 330 5015001 CALCITE -3.221 [1.000] 150 [1.000] 140 5015002 DIASPORE 2028100 PERS [-3.000] 330 [1.000] 30 [2.000] 2 [1.000] 150 [1.000] 460 [2.000] 140 [-3.000] 330 [1.000] 281 [3.000] 2 0.000 -6.366 2028100 FERRIHYDRITE -6.675 [-8.000] 330 [2.000] 281 [1.000] 280 2028101 FE3(OH)8 -33.487 [8.000] 2 2003003 GIBBSITE (C) -1.871 2 [-3.000] 330 [1.000] 30 [3.000] 3003000 A1203 [2.000] 30 [3.000] 2 [-6.000] 330 [-3.000] 330 [1.000] 281 [2.000] 2 -8.530 [1.000] 281 -2.491 0.000 [2.000] 2 2028102 GOETHITE [2.000] 281 [3.000] 2 [1.000] 150 [4.000] 140 3028100 HEMATITE [-6.000] 330 5015003 HUNTITE [3.000] 460 -16.816 [[5.000] 460 [4.000] 140 [-2.000] 330 5046001 HYDRMAGNESIT -28.210 [6.000] 2 3028101 MAGHEMITE -9.953 [-6.000] 330 [2.000] 281 [3.000] 2 5046002 MAGNESITE -3.643 [1.000] 460 [1.000] 140 [-8.000] 330 [2.000] 281 [1.000] 280 3028000 MAGNETITE -17.723 [4.000] 2 [2.000] 500 [[1.000] 460 [3050000 NATRON -13.541 1.000] 140 [10.000] 2 1.000] 140 [3.000] 5046003 NESQUEHONITE -6.046 2 -20.914 [1.000] 280 [1.000] 140 5028000 SIDERITE 5080000 STRONTIANITE -4.746 [1.000] 800 [1.000] 140 -15.242 [2.000] 500 [1.000] 140 [1.000] 5050001 THERMONATR 2 -5.103 5010000 WITHERITE [1.000] 100 [1.000] 140 [1.000] 231 [-2.000] 330 [1.000] 140 5023100 CUCO3 -9.561 [1.000] 231 [2.000] [1.000] 231 [1.000] 2023100 CU(OH)2 -6.358 2 -5.338 [[-2.000] 330 2023101 TENORITE 2 [2.000] 281 3023100 CUPRICFERIT -7.500 [-8.000] 330 [1.000] 231 [4.000] 2 95000 ZN METAL -64.020 [1.000] 950 [2.000] 1 -7.313 [1.000] 950 [1.000] 140 5095000 SMITHSONITE -6.991 5095001 ZNCO3, 1H20 [1.000] 950 [1.000] 140 [1.000] 2 2095000 ZN(OH)2 (A) -8.010 [-2.000] 330 [1.000] 950 [2.000] 2 [-2.000] 330 [1.000] 950 [2.000] [1.000] 950 [2.000] [1.000] 950 [2.000] [1.000] 950 [2.000] 2095001 ZN(OH)2 (C) -7.760 2 -7.310 2095002 ZN(OH)2 (B) [-2.000] 330 2 [-2.000] 330 [2095003 ZN(OH)2 (G) -7.270 2 -7.060[-2.000]330[1.000]950[2.000]-6.870[-2.000]330[1.000]950[1.000] 2095004 ZN(OH)2 (E) 2 2095005 ZNO(ACTIVE) 2 ID # NAME Sat. Index Stoichiometry in [brackets] -7.012 [-2.000] 330 [1.000] 950 [1.000] 2095006 ZINCITE 2
 -52.746
 [1.000] 160
 [2.000] 1

 -52.848
 [1.000] 160
 [2.000] 1
16000 CD METAL 16000 CD METAL 16001 GAMMA CD

5016000	OTAVITE	-4.781		[1.000]	160]	1.000]	140			
2016000	CD(OH)2 (A)	-10.849		[-2.000]	330	I	1.000]	160	Į	2.000]	2
2016001	CD(OH)2 (C)	-10.472		-2.000]	330	[1.000]	160	[2.000]	2
2016002	MONTEPONITE	-12.296	1	-2.000]	330	I	1.000]	160	[1.000]	2
60000	PB METAL	-45.956		1.000]	600	ſ	2.000]	1			
5060000	CERRUSITE	-8.006	1	1.0001	600	ſ	1.0001	140			
2060000	MASSICOT	-12,664		-2.0001	330	ſ	1.0001	600	ſ	1,0001	2
2060001	LITHARGE	-12,469	1	-2.0001	330	ſ	1.0001	600	ſ	1,0001	2
2060002	PBO. 3H20	-12.495	1	-2,0001	330	ſ	1.0001	600	ſ	1 3301	2
5060001	PB20C03	-20.383	1	-2.0001	330	ſ	2,0001	600	ſ	1,0001	2
2000001	1220000	20.000	1	1,0001	140	L	2.000	000	L	1.000]	-
5060002	PB302003	-31 632	Î	-4 0001	330	Г	3 0001	600	ſ	1 0001	140
5000002	1.0002000	51.052	1	2 0001	2	L	5.000]	000	L	1.000]	110
2060003	PLATTNERTTE	-7 648	1	-4 0001	330	Г	-2 0001	1	٢	1 0001	600
2000000			1	2.0001	2	L	21000]	-	L	1.000]	000
3060000	PB203	-17.892	1	-6.0001	330	ſ	-2,0001	1	ſ	2,0001	600
0000000	10000		ſ	3.0001	2	L		-	L	2.000)	000
3060001	MINIUM	-31,525		-8,0001	330	٢	-2.0001	1	ſ	3,0001	600
0000001			1	4.0001	2	L				,	
2060004	PB(OH)2(C)	-7.864	Ì	-2.0001	330	E	1.0001	600	ſ	2.0001	2
5060003	HYDCERRUSITE	-24.465	i	-2.0001	330	ſ	3.0001	600	ſ	2.0001	140
			ſ	2.0001	2						
2060005	PB20 (OH) 2	-25.229	1	-4.0001	330	[2.0001	600	ſ	3.0001	2
5054000	NICO3	-10.968		1.0001	540	ſ	1.0001	140		-	
2054000	NI (OH) 2	-6.340	1	-2.000]	330	Ī	1.000]	540	Ε	2.000]	2
2054001	BUNSENITE	-8.767		-2.000]	330	ſ	1.000]	540	[1.000]	2
5023101	MALACHITE	-11.734	1	2.000]	231]	2.000]	2]	1.000]	140
			[-2.000]	330					-	
5023102	AZURITE	-19.301	1	3.000]	231]	2.000]	2	[2.000]	140
			[-2.000]	330						
2015000	LIME	-23.431	1	-2.000]	330]	1.000]	150	[1.000]	2
2015001	PORTLANDITE	-13.087	[-2.000]	330]	1.000]	150	I	2.000]	2
2028000	WUSTITE	-20.483	1	-2.000]	330]	0.947]	280	[1.000]	2
2046001	PERICLASE	-11.920	[-2.000]	330	[1.000]	460	I	1.000]	2
3028001	HERCYNITE	-23.529	1	-8.000]	330]	1.000]	280	[2.000]	30
			[4.000]	2					-	
3046000	SPINEL	-13.050	[-8.000]	330	[1.000]	460	[2.000]	30
			(4.000]	2						
3046001	MAG-FERRITE	-11.178	[-8.000]	330	[1.000]	460]	2.000]	281
			[4.000]	2						
3028102	LEPIDOCROCIT	-3.155	[-3.000]	330	[1.000]	281	[2.000]	2
3021100	FECR204	-12.371	[2.000]	211]	1.000]	280]	-4.000]	330
3021101	MGCR204	-5.763	(2.000]	211	I	1.000]	460	[-4.000]	330
3021102	CR203	0.000	[2.000]	211]	-2.000]	330	J	-1.000]	2
2021102	CR(OH)3 (A)	-0.860	[1.000]	211	[1.000]	2	[-1.000]	330
2021101	CR(OH)3(C)	-3.412	1	1.0001	211	٢	1.0001	2	ſ	-1.0001	330

4 - Modelling with pH = 7.6

		PART	1 of OUTPU	JT FILE			
Revuè ri	ver water-S	ite $14 - pH = 7$. 6				
Entered	PCO_2 , PO_2 ,	fixed pH, solid	is allowed	to precip	pitate, Fe	redox pair a	and
adsorpti	on						
Tempera	ture (Colsi	19 30					
Units o	f concentra	tion: MG/L					
Tonic s	trength to	be computed.					
Carbona	te concentr	ation represent	s carbonate	alkalin	itv.		
Do not	automatical	ly terminate if	charge imb	alance e	xceeds 30%		
Precipi	tation is a	llowed for all	solids in t	the therm	odynamic da	atabase and	
the p	rint option	for solids is	set to: 1				
The max	imum number	of iterations	is: 200				
The met	hod used to	compute activi	ty coeffici	ents is:	Davies equ	uation	
Interme	diate outpu	t file					
Adsorpt	ion model:	Diffuse Layer					
Number	of adsorbin	g surfaces: 1					
INPUT DA	TA BEFORE T	YPE MODIFICATIC	NS				
ID	NAME	ACTIVITY G	UESS LOG	G GUESS	ANAL TOTAL	L	
330	H+1	2.512	E-08	-7.600	0.000E-0	1	
30	A1+3	4.786	E-06	-5.320	1.300E-0	1	
100	Ba+2	1.380	E-06	-5.860	1.900E-0	1	
150	Ca+2	1.288	E-04	-3.890	5.200E+00	0	
160	Ca+2	4.677	E-09	-8.330	5.300E-04	4	
231	CI(OH)Z+	2.010	E-08	-7.550	2.400E-0	2	
280	Ee+2	5 370	E = 07	-6.270	3 000E-02	2	
410	K+1	6.607	E = 0.5	-4.180	2.599E+00	0	
460	Mg+2	1.445	E - 04	-3.840	3.500E+00	0	
500	Na+1	2.089	E-04	-3.680	4.800E+00	0	
540	Ni+2	1.862	E-08	-7.730	1.100E-03	3	
600	Pb+2	1.778	E - 07	-6.750	3.700E-02	2	
800	Sr+2	5.754	E-07	-6.240	5.000E-02	2	
950	Zn+2	3.090	E-07	-6.510	2.000E-02	2	
1	E-1	1.000	E-16	-16.000	0.000E-0	1	
140	CO3-2	2.188	E-04	-3.660	1.310E+0	1	
281	Fe+3	1.778	E-21	-20.750	0.000E-0	1	
813	ADSIPSIO	1.000	E+00	0.000	0.000E-0.		
811	ADSITIPI	1.905	E-04	-3.720	1.922E-0	2	
210	H2O	1.000	E-03	-2.110	7.690E-0	1	
2	1120	1.000	1.00	0.000	0.0001 0.	±	
Cha	rge Balance	: UNSPECIATED					
S	um of CATIO	NS= 8.438E-04	Sum of ANIC	DNS = 4.	366E-04		
P	ERCENT DIFF	ERENCE = 3.180	E+01 (ANIC	DNS - CAT	IONS)/(ANI	ONS + CATIONS)
		PART	3 of OUTPU	IT FILF			
Type I -	COMPONENTS	AS SPECIES IN	SOLUTION	, , , , , , , , , , , , , , , , , , ,			
ID	NAME	CALC MOL	ACTIVITY	LOG ACT	VTY GAM	MA NEW LO	GK
330	H+1	2.586E-08	2.512E-08	-7.60	000 0.97	123 0.01	3
30	A1+3	3.459E-16	2.660E-16	-15.57	513 0.76	898 0.11	4
100	Ba+2	4.101E-07	3.649E-07	-6.43	787 0.88	980 0.05	1
150	Ca+2	6.986E-05	6.216E-05	-4.20	649 0.88	980 0.05	1
160	Cd+2	1.546E-12	1.376E-12	-11.86	154 0.889	980 0.05	1
211	Cr(OH)2+	6.345E-10	6.162E-10	-9.21	025 0.97	123 0.01	3
231	Cu+2	3.061E-13	2.724E-13	-12.56	487 0.889	980 0.05	1
280	Fe+2	1.424E-25	1.267E-25	-24.89	733 0.889	980 0.05	1
410	K+1 Mat 2	6.64/E-05	6.456E-05	-4.19	0.97	123 0.01	3
460	Mg+2	2 0885-04	2 0295 04	-3.89	300 0.07	123 0.01	1
540	Ni+2	1 0655-11	9 4815-12	-11 02	315 0.97	980 0.01	1
040	11112	T.000E-11	7.4016-12	-11.02	0.00	0.05	T

600	Db+2	2 1/70-15	2 2018-15	-11 55275	0 88980	0 051
800	Sr+2	5.707E - 07	5 078F-07	-6 29/32	0.88980	0.051
050	S1+2 7n+2	2.707E - 07	2 189F-11	-10 60397	0.88980	0.051
930		1.050E-04	1.050F - 01	-3.97864	1 00000	0.001
110	CO2_2	2 6335-07	3 2325-07	-6 19018	0.88980	0.051
201	CU3-2	3.0336-07	2 609F-25	-24 58367	0.76898	0.114
201	TETS ADC1 TVD2	5.392E-23	5 007E-03	-2 22036	1 00000	0.114
812	ADSITIFZ	5.897E-03	J.097E-03	-2.22930	1.00000	0.000
Type II	- OTHER SPECIE	S IN SOLUTI	ON OR ADSOR	BED		
TD	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
8121000	=S02Ba+	4.757E - 10	4.757E-10	-9.32262	1.00000	-7.200
2113302	Cr(OH)3 AO	1.818E-09	1.819E-09	-8.74025	1.00015	-7.130
2113303	Cr(OH) 4-	7.119E-13	6.914E-13	-12.16026	0.97123	-18.137
2113304	Cr02-	1.806E-12	1.755E-12	-11.75585	0.97123	-17.733
3300020	OH-	2.655E-07	2.578E-07	-6.58865	0.97123	-14.176
4603300	MgOH +	5.190E-09	5.041E-09	-8.29749	0.97123	-11.991
4601400	MgCO3 AQ	3.612E-08	3.612E-08	-7.44221	1.00015	2.942
4601401	MgHCO3 +	2.908E-07	2.825E-07	-6.54903	0.97123	11.448
1503300	CaOH +	3.986E-10	3.871E-10	-9.41214	0.97123	-12.793
1501400	CaHCO3 +	1.094E-07	1.063E-07	-6.97357	0.97123	11.336
1501401	CaCO3 AQ	2.537E-08	2.537E-08	-7.59561	1.00015	3.101
5001400	NaCO3 -	9.330E-10	9.062E-10	-9.04278	0.97123	1.153
5001401	NaHCO3 AQ	1.979E-08	1.979E-08	-7.70348	1.00015	10.080
303300	AlOH +2	8.233E-14	7.326E-14	-13.13512	0.88980	-5.109
303301	Al(OH)2 +	3.448E-11	3.349E-11	-10.47514	0.97123	-10.087
303302	A1(OH)4 -	1.615E-09	1.568E-09	-8.80458	0.97123	-23.617
303303	AI(OH) 3 AQ	1.678E-09	1.678E-09	-8.77515	1.00015	-16.000
2803300	FEOH +	1.064E-27	1.033E-27	-26.98589	0.97123	-9.676
2803301	FeOH3 -1	3.U3/E-34	2.950E-34	-33.53021	0.97123	-31.420
2803302	FeoHZ AQ	Z.111E-31	2.111E-31 4.762E-20	-30.67542	1.00015	-20.978
2813300	FeOH +Z	5.35IE-20	4.702E-20	-19.32223	0.00900	-2.200
2013301	FOORS TO	9.099E-10	1 133E-16	-15 39360	1 00015	-13 600
2813302	FeoHA -	4.133E-10 1 69/F-16	4.133E-10 1 646F-16	-15.78369	0 97123	-21 587
2813304	FeOrd = FeOrd	1.094E-10	7 759E-38	-37 11021	0.62687	-2 940
2813305	Fe3(OH)4+5	2 8955-50	1.395E-50	-49 85531	0.48205	-6 187
8003300	SrOH +	8.576E-13	8.329E-13	-12.07940	0.97123	-13.372
1003300	BaOH +	3.992E-13	3.877E-13	-12.41152	0.97123	-13.561
2311400	CuCO3 AO	4.727E-13	4.728E-13	-12.32534	1.00015	6.730
2311401	Cu(CO3)2-2	2.162E-16	1.924E-16	-15.71582	0.88980	9.881
2313300	CuOH +	1.116E-13	1.084E-13	-12.96487	0.97123	-7.987
2313301	Cu(OH)2 AQ	9.017E-12	9.018E-12	-11.04488	1.00015	-13.680
2313302	Cu(OH)3 -	2.232E-17	2.168E-17	-16.66389	0.97123	-26.886
2313303	Cu(OH)4 -2	1.931E-22	1.718E-22	-21.76489	0.88980	-39.549
2313304	Cu2(OH)2+2	3.250E-21	2.892E-21	-20.53881	0.88980	-10.558
2311402	CuHCO3 +	2.277E-14	2.211E-14	-13.65535	0.97123	13.013
9503300	ZnOH +	7.199E-13	6.992E-13	-12.15539	0.97123	-9.139
9503301	Zn(OH)2 AQ	4.977E-13	4.978E-13	-12.30298	1.00015	-16.899
9503302	Zn(OH)3 -	6.452E-17	6.266E-17	-16.20299	0.97123	-28.386
9503303	Zn(OH)4 -2	4.443E-22	3.954E-22	-21.40300	0.88980	-41.148
9501400	ZnHCO3 +	5.227E-13	5.076E-13	-12.29445	0.97123	12.413
9501401	ZnCO3 AQ	1.605E-12	1.605E-12	-11.79445	1.00015	5.300
9501402	Zn(CO3)2-2	1.247E-14	1.109E-14	-13.95493	0.88980	9.681
1601400	Cd(CO3)3-4	1.230E-25	7.710E-26	-25.11297	0.62687	6.423
1603300	COUL +	3.048E-15	2.960E-15	-14.52869	0.9/123	-10.254
1603301	Cd(OH) 2 AQ	9.736E-18	9.738E-18	-17.01155	1.00015	-20.350
1603302	Cd(OH) = 0	4.4/0E-23	4.33UE-23	-22.30156	0.9/123	-33.28/
1603303	Cd(0H) = 2	1.134E-29 2 700E 20	2 14AE-29	-20.01130	0.00900	-41.299
1601400		2.1000-20	2 8055-14	-23.000/0	0.10090	12 412
1601401	CdCO3 AO	1.114F - 13	1 114F - 12	-12 95301	1 00015	5 300
6001400	Pb(CO3) 2 - 2	1.435E-17	1.277E - 17	-16,89370	0.88980	10 691
6003300	PbOH +	2.238E-15	2.174E - 15	-14.66276	0.97123	-7.697
6003301	Pb(OH)2 AQ	3.366E-17	3.367E-17	-16.47276	1.00015	-17.120

6003302	Pb(OH)3 -	1.585E-20	1.539E-20	-19.81277	0.97123	-28.047
6003303	Pb20H +3	1.772E-28	1.363E-28	-27.86551	0.76898	-6.246
6003304	Pb3 (OH) 4+2	3.419E - 38	3.042E-38	-37.51685	0.88980	-24.208
6001401	PhCO3 AO	1 573E - 14	1 573E - 14	-13 80323	1 00015	7 240
6002205	Db (04) 1 - 2	1 5015 24	1 4075 24	-22 05170	0 00000	-20 610
6003303	PD(OR)4 -2	1.JOIE-24	1.4076-24	-23.03170	0.00900	-39.040
6001402	PDHCO3 +	3./IIE-16	3.604E-16	-15.44323	0.97123	13.213
5403300	NiOH +	3.565E-14	3.463E-14	-13.46059	0.97123	-10.025
5403301	Ni(OH)2 AQ	1.502E-15	1.503E-15	-14.82317	1.00015	-19.000
5403302	Ni(OH)3 -	6.159E-19	5.982E-19	-18.22317	0.97123	-29.987
5401400	NiHCO3 +	2.339E-13	2.272E-13	-12.64363	0.97123	12.483
5401401	NICO3 AO	2 271F-11	2 272F-11	-10 64363	1 00015	6 870
5401402	Ni (CO3)2-2	1 1315-14	1 2765-14	-12 00/11	0 000010	10 161
3401402	NI (COJ) 2-2	1.4346-14	1.2706-14	-13.09411	0.00900	10.101
3301400	HC03 -	2.022E-04	1.964E-04	-3.70680	0.97123	10.396
3301401	H2CO3 AQ	1.053E-05	1.053E-05	-4.97738	1.00015	16.713
2113300	Cr+3	4.089E-15	3.144E-15	-14.50252	0.76898	10.022
2113301	Cr(OH)+2	7.252E-12	6.453E-12	-11.19024	0.88980	5.671
8123301	=S02-	9.297E-04	9.297E-04	-3.03166	1.00000	-8.930
8123302	= SO2H2 +	8 569E-04	8 569E-04	-3 06706	1 00000	7 290
0113301	-901-	1 6565-05	1 656F-05	-1 72001	1 00000	-8 930
0113301	-301-	1.0000-00	1.600E-00	4.70094	1.00000	-0.930
8113302	=501H2+	1.526E-05	1.526E-05	-4.81634	1.00000	1.290
8129500	=SO2Zn+	1.7/4E-08	1.//4E-08	-7.75104	1.00000	-1.990
8119500	=SO1Zn+	2.882E-07	2.882E-07	-6.54032	1.00000	0.970
8121600	=SO2Cd+	1.206E-10	1.206E-10	-9.91860	1.00000	-2.900
8111600	=S01Cd+	4.593E-09	4.593E-09	-8.33789	1.00000	0.430
8112310	=SO1Cu+	2.392E-07	2.392E-07	-6.62122	1.00000	2.850
8122310	= 502C11+	7 552E-08	7 552E-08	-7 12193	1 00000	0 600
0115400	-SOINI+	1 661E-09	1 661E-09	-7 77050	1 00000	0.150
0105400	-SOINI+	1.001E-00	1.001E-00	-1.11930	1.00000	0.100
8125400	=502N1+	2.088E-09	2.088E-09	-8.68022	1.00000	-2.500
8116000	=SOIPb+	1.782E-07	1.782E-07	-6.74910	1.00000	4.710
8126000	=SO2Pb+	3.892E-10	3.892E-10	-9.40981	1.00000	0.300
8121500	=SO2Ca+	6.116E-06	6.116E-06	-5.21355	1.00000	-5.850
8111500	=SO1HCa++	5.364E-05	5.364E-05	-4.27054	1.00000	4.970
8111000	=SO1HBa++	9.729E-07	9.729E-07	-6.01191	1.00000	5,460
TIME TT	T ODECTEC I	NTUL ETVED NOU	TITUT			
Type II	I - SPECIES I	WITH FIXED ACT	IVITI			
ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH	
2	H20	-6.580E-06	-5.182	0.000	0.000	
330	H+1	-1.363E-04	-3.866	7.600	0.000	
3301403	CO2 (g)	2.329E-04	-3.633	21.690	-0.530	
3300021	02(a)	1.140E-04	-3.943	-84.354	133.830	
2802810	Fo+2/Fo+3	-5 3728-07	-6.270	13 175	-10,000	
2002010	retz/retj	-3.3726-07	-0.270	13.175	-10.000	
Type IV	- FINITE SO	LIDS (present	at equilibriu	(mL		
ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH	
3028100	HEMATITE	2.686E-07	-6.571	3.567	30.845	
2003002	DIASPORE	4.815E-06	-5.317	-7.225	24.630	
3021102	CR203	1.272E - 08	-7.895	3 220	12,125	
0021102	ONLOG	1.2721 00	,.055	5.220	12.120	
		מגם		ר הדדה		
DEDODUTT		PAR	I 4 OI OUTPU	г цтрр ————		
PERCENTA	GE DISTRIBUT	ION OF COMPONE	NTS AMONG			
	TYPE I	and TYPE II (dissolved and	d adsorbed)	species	
ADS1TYP2						
	76.7	PERCENT B	OUND IN SPECI	IES # 812	ADS1TYP2	
	12.1	PERCENT B	OUND IN SPECI	TES #8123301	=S02-	
	11 1	PERCENT B	OUND IN SPECT	TES #8123302	=S02H2+	
Ba+2		- BROBRI D		10120302	NULILL!	
Daiz	20 6	DEDCENT	OUND TH ODDO	100	Dala	
	29.6	PERCENT B	OUND IN SPECI	LES # 100	Ba+Z	
	70.3	PERCENT B	JUND IN SPECI	LES #8111000	=SOIHBa++	
Ca+2						
				the second secon		
	53.8	PERCENT B	OUND IN SPECI	IES # 150	Ca+2	
	53.8	PERCENT B	OUND IN SPECI OUND IN SPECI	IES # 150 IES #8121500	Ca+2 =S02Ca+	
	53.8 4.7 41.3	PERCENT B PERCENT B PERCENT B	OUND IN SPECT OUND IN SPECT OUND IN SPECT	IES # 150 IES #8121500 IES #8111500	Ca+2 =SO2Ca+ =SO1HCa++	
Cd+2	53.8 4.7 41.3	PERCENT B PERCENT B PERCENT B	OUND IN SPECT OUND IN SPECT OUND IN SPECT	IES # 150 IES #8121500 IES #8111500	Ca+2 =SO2Ca+ =SO1HCa++	
Cd+2	53.8 4.7 41.3 2.6	PERCENT B PERCENT B PERCENT B	OUND IN SPECT OUND IN SPECT OUND IN SPECT	IES # 150 IES #8121500 IES #8111500	Ca+2 =S02Ca+ =S01HCa++	
Cd+2	53.8 4.7 41.3 2.6	PERCENT B PERCENT B PERCENT B PERCENT B	OUND IN SPECI OUND IN SPECI OUND IN SPECI OUND IN SPECI	IES # 150 IES #8121500 IES #8111500 IES #8121600	Ca+2 =S02Ca+ =S01HCa++ =S02Cd+	

	97.4	PERCENT	BOUND	IN	SPECIES	#8111600	=SO1Cd+
Zn+2							
	5.8	PERCENT	BOUND	IN	SPECIES	#8129500	=SO2Zn+
	94.2	PERCENT	BOUND	TN	SPECTES	#8119500	=SO1Zn+
C11+2							
04.2	76 0	PERCENT	BOUND	TN	SPECTES	#8112310	= S01C11+
	24.0	DEDCENT	POUND	TN	SPECIES	#0122210	-502001
1 סעייי 1 סט	24.0	EBROBNI	DOOND	TIA	DEPCIED	#0122310	-502Cu+
ADSTITET		DEDGEN	DOUND	ThI	ODDOTDO		a Dollmurp1
	54.7	PERCENT	BOUND	TN	SPECIES	# 811	ADSITIPI
	8.6	PERCENT	BOOND	IN	SPECIES	#8113301	=501-
	7.9	PERCENT	BOUND	IN	SPECIES	#8113302	=SO1H2+
	27.9	PERCENT	BOUND	IN	SPECIES	#8111500	=SO1HCa++
K+1							
	100.0	PERCENT	BOUND	IN	SPECIES	# 410	K+1
Mg+2							
	99.8	PERCENT	BOUND	IN	SPECIES	# 460	Mg+2
Na+1							
	100.0	PERCENT	BOUND	IN	SPECIES	# 500	Na+1
Ni+2							
	88.7	PERCENT	BOUND	IN	SPECIES	#8115400	=SO1Ni+
	11.1	PERCENT	BOUND	IN	SPECIES	#8125400	=SO2Ni+
Pb+2							C O LITA
1011	99.8	PERCENT	BOUND	TN	SPECIES	#8116000	=SO1Pb+
Sr+2	55.0	L DICOLICI	200112	111	0110110	10110000	DOTID
DITZ	100 0	DEDCENT	ROUND	TN	SPECTES	# 800	Sr+2
Cm/04121	100.0	LERCENT	DOOND	TIA	DIDCIDO	π 000	DIIZ
CI (OR) 2+	25 0	DEDCENT	DOUND	TN	ODECTES	# 011	Cm/OIL 21
	23.0	PERCENT	BOUND	TN	SPECIES	# 211	CI (OH) 2+
2112	15.0	PERCENT	BOUND	TIN	SPECIES	#2113302	Cr(OH) 5 AQ
A1+3	1 0	DDDODNI	DOUND	Th	ODDOTEO	1 202201	71/0000
	1.0	PERCENT	BOUND	IN	SPECIES	# 303301	AI (OH) 2 +
	48.5	PERCENT	BOUND	IN	SPECIES	# 303302	A1 (OH) 4 -
	50.4	PERCENT	BOUND	IN	SPECIES	# 303303	Al(OH)3 AQ
CO3-2							
	94.7	PERCENT	BOUND	IN	SPECIES	#3301400	HCO3 -
	4.9	PERCENT	BOUND	IN	SPECIES	#3301401	H2CO3 AQ
Fe+2							
	99.3	PERCENT	BOUND	IN	SPECIES	# 280	Fe+2
E-1							
Fe+3							
	61.0	PERCENT	BOUND	IN	SPECIES	#2813301	FeOH2 +
	27.7	PERCENT	BOUND	IN	SPECIES	#2813302	FeOH3 AQ
	11.4	PERCENT	BOUND	IN	SPECIES	#2813303	FeOH4 -
H+1							
	142.0	PERCENT	BOUND	IN	SPECIES	#3301400	нсоз -
	14.8	PERCENT	BOUND	IN	SPECIES	#3301401	H2CO3 AO
	601.5	PERCENT	BOUND	TN	SPECIES	#8123302	=S02H2+
	10.7	PERCENT	BOUND	TN	SPECTES	#8113302	= SO1H2 +
H20	2017	L DITOLITI	200112		orborido	10110000	o o ante
112.0	24 0	DEBCENT	ROUND	TN	SPECTES	#3300020	OH-
	1 6	DEDCENT	BOUND	TN	SPECTES	#8129500	=SO27n+
	26.0	DEDCENT	POLIND	TN	CDECTES	#0110500	-901721
	20.0	PERCENT	BOUND	TN	CDECTES	#0112210	-301211+
	21.0	PERCENT	BOUND	TN	OPECIES	#0112310	-50100+
	0.8	PERCENT	ROOND	IN	SPECIES	#8122310	=50200+
	1.5	PERCENT	ROUND	TN	SPECIES	#8115400	=SOIN1+
	16.1	PERCENT	BOUND	IN	SPECIES	#8110000	=SO1Pb+
				-			
		PZ	ART 5 d	of (OUTPUT FI	LLE	
		- EQUILIBR	ATED M	ASS	DISTRIB	UTION	

IDX	NAME	DISSOL	VED	SORBE	D	PRECIPI	TATED
		MOL/KG	PERCENT	MOL/KG	PERCENT	MOL/KG	PERCENT
100	Ba+2	4.101E-07	29.6	9.734E-07	70.4	0.000E-01	0.0
150	Ca+2	6.999E-05	53.9	5.975E-05	46.1	0.000E-01	0.0
160	Cd+2	1.689E-12	0.0	4.714E-09	100.0	0.000E-01	0.0

950	Zn+2	3.	133E-11	Ο.	0 3.05	9E-0	7 :	100.0	0.00)0E-	-01	0.0
231	Cu+2	9.	930E-12	0.	0 3.14	7E-0	7 3	100.0	0.00)0E-	-01	0.0
410	K+1	6.	647E-05	100.	0 0.00	0E-0	1	0.0	0.00)0E-	-01	0.0
460	Ma+2	1.	440E-04	100.	0 0.00	0E-0	1	0.0	0.00	DOE-	-01	0.0
500	Na+1	2.	088E-04	100.	0 0.00	0E-0	1	0.0	0.00)0E-	-01	0.0
540	Ni+2	3	365E-11	0.	2 1.87	OE - OB	8	99.8	0.00	OF-	-01	0.0
600	Ph+2	2	153E - 14	0	0 1 78	6E-0	7 -	100.0	0.00	OF-	-01	0 0
800	Sr+2	5	707E - 07	100	0 0.00	OF-O	1 -	0.0	0.00	OF-	-01	0.0
211	Criot	1) 2 + 2	163E-00	100.	0.00	05-01	1	0.0	2 5/		_02 0	1 2
211	7112	1) 2 + 2.	403E-09	0.	1 0.00	OE O	1	0.0	2.04	146-	-00 9	1.2
30	A1+3		327E-09	100.	0.00	OF OF	1	0.0	4.81	LDE-	-06 9	9.9
140	003-2	2.	136E-04	100.	0 0.00	UE-U.	1	0.0	0.00	JUE-	-01	0.0
280	Fe+2	1.	434E-25	100.	0 0.00	OE-O.	L	0.0	0.00	JOE-	-01	0.0
1	E-1	0.	000E-01	0.	0 0.00	OE-0	1	0.0	0.00)0E-	-01	0.0
281	Fe+3	1.	493E-15	0.	0 0.00	0E-0.	1	0.0	5.37	72E-	-07 10	0.0
330	H+1	2.	235E-04	156.	9 -8.10	1E-0	5 -	-56.9	0.00)0E-	-01	0.0
2	H20	2.	845E-07	25.	7 8.22	7E-0	7	74.3	0.00)0E-	-01	0.0
	Charg Sum PEF NON-C EQUII EQUII EQUII	ge Balance: S a of CATIONS RCENT DIFFERE CARBONATE ALK LIBRIUM IONIC LIBRIUM PH LIBRIUM PE	PECIATED = 1.693 NCE = ALINITY STRENGT	E-03 S 1.912E H (m)	um of AN +01 (AN = 2.40 = 6.68 = 7.60 = 13.48	IONS IONS 0E-0 8E-0 0 9 (1. - C# 7 4 or Eh	.150E-0 ATIONS) n =)3 /(AN] 782.6	EONS 57 r	S + CATI nv	ONS)
**** E1 Ad	*** DI * Para ectros sorber ecific	FFUSE LAYER ameters For A static Variab at Concentrat c Surface Are	ADSORPTI dsorbent les: ps ps ion (g/l a (sq. m	ON MOD Numbe i0 = 0 ib = 0 id = 0): 3 eters/	EL ***** r 1 **** .030620 .000000 .000000 .442 g): 600	*** .00	sig0 sigb sigd	= 0.00 = 0.00 = 0.00	01966 00000 00000			
Satu	ration	indices and	stoichi	PART 6	of OUTP	UT FI	ILE rals	and the second second	-11			
Datu	TD #	NAME	Sat In	dex	Sto	ichic	met	cv in [brack	cet	5]	
20	03000	ALOH3(A)	-3 54	2 [1 0001	30	19201	3 0001	2	1000	-3 0001	330
50	15000	ARAGONITE	-2 41	μ 1 Γ	1 0001	150	ſ	1 0001	140	L	5.000]	550
50	46000	ARTINITE	-9 08	т I 8 Г	-2 0001	330	ſ	2 0001	460	г	1 0001	140
50	10000	LUCT TRATTE	5.00	r c	5 0001	200	L	2.000]	400	L	1.000]	140
20	03001	BOEHMITE	-1 75	5 F	-3 0001	330	ſ	1 0001	30	Г	2 0001	2
20	16000	BOUCTTE	-5.85	5 I	1 0001	160	ſ	2 0001	20	r	-2.000]	330
50	15001	CALCITE	-2 25	5 I	1 0001	150	ſ	1 0001	140	L	2.000]	550
20	03002	DIASDODE	0.00		-3 0001	330	r	1 0001	30	ſ	2 0001	2
50	15002	DOLOMITE	-4 19	a r	1 0001	150	ſ	1 0001	460	ſ	2.000]	140
20	28100	FERTHYDRITE	-6.67	5 [-3 0001	330	ſ	1 0001	281	r	3 0001	2
20	28101	FE3 (OH) 8	-33.48	7 [-8.0001	330	ſ	2,0001	281	ſ	1,0001	280
20	10101	120 (011) 0	00.10	· [8 0001	2	L	2.000]	201	L	1.000]	200
20	03003	GIBBSITE (C)	-1.87	1 r	-3,0001	330	ſ	1 0001	30	ſ	3,0001	2
30	03000	A1203	-8 53		2 0001	30	Г	3 0001	2	ſ	-6 0001	330
20	28102	COFTHITE	-2.49	о (1 Г	-3 0001	330	Г	1 0001	281	r	2 0001	200
30	28100	HEMATITE	0.00		-6.0001	330	r	2 0001	281	F	3 0001	2
50	15003	HINTTTE	-12 24	a r	3 0001	160	r	1 0001	150	r	4 0001	140
50	16001	HVDDMACNESTT	-22 20		5.000]	460	L F	1.0001	140	ſ	-2 0001	330
50	40001	MI DRMAGNES I I	-22.20	J L	5.000]	400	L	4.000]	140	L	-2.000]	220
30	20101	MACHEMITTE	-0.05	2 1	6.000]	220	r	2 0001	201	r	2 0001	0
50	16002	MAGNESTTE	-2.11	3 [1 0001	160	r	1 0001	140	L	5.000]	2
30	280002	MAGNETITE	_17 72		-8 0001	330	L L	2 0001	201	r	1 0001	200
20	20000	TRACINET L L E	11.12		4 0001	220	L	2.000]	201	L	T.000]	200
20	50000	NATION	_10 04	1 r	2 0001	500	r	1 0001	140	r	10 0001	0
50	16002	NECOLEUONITE	_1 01		1 0001	160	r	1 0001	140	L	3 0001	2
50	280003	SIDEPITE	-4.04		1 0001	200	L	1 0001	140	l	5.000]	2
50	20000	STUDATIE CTDONTTANTER	-20.91	z l	1 0001	200	L	1 0001	140			
50	50000	THERMONATO	-3.54		2 0001	500	L r	1 0001	140	r	1 0001	0
50	100001	MITUFDITE	-14.04		1 0001	100	L	1 0001	140	l	1.000]	2
20	10000	WTTUEVTTE	-4.33		T.000]	TUU	L	T.000]	140			

5023100 2023100 2023101 3023100	CUCO3 CU(OH)2 TENORITE CUPRICFERIT	-9.425 -6.223 -5.203 -7.365		1.000] -2.000] -2.000] -8.000] 4.000]	231 330 330 330 2	[[[[1.000] 1.000] 1.000] 1.000]	140 231 231 231	[[[2.000] 1.000] 2.000]	2 2 281
5095000 5095001 2095000 2095002 2095002 2095003 2095004 2095005	SMITHSONITE ZNCO3, 1H2O ZN(OH)2 (A) ZN(OH)2 (C) ZN(OH)2 (C) ZN(OH)2 (B) ZN(OH)2 (G) ZN(OH)2 (E) ZNO(ACTIVE)	-7.157 -6.834 -7.854 -7.604 -7.154 -7.114 -6.904 -6.714		1.000] 1.000] -2.000] -2.000] -2.000] -2.000] -2.000] -2.000]	950 950 330 330 330 330 330 330 330		1.000] 1.000] 1.000] 1.000] 1.000] 1.000] 1.000] 1.000]	140 140 950 950 950 950 950 950		1.000] 2.000] 2.000] 2.000] 2.000] 2.000] 1.000]	2 2 2 2 2 2 2 2
ID # 2095006 16000 16001	NAME S ZINCITE CD METAL GAMMA CD	Sat. Index -6.856 -52.586 -52.688	[[Stoid -2.000] 1.000] 1.000]	chior 330 160 160	net: [[ry in [b: 1.000] 2.000] 2.000]	racke 950 1 1	ets] [1.000]	2
5016000 2016000 2016001 2016002 60000	OTAVITE CD(OH)2 (A) CD(OH)2 (C) MONTEPONITE PB METAL	-4.620 -10.688 -10.312 -12.135 -45.794	[[[[[1.000] -2.000] -2.000] -2.000] 1.000]	160 330 330 330 600		1.000] 1.000] 1.000] 1.000] 2.000]	140 160 160 160 1	[[]	2.000] 2.000] 1.000]	2 2 2
5060000 2060000 2060001 2060002 5060001	CERRUSITE MASSICOT LITHARGE PBO, .3H2O PB2OCO3	-7.844 -12.502 -12.307 -12.333 -20.060	[[[[[r	1.000] -2.000] -2.000] -2.000] -2.000]	600 330 330 330 330 330	[[[[1.000] 1.000] 1.000] 1.000] 2.000]	140 600 600 600 600	[[[1.000] 1.000] 1.330] 1.000]	2 2 2 2
5060002	PB302C03	-31.146	[-4.000]	330 2	[3.000]	600	[1.000]	140
2060003	PLATTNERITE	-7.486	[[-4.000] 2.000]	330 2	[-2.000]	1	[1.000]	600
3060000	PB203	-17.568	[[-6.000] 3.000]	330 2	[-2.000]	1	[2.000]	600
3060001	MINIUM	-31.039	[[-8.000] 4.000]	330 2	[-2.000]	1	[3.000]	600
2060004 5060003	PB(OH)2 (C) HYDCERRUSITE	-7.703 -23.979	[[]	-2.000] -2.000] 2.000]	330 330 2	[1.000] 3.000]	600 600	[[2.000] 2.000]	2 140
2060005 5054000	PB2O(OH)2 NICO3	-24.906 -10.816	[[-4.000] 1.000]	330 540] [2.000] 1.000]	600 140	[3.000]	2
2054000	NI (OH) 2	-6.188	[-2.000]	330	[1.000]	540	[2.000]	2
5023101	MALACHITE	-11.463	[2.000]	231	(2.000]	2	[1.000]	140
5023102	AZURITE	-18.895		3.000]	231 330	[2.000]	2	[2.000]	140
2015000	LIME	-22.464	I	-2.000]	330]	1.000]	150	[1.000]	2
2015001	PORTLANDITE	-12.120]	-2.000]	330]	1.000]	150]	2.000]	2
2028000	WUSTITE	-20.420	l	-2.000]	330	L	0.947]	280	L	1.000]	2
3028001	HERCYNITE	-23.529	[-2.000]	330	[1.000]	460 280		2.000]	30
3046000	SPINEL	-11.849	[4.000]	2 330 2	[1.000]	460	[2.000]	30
3046001	MAG-FERRITE	-9.978	[-8.000]	330 2	[1.000]	460	[2.000]	281
3028102	LEPIDOCROCIT	-3.155	[-3.000]	330]	1.000]	281	[2.000]	2
3021100	FECR204	-12.371	[2.000]	211]	1.000]	280	[-4.000]	330
3021101	MGCR204	-4.563	[2.000]	211]	1.000]	460	[-4.000]	330
3021102	CR203	0.000]	2.000]	211]	-2.000]	330	[-1.000]	2
2021102	CR (OH) 3 (A) CR (OH) 3 (C)	-0.860	[1.000]	211	[1.000]	2	[-1.000]	330 330

5 - Modelling with pH = 8.0

		PART	1 of OUTPU	JT FILE				
Revuè ri Entered adsorpti	ver water-Site PCO ₂ , PO ₂ , fix on	p = 14 - pH = 8 ked pH, solid	.0 Is allowed	to precip	oitate,	Fe redox	pair	and
Tempera Units o Ionic s Carbona Do not Precipi the p The max The met Interme Adsorpt Number	ture (Celsius) f concentration trength to be te concentration automatically tation is allow rint option for imum number of hod used to con- diate output for ion model: Diff of adsorbing s	19.30 on: MG/L computed. ion represent terminate if bwed for all or solids is f iterations ompute activi file ffuse Layer surfaces: 1	s carbonate charge imb solids in t set to: 1 is: 200 ty coeffici	e alkalini palance ex the thermo .ents is:	ty. ceeds 3 odynamic Davies	0% databas equation	e and	
INPUT DA ID 330 100 150 160 211 231 280 410 460 500 540 600 800 950 1 140 281 813 811 812 2	TA BEFORE TYPE NAME H+1 Al+3 Ba+2 Ca+2 Cd+2 Cd+2 Cr(OH)2+ Cu+2 Fe+2 K+1 Mg+2 Na+1 Ni+2 Pb+2 Sr+2 Zn+2 E-1 CO3-2 Fe+3 ADS1PSIO ADS1TYP1 ADS1TYP2 H2O	E MODIFICATIO ACTIVITY G 1.000 4.786 1.380 1.288 4.677 2.818 3.162 5.370 6.607 1.445 2.089 1.862 1.778 5.754 3.090 1.000 2.188 1.778 1.000 1.905 7.762 1.000	NS UESS LOC E-08 E-06 E-06 E-04 E-09 E-07 E-07 E-07 E-04 E-04 E-07 E-04 E-03 E+00	GUESS -8.000 -5.320 -5.860 -3.890 -8.330 -7.550 -6.500 -6.270 -4.180 -3.840 -3.680 -7.730 -6.750 -6.240 -6.510 -16.000 -3.660 -20.750 0.000 -3.720 -2.110 0.000	ANAL TC 0.000E 1.300E 1.900E 5.200E 5.300E 2.400E 2.000E 3.000E 3.500E 4.800E 1.100E 3.700E 5.000E 0.000E 1.310E 0.000E 1.922E 7.690E 0.000E	DTAL 2-01 2-01 2-01 2-02 2-02 2-02 2-02 2-03 2-02 2-03 2-02 2-02 2-02 2-02 2-02 2-01 2-01 2-01 2-01 2-01 2-01 2-01		
Cha S P Type I ID 330 30 100 150 160 211 231 280	rge Balance: U um of CATIONS= ERCENT DIFFERE - COMPONENTS Z NAME H+1 Al+3 Ba+2 Ca+2 Cd+2 Cd+2 Cr(OH)2+ Cu+2 Fe+2	UNSPECIATED = 8.438E-04 ENCE = 3.180 PART AS SPECIES IN CALC MOL 1.031E-08 2.211E-17 1.270E-07 2.750E-05 3.471E-13 2.530E-10 6.413E-14 2.269E-26	Sum of ANIC E+01 (ANIC SOLUTION ACTIVITY 1.000E-08 1.678E-17 1.124E-07 2.432E-05 3.070E-13 2.453E-10 5.673E-14 2.008E-26	DNS = 4.3 DNS - CATI LOG ACTV -8.000 -16.775 -6.949 -4.613 -12.512 -9.610 -13.246 -25.697	366E-04 CONS) / (P TY 6 000 0. 013 0. 038 0. 038 0. 038 0. 038 0. 038 0. 030 0. 031 0. 032 0. 033 0. 034 0. 035 0. 00. 00. 00. 00. 00. 00. 00. 00. 00.	ANIONS + 96982 75894 88462 88462 88462 96982 88462 96982 88462 88462	NEW L 0.0 0.1 0.0 0.0 0.0 0.0 0.0 0.0	S) OGK 13 20 53 53 53 13 53 53
410 460 500 540	K+1 Mg+2 Na+1 Ni+2	6.647E-05 1.430E-04 2.087E-04 2.325E-12	6.446E-05 1.265E-04 2.024E-04 2.057E-12	-4.190 -3.897 -3.693 -11.686	069 0. 189 0. 171 0. 1678 0.	96982 88462 96982 88462	0.0	13 53 13 53

600	Pb+2	7.121E-16	6.299E-16	-15.20072	0.88462	0.053
800	Sr+2	5.707E-07	5.048E-07	-6.29686	0.88462	0.053
950	Zn+2	6.213E-12	5.496E-12	-11.25997	0.88462	0.053
811	ADS1TYP1	7.849E-05	7.849E-05	-4.10519	1.00000	0.000
140	CO3-2	2.305E-06	2.039E-06	-5.69048	0.88462	0.053
281	Fe+3	2.168E-26	1.646E-26	-25.78367	0.75894	0.120
812	ADS1TYP2	5.885E-03	5.885E-03	-2.23024	1.00000	0.000
Type II	- OTHER SPECIE	S IN SOLUTI	ON OR ADSORE	ED		
ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
8121000	=SO2Ba+	2.058E-09	2.058E-09	-8.68661	1.00000	-7.200
2113302	Cr(OH) 3 AQ	1.818E-09	1.819E-09	-8.74025	1.00017	-7.130
2113303	Cr(OH)4-	1.791E-12	1.737E-12	-11.76026	0.96982	-18.137
2113304	Cr02-	4.544E-12	4.407E-12	-11.35585	0.96982	-17.732
3300020	OH-	6.678E-07	6.477E-07	-6.18865	0.96982	-14.175
4603300	MgOH +	1.292E-08	1.253E-08	-7.90193	0.96982	-11.991
4601400	MgCO3 AQ	2.256E-07	2.256E-07	-6.64666	1.00017	2.942
4601401	MgHCO3 +	7.242E-07	7.023E-07	-6.15348	0.96982	11.448
1503300	CaOH +	3.924E-10	3.805E-10	-9.41960	0.96982	-12.792
1501400	CaHCO3 +	1.077E-07	1.045E-07	-6.98103	0.96982	11.337
1501401	CaCO3 AQ	6.264E-08	6.265E-08	-7.20307	1.00017	3.101
5001400	NaCO3 -	5.886E-09	5.708E-09	-8.24348	0.96982	1.154
5001401	NaHCO3 AQ	4.963E-08	4.964E-08	-7.30418	1.00017	10.080
303300	AloH +2	1.313E-14	1.161E-14	-13.93512	0.88462	-5.107
303301	A1(OH)2 +	1.375E-11	1.333E-11	-10.87514	0.96982	-10.087
303302	AI (OH) 4 -	4.062E-09	3.939E-09	-8.40458	0.96982	-23.616
303303	AI (OH) 3 AQ	1.6/8E-09	1.678E-09	-8.77515	1.00017	-16.000
2803300	FeOH +	4.241E-28	4.113E-28	-27.38589	0.96982	-9.675
2803301	FeOH3 -1	7.64UE-34	7.410E-34	-33.13021	0.96982	-31.420
2803302	FeoHZ AQ	2.111E-31	Z.111E-31	-30.67542	1.00017	-20.978
2013300	FeoH +Z	8.331E-21	7.54/E-ZI	-20.12223	0.06002	-2.200
2013301	FEORZ +	1 133E-16	1 133E-16	-15 38369	1 00017	-13 600
2013302	Feons AQ	4.155E-16	4.133E-16	-15.38369	0.96982	-21 597
2813304	Fe2(OH) 2+4	3 1825-39	1 949F-39	-38 71021	0.61240	-2 930
2813305	Fe3 (OH) 4+5	3 002E-52	1.395E - 52	-51 85531	0 46477	-6 172
8003300	SrOH +	2.145E - 12	2.080E-12	-11,68194	0.96982	-13.372
1003300	BaOH +	3.092E-13	2.999E-13	-12.52303	0.96982	-13.560
2311400	CuCO3 AO	6.213E-13	6.214E-13	-12,20664	1.00017	6.730
2311401	Cu(CO3)2-2	1.804E-15	1.595E-15	-14.79712	0.88462	9.883
2313300	CuOH +	5.850E-14	5.673E-14	-13.24617	0.96982	-7.987
2313301	Cu(OH)2 AQ	1.185E-11	1.185E-11	-10.92617	1.00017	-13.680
2313302	Cu(OH)3 -	7.381E-17	7.158E-17	-16.14518	0.96982	-26.886
2313303	Cu(OH) 4 -2	1.611E-21	1.425E-21	-20.84619	0.88462	-39.547
2313304	Cu2(OH)2+2	8.950E-22	7.918E-22	-21.10140	0.88462	-10.556
2311402	CuHCO3 +	1.193E-14	1.157E-14	-13.93664	0.96982	13.013
9503300	ZnOH +	3.999E-13	3.878E-13	-12.41139	0.96982	-9.138
9503301	Zn(OH)2 AQ	6.933E-13	6.935E-13	-12.15898	1.00017	-16.899
9503302	Zn(OH)3 -	2.261E-16	2.193E-16	-15.65899	0.96982	-28.386
9503303	Zn(OH)4 -2	3.929E-21	3.475E-21	-20.45899	0.88462	-41.146
9501400	ZnHCO3 +	2.903E-13	2.815E-13	-12.55045	0.96982	12.413
9501401	ZnCO3 AQ	2.236E-12	2.236E-12	-11.65044	1.00017	5.300
9501402	Zn(CO3)2-2	1.102E-13	9.752E-14	-13.01092	0.88462	9.683
1601400	Cd(CO3)3-4	7.059E-24	4.323E-24	-23.36423	0.61240	6.433
1603300	CdOH +	1.711E-15	1.660E-15	-14.77995	0.96982	-10.254
1603301	Cd(OH)2 AQ	1.371E-17	1.371E-17	-16.86281	1.00017	-20.350
1603302	Cd(OH)3 -	1.587E-22	1.539E-22	-21.81282	0.96982	-33.287
1603303	Cd(OH)4 -2	1.550E-28	1.371E-28	-27.86282	0.88462	-47.297
1603304	Cd20H +3	3.536E-27	2.683E-27	-26.57130	0.75894	-9.426
1601400	CdHCO3 +	1.622E-14	1.573E-14	-13.80328	0.96982	12.413
1601401	CdCO3 AQ	1.569E-13	1.569E-13	-12.80428	1.00017	5.399
6001400	Pb(CO3)2-2	1.293E-16	1.144E-16	-15.94168	0.88462	10.693
6003300	PbOH +	1.266E-15	1.228E-15	-14.91073	0.96982	-7.697
6003301	Pb(OH)2 AQ	4.777E-17	4.778E-17	-16.32074	1.00017	-17.120

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6003302	Pb(OH)3 -	5.657E-20	5.486E-20	-19.26074	0.96982	-28.047
6003303	Pb20H +3	2.282E-29	1.732E-29	-28.76145	0.75894	-6.240
6003304	Pb3 (OH) 4+2	1.558E-38	1.378E-38	-37.86077	0.88462	-24.205
6001401	PbCO3 AQ	2.232E-14	2.233E-14	-13.65120	1.00017	7.240
6003305	Pb(OH)4 -2	1.424E-23	1.260E-23	-22.89975	0.88462	-39.646
6001402	PbHCO3 +	2.099E-16	2.036E-16	-15.69120	0.96982	13.213
5403300	NiOH +	1.946E-14	1.887E-14	-13.72422	0.96982	-10.024
5403301	Ni(OH)2 AQ	2.056E-15	2.057E-15	-14.68680	1.00017	-19.000
5403302	Ni(OH)3 -	2.121E-18	2.057E-18	-17.68681	0.96982	-29.987
5401400	NiHCO3 +	1.277E-13	1.238E-13	-12.90726	0.96982	12.483
5401401	NiCO3 AQ	3.109E-11	3.110E-11	-10.50726	1.00017	6.870
5401402	Ni(CO3)2-2	1.246E-13	1.102E-13	-12.95774	0.88462	10.163
3301400	HCO3 -	5.088E-04	4.934E-04	-3.30680	0.96982	10.397
3301401	H2CO3 AQ	1.053E-05	1.053E-05	-4.97738	1.00017	16.713
2113300	Cr+3	2.614E-16	1.984E-16	-15.70252	0.75894	10.028
2113301	Cr(OH) + 2	1.136E-12	1.023E-12	-11.99024	0.88462	5.6/3
0123301	-502-	9.040L-04	9.040E-04	-3.00074	1.00000	-0.930
8113301	-502112+	1.313E-05	1.313E - 05	-1.99170	1.00000	-8 930
8113302	=501H2+	1.075E-05	1.075E-05	-4.96869	1.00000	7 290
8129500	=SO27n+	2.324E-08	2.324E-08	-7.63371	1.00000	-1.990
8119500	=SO1Zn+	2.827E-07	2.827E-07	-6.54866	1.00000	0.970
8121600	=SO2Cd+	1.598E-10	1.598E-10	-9.79654	1.00000	-2,900
8111600	=SO1Cd+	4.555E-09	4.555E-09	-8.34149	1.00000	0.430
8112310	=SO1Cu+	2.214E-07	2.214E-07	-6.65486	1.00000	2.850
8122310	=SO2Cu+	9.335E-08	9.335E-08	-7.02990	1.00000	0.600
8115400	=SO1Ni+	1.601E-08	1.601E-08	-7.79548	1.00000	0.150
8125400	=SO2Ni+	2.688E-09	2.688E-09	-8.57053	1.00000	-2.500
8116000	=SO1Pb+	1.781E-07	1.781E-07	-6.74942	1.00000	4.710
8126000	=SO2Pb+	5.194E-10	5.194E-10	-9.28446	1.00000	0.300
8121500	=SO2Ca+	1.420E-05	1.420E-05	-4.84768	1.00000	-5.850
8111500	=SO1HCa++	8.788E-05	8.788E-05	-4.05613	1.00000	4.970
8111000	=SO1HBa++	1.254E-06	1.254E-06	-5.90157	1.00000	5.460
Type II	I - SPECIES W	ITH FIXED ACT	IVITY			
ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH	
2	H20	-3.161E-04	-3.500	0.000	0.000	
330	H+1	2.906E-04	-3.537	8.000	0.000	
3301403	CO2 (g)	-7.889E-05	-4.103	21.690	-0.530	
3300021	O2 (g)	1.127E-04	-3.948	-84.354	133.830	
2802810	Fe+2/Fe+3	-5.372E-07	-6.270	13.175	-10.000	
Type IV	- FINITE SOI	IDS (present	at equilibri	um)		
ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH	
3028100	HEMATITE	2.686E-07	-6.571	3.567	30.845	
2003002	DIASPORE	4.813E-06	-5.318	-7.225	24.630	
3021102	CR203	1.291E-08	-7.889	3.220	12.125	
		PAR	T 4 of OUTPU	T FILE		
	PERC	CENTAGE DISTRI	BUTION OF CON	MPONENTS AMO	NG	
	TYPE I	and TYPE II (dissolved and	d adsorbed)	species	
ADS1PSIO	1000					
	>1000.	PERCENT B	OUND IN SPEC	IES #8123302	=SO2H2+	
	88.2	PERCENT B	JUND IN SPEC	IES #8113302	=S01H2+	
	2.3	PERCENT B	JUND IN SPEC	IES #8119500	=S01Zn+	
	1.8	PERCENT B	JUND IN SPEC	TES #8112310	=S01Cu+	
	116 6	PERCENT B	JUND IN SPEC.	TES #8116000	=S01Pb+	
	1000	PERCENT B	DUND IN SPEC.	TES #0111500	=502Ca+	
	20 6	PERCENT B	DUND IN SPEC.	TES #8111000	=SOIRCa++	
ADS1TYP2	20.0	L DIVODINT D	SOND IN DEC.	100 HOIII000	-SUIIDATT	
	76.5	PERCENT B	OUND IN SPEC	IES # 812	ADS1TYP2	
	12 0	DEBCENT B	NUND TH SPEC	TES #8123301	=502-	

	10.5	PERCENT	BOUND	IN	SPECIES	#8123302	=SO2H2+
Ba+2							-
	9.2	PERCENT	BOUND	IN	SPECIES	# 100	Ba+2
	90.7	PERCENT	BOUND	IN	SPECIES	#8111000	=SO1HBa++
Ca+2							
	21.2	PERCENT	BOUND	IN	SPECIES	# 150	Ca+2
	10.9	PERCENT	BOUND	IN	SPECIES	#8121500	=SO2Ca+
	67.7	PERCENT	BOUND	IN	SPECIES	#8111500	=SO1HCa++
Cd+2							
	3.4	PERCENT	BOUND	IN	SPECIES	#8121600	=SO2Cd+
	96.6	PERCENT	BOUND	IN	SPECIES	#8111600	=SO1Cd+
Zn+2							
	7.6	PERCENT	BOUND	IN	SPECIES	#8129500	=SO2Zn+
	92.4	PERCENT	BOUND	IN	SPECIES	#8119500	=SO1Zn+
Cu+2							2210
	70.3	PERCENT	BOUND	IN	SPECIES	#8112310	=SOICu+
	29.7	PERCENT	BOUND	IN	SPECIES	#8122310	=SO2Cu+
ADS1TYP1			-				
	40.8	PERCENT	BOUND	IN	SPECIES	# 811	ADS1TYP1
	6.8	PERCENT	BOUND	IN	SPECIES	#8113301	=S01-
	5.6	PERCENT	BOUND	IN	SPECIES	#8113302	=SO1H2+
	45.7	PERCENT	BOUND	IN	SPECIES	#8111500	=SO1HCa++
K+1	100.0						
	100.0	PERCENT	BOUND	IN	SPECIES	# 410	K+1
Mg+2	0.0.0	DDD ODM	DOUND		apparta		
	99.3	PERCENT	BOUND	IN	SPECIES	# 460	Mg+2
Na+1	100 0	555 G5115	DOUND	***			
11.0	100.0	PERCENT	ROOND	IN	SPECIES	# 500	Na+1
NI+2	05 5	DEDGENE	DOUND	T 1 7	apparea	10115400	00111
	85.5	PERCENT	BOUND	IN	SPECIES	#8115400	=SOIN1+
Dh + O	14.3	PERCENT	BOUND	TN	SPECIES	#8125400	=502N1+
PD+Z	00 7	DEDCENT	DOUND	TN	ODECTEC	#0116000	-CO1Db1
0.0010	99.7	PERCENT	BOOND	TIN	SPECIES	#0110000	=501PD+
SITZ	100 0	DEDCENT	ROUND	TN	CDECTES	# 800	Sr+2
Cr (04) 2+	100.0	FERCENT	DOOND	TIN	SFECIES	# 000	DITZ
CI (OR) ZT	12 2	DEDCENT	ROUND	TN	OPECTES	# 211	Cr(0H)2+
	87 5	DEDCENT	BOUND	TN	SPECIES	# 2113302	Cr (OH) 3 DO
A1+3	07.5	I BROBNI	DOOND	TIA	DEDCIED	#2113302	CI (OII) 5 AQ
MT 10	70 6	DEDCENT	ROUND	TN	SPECIES	# 303302	A1 (OH) 4 -
	29.2	PERCENT	BOUND	TN	SPECIES	# 303302	AL (OH) 3 AO
CO3-2	23.2	I DRODRI	DOOLD	714	DIDCIDD	1 000000	
005 2	97 3	PERCENT	BOUND	TN	SPECTES	#3301400	HCO3 -
	2 0	PERCENT	BOUND	TN	SPECIES	#3301401	H2CO3 A0
Fe+2	2.0	I DROBILI	DOOLD	114	01 HOIHO	10001101	112000 112
1012	98.2	PERCENT	BOUND	TN	SPECTES	# 280	Fe+2
	1.8	PERCENT	BOUND	IN	SPECTES	#2803300	FeOH +
E-1	1.0	1 BROBRI	DOULD		0110110	12000000	20011
Fe+3							
2010	30.2	PERCENT	BOUND	TN	SPECTES	#2813301	FeOH2 +
	34.4	PERCENT	BOUND	IN	SPECIES	#2813302	FeOH3 AO
	35.5	PERCENT	BOUND	TN	SPECIES	#2813303	FeOH4 -
H+1	00.0	2 DICODICE	200110		or hor ho	12020000	
	152.4	PERCENT	BOUND	IN	SPECIES	#3301400	HCO3 -
	6.3	PERCENT	BOUND	IN	SPECIES	#3301401	H2CO3 AO
	241.4	PERCENT	BOUND	IN	SPECIES	#8123302	=S02H2+
	3.2	PERCENT	BOUND	IN	SPECIES	#8113302	=S01H2+
H20							
	43.7	PERCENT	BOUND	IN	SPECIES	#3300020	OH-
	1.1	PERCENT	BOUND	IN	SPECIES	# 303302	Al(OH)4 -
	1.5	PERCENT	BOUND	IN	SPECIES	#8129500	=SO2Zn+
	18.5	PERCENT	BOUND	IN	SPECIES	#8119500	=SO1Zn+
	14.5	PERCENT	BOUND	IN	SPECIES	#8112310	=SO1Cu+
	6.1	PERCENT	BOUND	IN	SPECIES	#8122310	=SO2Cu+
	1.0	PERCENT	BOUND	IN	SPECIES	#8115400	=SO1Ni+

11 7	PERCENT	BOUND	ΤN	SPECTES	#8116000	=SO1Pb+
TT • 1	LEVCENT	DOOND	TTA	DECCTRD	#0110000	-DOILD!

IDX NAME DISSOLVED MOL/KG SORBED PERCENT PRECIPITATED MOL/KG PERCIPITATED MOL/KG 100 Ba+2 1.270E-07 9.2 1.256E-06 90.8 0.000E-01 0.0 150 Ca+2 2.767E-05 21.3 1.021E-04 78.7 0.000E-01 0.0 160 Cd+2 5.219E-13 0.0 4.715E-09 100.0 0.000E-01 0.0 950 Zn+2 9.943E-12 0.0 3.060E-07 100.0 0.000E-01 0.0 231 Cu+2 1.261E-11 0.0 3.147E-07 100.0 0.000E-01 0.0 410 K+1 6.647E-05 100.0 0.000E-01 0.0 0.000E-01 0.0 500 Na+1 2.088E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 500 Na+1 2.088E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 600 Pb+2 2.469E-14 0.0 1.786E-07 100.0 0.0000E-01
IDX NAME DISSOLVED MOL/KG SORBED PERCENT SORBED MOL/KG PERCIPITATED MOL/KG PERCIPITATED MOL/KG 100 Ba+2 1.270E-07 9.2 1.256E-06 90.8 0.000E-01 0.0 150 Ca+2 2.767E-05 21.3 1.021E-04 78.7 0.000E-01 0.0 160 Cd+2 5.219E-13 0.0 4.715E-09 100.0 0.000E-01 0.0 950 Zn+2 9.943E-12 0.0 3.060E-07 100.0 0.000E-01 0.0 231 Cu+2 1.261E-11 0.0 3.147E-07 100.0 0.000E-01 0.0 410 K+1 6.647E-05 100.0 0.000E-01 0.0 0.000E-01 0.0 500 Na+1 2.088E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 600 Pb+2 2.469E-14 0.0 1.786E-07 100.0 0.000E-01 0.0 211 cr(oH)2+ 2.079E-09 7.4 0.000E-01 0.0
IDX NAME DISSOLVED SORBED PRECIPITATED MOL/KG PERCENT MOL/KG PERCENT MOL/KG PERCENT 100 Ba+2 1.270E-07 9.2 1.256E-06 90.8 0.000E-01 0.0 150 Ca+2 2.767E-05 21.3 1.021E-04 78.7 0.000E-01 0.0 950 Zn+2 9.943E-12 0.0 3.060E-07 100.0 0.000E-01 0.0 231 Cu+2 1.261E-11 0.0 3.147E-07 100.0 0.000E-01 0.0 410 K+1 6.647E-05 100.0 0.000E-01 0.0 0.000E-01 0.0 500 Na+1 2.088E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 540 Ni+2 3.369E-11 0.2 1.870E-08 9.8 0.000E-01 0.0 540 Ni+2 3.369E-14 0.0 1.786E-07 100.0 0.000E-01 0.0 540 Pite 1.00.00
MOL/KG PERCENT MOL/KG PERCENT MOL/KG PERCENT MOL/KG PERCENT 100 Ba+2 1.270E-07 9.2 1.256E-06 90.8 0.000E-01 0.0 150 Ca+2 2.767E-05 21.3 1.021E-04 78.7 0.000E-01 0.0 160 Cd+2 5.219E-13 0.0 4.715E-09 100.0 0.000E-01 0.0 950 Zn+2 9.943E-12 0.0 3.060E-07 100.0 0.000E-01 0.0 231 Cu+2 1.261E-11 0.0 3.147E-07 100.0 0.000E-01 0.0 410 K+1 6.647E-05 100.0 0.000E-01 0.0 0.000E-01 0.0 500 Na+1 2.088E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 500 Na+2 3.369E-11 0.2 1.870E-08 99.8 0.000E-01 0.0 600 Pb+2 2.469E-14 0.0 1.786E-07 100.0 0.000E
100Ba+21.270E-079.21.256E-0690.80.000E-010.0150Ca+22.767E-0521.31.021E-0478.70.000E-010.0160Cd+25.219E-130.04.715E-09100.00.000E-010.0950Zn+29.943E-120.03.060E-07100.00.000E-010.0231Cu+21.261E-110.03.147E-07100.00.000E-010.0410K+16.647E-05100.00.000E-010.00.000E-010.0460Mg+21.440E-04100.00.000E-010.00.000E-010.0500Na+12.088E-04100.00.000E-010.00.000E-010.0540Ni+23.369E-110.21.870E-0899.80.000E-010.0540Ni+23.369E-140.01.786E-07100.00.000E-010.0600Pb+22.469E-140.01.786E-07100.00.000E-010.0800Sr+25.707E-07100.00.000E-010.00.000E-010.0211Cr(OH)2+2.079E-097.40.000E-010.02.583E-0892.630A1+35.754E-090.10.000E-010.00.000E-010.0280Fe+22.312E-26100.00.000E-010.00.000E-010.0281Fe+31.202E-150.00.000E-010.05.372E-07100.0330H+1<
150Ca+22.767E-0521.31.021E-0478.70.000E-010.0160Cd+25.219E-130.04.715E-09100.00.000E-010.0950Zn+29.943E-120.03.060E-07100.00.000E-010.0231Cu+21.261E-110.03.147E-07100.00.000E-010.0410K+16.647E-05100.00.000E-010.00.000E-010.0460Mg+21.440E-04100.00.000E-010.00.000E-010.0500Na+12.088E-04100.00.000E-010.00.000E-010.0540Ni+23.369E-110.21.870E-0899.80.000E-010.0600Pb+22.469E-140.01.786E-07100.00.000E-010.0610Sr+25.707E-07100.00.000E-010.00.000E-010.0621Cr(OH)2+2.079E-097.40.000E-010.02.583E-0892.630Al+35.754E-090.10.000E-010.00.000E-010.0280Fe+22.312E-26100.00.000E-010.00.000E-010.0281Fe+31.202E-150.00.000E-010.00.000E-010.0281Fe+31.202E-150.00.000E-010.05.372E-07100.0281Fe+31.202E-150.00.000E-010.05.372E-07100.0281Fe+3<
160 $Cd+2$ $5.219E-13$ 0.0 $4.715E-09$ 100.0 $0.000E-01$ 0.0 950 $Zn+2$ $9.943E-12$ 0.0 $3.060E-07$ 100.0 $0.000E-01$ 0.0 231 $Cu+2$ $1.261E-11$ 0.0 $3.147E-07$ 100.0 $0.000E-01$ 0.0 410 $K+1$ $6.647E-05$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 460 $Mg+2$ $1.440E-04$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 500 $Na+1$ $2.088E-04$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 500 $Na+2$ $3.369E-11$ 0.2 $1.870E-08$ 99.8 $0.000E-01$ 0.0 600 $Pb+2$ $2.469E-14$ 0.0 $1.786E-07$ 100.0 $0.000E-01$ 0.0 211 $Cr(OH)2+$ $2.079E-09$ 7.4 $0.000E-01$ 0.0 $2.583E-08$ 92.6 30 $A1+3$ $5.754E-09$ 0.1 $0.000E-01$ 0.0 $4.813E-06$ 99.9 140 $CO3-2$ $5.228E-04$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 280 $Fe+2$ $2.312E-26$ 100.0 <t< td=""></t<>
950 Zn+2 9.943E-12 0.0 $3.060E-07$ 100.0 $0.000E-01$ 0.0 231 Cu+2 1.261E-11 0.0 $3.147E-07$ 100.0 $0.000E-01$ 0.0 410 K+1 6.647E-05 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 460 Mg+2 1.440E-04 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 500 Na+1 2.088E-04 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 540 Ni+2 $3.369E-11$ 0.2 $1.870E-08$ 99.8 $0.000E-01$ 0.0 600 Pb+2 2.469E-14 0.0 $1.786E-07$ 100.0 $0.000E-01$ 0.0 800 Sr+2 $5.707E-07$ 100.0 $0.000E-01$ 0.0 $2.583E-08$ 92.6 30 Al+3 $5.754E-09$ 0.1 $0.000E-01$ 0.0 $4.813E-06$ 99.9 140 CO3-2 $5.228E-04$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 280 Fe+2 $2.312E-26$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 1 E-1 $0.000E-01$ 0.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 281 Fe+3 $1.202E-15$ 0.0 $0.000E-01$ 0.0 $5.372E-07$ 100.0 30 H+1 $5.300E-04$ 158.7 $-1.961E-04$ -58.7 $0.000E-01$ 0.0 20 Charge Balance: SPECIATED Sum of CATIONS = $1.628E-03$ Sum of ANIONS $1.512E-03$
231 Cu+2 1.261E-11 0.0 $3.147E-07$ 100.0 0.000E-01 0.0 410 K+1 6.647E-05 100.0 0.000E-01 0.0 0.000E-01 0.0 460 Mg+2 1.440E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 500 Na+1 2.088E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 540 Ni+2 3.369E-11 0.2 1.870E-08 99.8 0.000E-01 0.0 600 Pb+2 2.469E-14 0.0 1.786E-07 100.0 0.000E-01 0.0 800 Sr+2 5.707E-07 100.0 0.000E-01 0.0 0.000E-01 0.0 211 Cr(OH)2+ 2.079E-09 7.4 0.000E-01 0.0 2.583E-08 92.6 30 Al+3 5.754E-09 0.1 0.000E-01 0.0 4.813E-06 99.9 140 CO3-2 5.228E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 280 Fe+2 2.312E-26 100.0 0.000E-01 0.0 0.000E-01 0.0 1 E-1 0.000E-01 0.0 0.000E-01 0.0 0.000E-01 0.0 281 Fe+3 1.202E-15 0.0 0.000E-01 0.0 5.372E-07 100.0 3030 H+1 5.300E-04 158.7 -1.961E-04 -58.7 0.000E-01 0.0 Charge Balance: SPECIATED Sum of CATIONS = 1.628E-03 Sum of ANIONS 1.512E-03
410K+1 $6.647E-05$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 460Mg+2 $1.440E-04$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 500Na+1 $2.088E-04$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 540Ni+2 $3.369E-11$ 0.2 $1.870E-08$ 99.8 $0.000E-01$ 0.0 600Pb+2 $2.469E-14$ 0.0 $1.786E-07$ 100.0 $0.000E-01$ 0.0 800Sr+2 $5.707E-07$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 211Cr (OH)2+ $2.079E-09$ 7.4 $0.000E-01$ 0.0 $2.583E-08$ 92.6 30Al+3 $5.754E-09$ 0.1 $0.000E-01$ 0.0 $4.813E-06$ 99.9 140CO3-2 $5.228E-04$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 280Fe+2 $2.312E-26$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 281Fe+3 $1.202E-15$ 0.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 281Fe+3 $1.202E-15$ 0.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 281Fe+3 $1.202E-15$ 0.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 2H2O $7.043E-07$ 46.1 $8.227E-07$ 53.9 $0.000E-01$ 0.0 2H2O $7.043E-07$ 46.1 $8.227E-07$ 53.9 $0.000E-01$ </td
460Mg+2 $1.440E-04$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 500Na+1 $2.088E-04$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 540Ni+2 $3.369E-11$ 0.2 $1.870E-08$ 99.8 $0.000E-01$ 0.0 600Pb+2 $2.469E-14$ 0.0 $1.786E-07$ 100.0 $0.000E-01$ 0.0 800Sr+2 $5.707E-07$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 211Cr(OH)2+ $2.079E-09$ 7.4 $0.000E-01$ 0.0 $2.583E-08$ 92.6 30Al+3 $5.754E-09$ 0.1 $0.000E-01$ 0.0 $4.813E-06$ 99.9 140CO3-2 $5.228E-04$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 280Fe+2 $2.312E-26$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 281Fe+3 $1.202E-15$ 0.0 $0.000E-01$ 0.0 $5.372E-07$ 100.0 330H+1 $5.300E-04$ 158.7 $-1.961E-04$ -58.7 $0.000E-01$ 0.0 2H2O $7.043E-07$ 46.1 $8.227E-07$ 53.9 $0.000E-01$ 0.0 Charge Balance: SPECIATEDSum of CATIONS = $1.628E-03$ Sum of ANIONS $1.512E-03$
500 Na+1 2.088E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 540 Ni+2 3.369E-11 0.2 1.870E-08 99.8 0.000E-01 0.0 600 Pb+2 2.469E-14 0.0 1.786E-07 100.0 0.000E-01 0.0 800 Sr+2 5.707E-07 100.0 0.000E-01 0.0 0.000E-01 0.0 211 Cr(OH)2+ 2.079E-09 7.4 0.000E-01 0.0 2.583E-08 92.6 30 Al+3 5.754E-09 0.1 0.000E-01 0.0 4.813E-06 99.9 140 C03-2 5.228E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 280 Fe+2 2.312E-26 100.0 0.000E-01 0.0 0.000E-01 0.0 281 Fe+3 1.202E-15 0.0 0.000E-01 0.0 5.372E-07 100.0 281 Fe+3 1.202E-15 0.0 0.000E-01 0.0 5.372E-07 100.0 281 Fe+3 1.202E-15 0.0 0.000E-01 </td
540Ni+2 $3.369E-11$ 0.2 $1.870E-08$ 99.8 $0.000E-01$ 0.0 600Pb+2 $2.469E-14$ 0.0 $1.786E-07$ 100.0 $0.000E-01$ 0.0 800Sr+2 $5.707E-07$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 211Cr(OH)2+ $2.079E-09$ 7.4 $0.000E-01$ 0.0 $2.583E-08$ 92.6 30Al+3 $5.754E-09$ 0.1 $0.000E-01$ 0.0 $4.813E-06$ 99.9 140CO3-2 $5.228E-04$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 280Fe+2 $2.312E-26$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 281Fe+3 $1.202E-15$ 0.0 $0.000E-01$ 0.0 $5.372E-07$ 100.0 330H+1 $5.300E-04$ 158.7 $-1.961E-04$ -58.7 $0.000E-01$ 0.0 2H2O $7.043E-07$ 46.1 $8.227E-07$ 53.9 $0.000E-01$ 0.0 Charge Balance: SPECIATEDSum of CATIONS = $1.628E-03$ Sum of ANIONS $1.512E-03$
600Pb+2 $2.469E-14$ 0.0 $1.786E-07$ 100.0 $0.000E-01$ 0.0 800Sr+2 $5.707E-07$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 211Cr(OH)2+ $2.079E-09$ 7.4 $0.000E-01$ 0.0 $2.583E-08$ 92.6 30Al+3 $5.754E-09$ 0.1 $0.000E-01$ 0.0 $4.813E-06$ 99.9 140CO3-2 $5.228E-04$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 280Fe+2 $2.312E-26$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 281Fe+3 $1.202E-15$ 0.0 $0.000E-01$ 0.0 $5.372E-07$ 100.0 330H+1 $5.300E-04$ 158.7 $-1.961E-04$ -58.7 $0.000E-01$ 0.0 2H2O $7.043E-07$ 46.1 $8.227E-07$ 53.9 $0.000E-01$ 0.0 Charge Balance: SPECIATEDSum of CATIONS = $1.628E-03$ Sum of ANIONS $1.512E-03$
800 $Sr+2$ $5.707E-07$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 211 $Cr(OH)2+$ $2.079E-09$ 7.4 $0.000E-01$ 0.0 $2.583E-08$ 92.6 30 $Al+3$ $5.754E-09$ 0.1 $0.000E-01$ 0.0 $4.813E-06$ 99.9 140 $CO3-2$ $5.228E-04$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 280 $Fe+2$ $2.312E-26$ 100.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 1 $E-1$ $0.000E-01$ 0.0 $0.000E-01$ 0.0 $0.000E-01$ 0.0 281 $Fe+3$ $1.202E-15$ 0.0 $0.000E-01$ 0.0 $5.372E-07$ 100.0 330 $H+1$ $5.300E-04$ 158.7 $-1.961E-04$ -58.7 $0.000E-01$ 0.0 2 $H20$ $7.043E-07$ 46.1 $8.227E-07$ 53.9 $0.000E-01$ 0.0 Charge Balance: SPECIATEDSum of CATIONS = $1.628E-03$ Sum of ANIONS $1.512E-03$
211 $Cr(0H)2+$ 2.079E-09 7.4 0.000E-01 0.0 2.583E-08 92.6 30 Al+3 5.754E-09 0.1 0.000E-01 0.0 4.813E-06 99.9 140 $CO3-2$ 5.228E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 280 Fe+2 2.312E-26 100.0 0.000E-01 0.0 0.000E-01 0.0 1 E-1 0.000E-01 0.0 0.000E-01 0.0 0.000E-01 0.0 281 Fe+3 1.202E-15 0.0 0.000E-01 0.0 5.372E-07 100.0 330 H+1 5.300E-04 158.7 -1.961E-04 -58.7 0.000E-01 0.0 2 H20 7.043E-07 46.1 8.227E-07 53.9 0.000E-01 0.0 Charge Balance: SPECIATED Sum of CATIONS = 1.628E-03 Sum of ANIONS 1.512E-03
30 Al+3 5.754E-09 0.1 0.000E-01 0.0 4.813E-06 99.9 140 CO3-2 5.228E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 280 Fe+2 2.312E-26 100.0 0.000E-01 0.0 0.000E-01 0.0 1 E-1 0.000E-01 0.0 0.000E-01 0.0 0.000E-01 0.0 281 Fe+3 1.202E-15 0.0 0.000E-01 0.0 5.372E-07 100.0 300 H+1 5.300E-04 158.7 -1.961E-04 -58.7 0.000E-01 0.0 2 H20 7.043E-07 46.1 8.227E-07 53.9 0.000E-01 0.0 Charge Balance: SPECIATED Sum of CATIONS = 1.628E-03 Sum of ANIONS 1.512E-03
140 CO3-2 5.228E-04 100.0 0.000E-01 0.0 0.000E-01 0.0 280 Fe+2 2.312E-26 100.0 0.000E-01 0.0 0.000E-01 0.0 1 E-1 0.000E-01 0.0 0.000E-01 0.0 0.000E-01 0.0 281 Fe+3 1.202E-15 0.0 0.000E-01 0.0 5.372E-07 100.0 330 H+1 5.300E-04 158.7 -1.961E-04 -58.7 0.000E-01 0.0 2 H20 7.043E-07 46.1 8.227E-07 53.9 0.000E-01 0.0 Charge Balance: SPECIATED Sum of CATIONS = 1.628E-03 Sum of ANIONS 1.512E-03
280 Fe+2 2.312E-26 100.0 0.000E-01 0.0 0.000E-01 0.0 1 E-1 0.000E-01 0.0 0.000E-01 0.0 0.000E-01 0.0 281 Fe+3 1.202E-15 0.0 0.000E-01 0.0 5.372E-07 100.0 330 H+1 5.300E-04 158.7 -1.961E-04 -58.7 0.000E-01 0.0 2 H20 7.043E-07 46.1 8.227E-07 53.9 0.000E-01 0.0 Charge Balance: SPECIATED Sum of CATIONS = 1.628E-03 Sum of ANIONS 1.512E-03
1 E-1 0.000E-01 0.0 0.000E-01 0.0 0.000E-01 0.0 281 Fe+3 1.202E-15 0.0 0.000E-01 0.0 5.372E-07 100.0 330 H+1 5.300E-04 158.7 -1.961E-04 -58.7 0.000E-01 0.0 2 H20 7.043E-07 46.1 8.227E-07 53.9 0.000E-01 0.0 Charge Balance: SPECIATED Sum of CATIONS = 1.628E-03 Sum of ANIONS 1.512E-03
281 Fe+3 1.202E-15 0.0 0.000E-01 0.0 5.372E-07 100.0 330 H+1 5.300E-04 158.7 -1.961E-04 -58.7 0.000E-01 0.0 2 H20 7.043E-07 46.1 8.227E-07 53.9 0.000E-01 0.0 Charge Balance: SPECIATED Sum of CATIONS = 1.628E-03 Sum of ANIONS 1.512E-03
330 H+1 5.300E-04 158.7 -1.961E-04 -58.7 0.000E-01 0.0 2 H20 7.043E-07 46.1 8.227E-07 53.9 0.000E-01 0.0 Charge Balance: SPECIATED Sum of CATIONS = 1.628E-03 Sum of ANIONS
2 H20 7.043E-07 46.1 8.227E-07 53.9 0.000E-01 0.0 Charge Balance: SPECIATED Sum of CATIONS = 1.628E-03 Sum of ANIONS 1.512E-03
Charge Balance: SPECIATED Sum of CATIONS = 1.628E-03 Sum of ANIONS 1.512E-03
Sum of CATIONS = $1.628E-03$ Sum of ANIONS $1.512E-03$
SUM OF CATIONS - 1.020E-05 SUM OF ANIONS 1.512E-05
PEPCENT DIFFERENCE = 3.713E+00 (ANIONS - CATIONS) / (ANIONS + CATIONS)
NON-CAPENATE ALKALINTY $-6.570E-07$
FOULTEBRING INTO STEENGTH $(m) = 7.398E-04$
FOULL BRUM properties $= 13.089$ or $Fh = 759.46$ my
****** DIFFUSE LAVER ADSORDTION MODEL *******
**** Darameters For Edsorbant Number 1 ****
Electrostatic Variables: $psi0 = 0.008907$ $sid0 = 0.000569$
$p_{sib} = 0.000000$ $sigh = 0.000000$
psid = 0.000000 $sigd = 0.000000$
Adsorbent Concentration $(\alpha/1)$: 3.442
Specific Surface Area (sg. meters/g): 600.00

		PART	6	of OUTPU	JT FI	LE					
Saturation	n indices and	stoichiometry	У	of all r	nine	cals					
ID #	NAME	Sat. Index		Sto	ichic	omet	ry in []	bracl	kets	s]	
2003000	ALOH3(A)	-3.542	[1.000]	30]	3.000]	2	[-3.000]	330
5015000	ARAGONITE	-2.019	[1.000]	150]	1.000]	140			
5046000	ARTINITE	-7.497	Ε	-2.000]	330]	2.000]	460	[1.000]	140
			I	5.000]	2						
2003001	BOEHMITE	-1.755	[-3.000]	330]	1.000]	30	[2.000]	2
2046000	BRUCITE	-5.059]	1.000]	460]	2.000]	2]	-2.000]	330
5015001	CALCITE	-1.862	E	1.000]	150]	1.000]	140			
2003002	DIASPORE	0.000]	-3.000]	330]	1.000]	30	[2.000]	2
5015002	DOLOMITE	-3.011	[1.000]	150]	1.000]	460	[2.000]	140
2028100	FERRIHYDRITE	-6.675	Ε	-3.000]	330]	1.000]	281	E	3.000]	2
2028101	FE3(OH)8	-33.487	[-8.000]	330	[2.000]	281	[1.000]	280
			[8.000]	2						
2003003	GIBBSITE (C)	-1.871	[-3.000]	330	[1.000]	30	[3.000]	2
3003000	A1203	-8.530]	2.000]	30	[3.000]	2	[-6.000]	330
2028102	GOETHITE	-2.491	I	-3.000]	330	[1.000]	281]	2.000]	2
3028100	HEMATITE	0.000]	-6.000]	330]	2.000]	281	I	3.000]	2
5015003	HUNTITE	-9.470]	3.000]	460	I	1.000]	150	[4.000]	140
5046001	HYDRMAGNESIT	-18.231]	5.000]	460	[4.000]	140	[-2.000]	330
			ſ	6.0001	2						

3028101	MAGHEMITE	-9.953	[-6.000]	330	[2.000]	281	[3.000]	2
5046002	MAGNESITE	-1.647	Ľ	1.000]	460	I	1.000]	140			
3028000	MAGNETITE	-17.723	[-8.000]	330	[2.000]	281	[1.000]	280
			[4.000]	2						
3050000	NATRON	-11.542	ſ	2.0001	500	٦	1.0001	140	ſ	10.0001	2
5046003	NESOLEHONTTE	-4.050	ſ	1.0001	460	ſ	1,0001	140	ſ	3.0001	2
5028000	CT DEDITE	-20 914	ſ	1 0001	280	r	1 0001	140	L	5.000]	2
5020000	OTDERTIE	20.914	L	1.000]	200	r	1.000]	140			
5050000	SIRONIIANIIE	-2.747	L	1.000]	500	L	1.000]	140	r	1 0001	0
5050001	THERMONATR	-13.243	L	2.000]	500	L	1.000]	140	l	1.000]	2
5010000	WITHERITE	-4.050	Ł	1.000]	100	L	1.000]	140			
5023100	CUCO3	-9.307	[1.000]	231	[1.000]	140			
2023100	CU (OH) 2	-6.104	[-2.000]	330]	1.000]	231	I	2.000]	2
2023101	TENORITE	-5.084	[-2.000]	330	J	1.000]	231]	1.000]	2
3023100	CUPRICFERIT	-7.246	F	-8.0001	330	٢	1.0001	231	Γ	2.0001	281
			ſ	4,0001	2	-					
95000	ZN METAL	-63 719	ſ	1,0001	950	Г	2,0001	1			
5005000	CMTTUCONTTE	-7 013	ſ	1 0001	950	r	1 0001	110			
5095000	SMITHSONITE	-7.013	L	1.000]	950	L	1.000]	140	Г	1 0001	2
5095001	ZNCOS, THZO	-6.690	L	1.000]	950	L	1.000]	140	L	1.000]	2
2095000	ZN (OH) 2 (A)	-7.710	L	-2.000]	330	L	1.000]	950	L	2.000]	2
2095001	ZN(OH)2 (C)	-7.460	l	-2.000]	330	[1.000]	950	L	2.000]	2
2095002	ZN(OH)2 (B)	-7.010	[-2.000]	330	[1.000]	950	[2.000]	2
2095003	ZN(OH)2 (G)	-6.970	[-2.000]	330	[1.000]	950	[2.000]	2
2095004	ZN(OH)2 (E)	-6.760	[-2.000]	330	[1.000]	950	[2.000]	2
2095005	ZNO(ACTIVE)	-6.570	٢	-2.0001	330	Г	1.0001	950	1	1.0001	2
	,					-					
TD #	NAME	Sat. Index		Sto	ichic	me	try in [brack	ret	3]	
2095006	TNCTTE	-6 712	Г	-2 0001	330	Г	1 0001	950	1	1 0001	2
2095000	OD MEMDI	ED 127	L r	2.000]	100	L	2.000]	1	L	1.000]	2
16000	CD METAL	-52.437	L	1.000]	160	L	2.000]	1			
16001	GAMMA CD	-52.539	L	1.000]	160	L	2.000]	T			
5016000	OTAVITE	-4.472	l	1.000]	160	L	1.000]	140			
2016000	CD(OH)2 (A)	-10.540	[-2.000]	330	[1.000]	160	[2.000]	2
2016001	CD(OH)2 (C)	-10.163	J	-2.000]	330	[1.000]	160	[2.000]	2
2016002	MONTEPONITE	-11.987	I	-2.000]	330	I	1.000]	160	[1.000]	2
60000	PB METAL	-45.642	[1.000]	600	[2.000]	1			
5060000	CERRUSITE	-7.692	٢	1.0001	600	ſ	1.0001	140			
2060000	MASSICOT	-12 350	ſ	-2.0001	330	r	1,0001	600	٢	1,0001	2
2060001	LITHARCE	-12 155	ſ	-2 0001	330	Г	1 0001	600	F	1 0001	2
2060001	DDO 3030	-12 191	L	-2.000]	330	L	1 0001	600	ſ	1 3301	2
2000002	PB0, .3n20	10 756	L	-2.000]	220	L	2.000]	600	L	1.0001	2
2000001	PBZUCUS	-19.756	L	-2.000]	330	l	2.000	600	L	1.000]	2
		22 622	1	1.000]	140		0.0001	600		1 0001	1.4.0
5060002	PB302C03	-30.690	L	-4.000]	330	L	3.000]	600	L	1.000]	140
			[2.000]	2						
2060003	PLATTNERITE	-7.334	[-4.000]	330	[-2.000]	1	[1.000]	600
]	2.000]	2						
3060000	PB203	-17.264	I	-6.000]	330	[-2.000]	1	Γ	2.000]	600
			F	3.000]	2						
3060001	MINIUM	-30.583	ſ	-8,0001	330	٢	-2.0001	1	٦	3.0001	600
0000001		001000	ſ	4 0001	2	c			L	,	
2060004	DR (OH) 2 (C)	-7 551	ſ	-2 0001	330	Г	1 0001	600	Г	2 0001	2
5060003	UVDCEDDUCTTE	-7.551	L	-2.000]	330	L	2 0001	600	r	2.000]	110
3060003	HIDCERRUSIIE	-23.325	L	-2.000]	550	L	5.000]	000	L	2.000]	140
0000005	2200/00110	04 601	L	2.000]	2		0 0001	600		2 0003	0
2060005	PB20 (OH) 2	-24.601	l	-4.000]	330	l	2.000]	600	L	3.000]	2
5054000	NICO3	-10.679	[1.000]	540	[1.000]	140			
2054000	NI (OH) 2	-6.052	[-2.000]	330	[1.000]	540	E	2.000]	2
2054001	BUNSENITE	-8.479]	-2.000]	330]	1.000]	540	[1.000]	2
5023101	MALACHITE	-11.226]	2.000]	231	[2.000]	2	J	1.000]	140
			٢	-2.0001	330						
5023102	AZURTTE	-18.539	ſ	3,0001	231	٢	2,0001	2	Г	2,0001	140
0020202	a and the table is held	10.000	Г	-2 0001	330	L	2.000]	-	L	2.000]	
2015000	TIME	-22 072	L F	-2 0001	330	г	1 0001	150	г	1 0001	2
2015000	DODULTNICTOR	11 707	L	-2.000]	220	L	1.0000]	150	L	1,000]	4
2013001	PORTLANDITE	-11.727	L	-2.000]	330	L	T.000]	120	L	2.000]	2
2028000	WUSTITE	-20.377	L	-2.000]	330	L	0.947]	280	L	1.000]	2
2046001	PERICLASE	-9.924	[-2.000]	330	[1.000]	460	[1.000]	2
3028001	HERCYNITE	-23.529	[-8.000]	330	[1.000]	280]	2.000]	30
			٢	4,0001	2						

3046000	SPINEL	-11.054] [-8.000]	330	[1.000]	460	[2.000]	30
3046001	MAG-FERRITE	-9.182	[-8.000]	330]	1.000]	460	[2.000]	281
3028102	LEPIDOCROCIT	-3.155	[-3.000]	330	[1.000]	281	[2.000]	2
3021100	FECR204	-12.371]	2.000]	211	[1.000]	280	[-4.000]	330
3021101	MGCR204	-3.767]	2.000]	211	[1.000]	460	[-4.000]	330
3021102	CR203	0.000	[2.000]	211	I	-2.000]	330]	-1.000]	2
2021102	CR (OH) 3 (A)	-0.860]	1.000]	211]	1.000]	2	[-1.000]	330
2021101	CR (OH) 3 (C)	-3.412	[1.000]	211]	1.000]	2	I	-1.000]	330

6 - Modelling with pH = 8.5

		PART	1 of OUTPU	JT FILE				
Revuè ri Entered adsorpti	ver water-Site PCO ₂ , PO ₂ , fix on	e 14 - pH = 8 ed pH, solid	.5 is allowed	to precip	pitate,	Fe redo:	x pair	and
Tempera Units o Ionic s Carbona Do not Precipi the p The max The met Interme Adsorpt Number	ture (Celsius) f concentration trength to be te concentration automatically tation is allow rint option for imum number of hod used to con- diate output f ion model: Dif of adsorbing s	: 19.30 on: MG/L computed. on represent terminate if owed for all or solids is iterations ompute activi file fuse Layer surfaces: 1	s carbonate charge imb solids in t set to: 1 is: 200 ty coeffici	e alkalin: balance ex the thermo .ents is:	ity. kceeds i odynamic Davies	30% c databas equation	se and	
INPUT DA ID 330 100 150 160 211 231 280 410 460 500 540 600 800 950 1 140 281 813 811 812 2	TA BEFORE TYPE NAME H+1 Al+3 Ba+2 Ca+2 Cd+2 Cr(OH)2+ Cu+2 Fe+2 K+1 Mg+2 Na+1 Ni+2 Pb+2 Sr+2 Zn+2 E-1 CO3-2 Fe+3 ADS1PSIO ADS1TYP1 ADS1TYP2 H2O	E MODIFICATIO ACTIVITY G 3.162 4.786 1.380 1.288 4.677 2.818 3.162 5.370 6.607 1.445 2.089 1.862 1.778 5.754 3.090 1.000 2.188 1.778 1.000 1.905 7.762 1.000	NS UESS LOG E - 09 E - 06 E - 04 E - 09 E - 08 E - 07 E - 07 E - 04 E - 04 E - 04 E - 07 E - 03 E + 00	GUESS -8.500 -5.320 -5.860 -3.890 -8.330 -7.550 -6.500 -6.270 -4.180 -3.840 -3.680 -7.730 -6.750 -6.240 -6.510 -16.000 -3.660 -20.750 0.000 -3.720 -2.110 0.000	ANAL TO 0.000H 1.300H 5.200H 5.300H 2.400H 2.000H 3.000H 2.599H 3.500H 4.800H 1.100H 3.700H 5.000H 2.000H 0.000H 1.310H 0.000H 1.922H 7.690H 0.000H	$\begin{array}{l} \text{DTAL} \\ \text{E} - 01 \\ \text{E} - 01 \\ \text{E} - 01 \\ \text{E} + 00 \\ \text{E} - 04 \\ \text{E} - 03 \\ \text{E} - 02 \\ \text{E} - 02 \\ \text{E} + 00 \\ \text{E} + 00 \\ \text{E} + 00 \\ \text{E} - 03 \\ \text{E} - 02 \\ \text{E} - 02 \\ \text{E} - 01 \\ \text{E} - 03 \\ \text{E} - 03 \\ \text{E} - 01 \\ \text$		
Cha S P Type I	rge Balance: U um of CATIONS= ERCENT DIFFERE - COMPONENTS F	UNSPECIATED = 8.438E-04 ENCE = 3.180 PART AS SPECIES IN	Sum of ANIC E+01 (ANIC 3 of OUTPU SOLUTION	ONS = 4.3 ONS - CAT T FILE	366E-04 IONS)/(2	ANIONS +	CATION	IS)
ID 330 30 100 150 160 211 231 280 410 460 500 540	NAME H+1 Al+3 Ba+2 Ca+2 Cd+2 Cr(OH)2+ Cu+2 Fe+2 K+1 Mg+2 Na+1 Ni+2	CALC MOL 3.291E-09 7.609E-19 1.871E-08 4.441E-06 4.479E-14 8.075E-11 7.885E-15 2.356E-27 6.647E-05 1.396E-04 2.086E-04 2.938E-13	ACTIVITY 3.162E-09 5.307E-19 1.595E-08 3.784E-06 3.816E-14 7.758E-11 6.719E-15 2.008E-27 6.386E-05 1.190E-04 2.004E-04 2.504E-13	LOG ACTV -8.500 -18.275 -7.79 -5.422 -13.418 -10.110 -14.172 -26.697 -4.194 -3.924 -3.698 -12.601	JTY C 000 0. 513 0. 513 0. 513 0. 513 0. 513 0. 513 0. 208 0. 340 0. 025 0. 272 0. 733 0. 476 0. 311 0. 142 0.	GAMMA .96076 .69751 .85206 .85206 .85206 .85206 .85206 .96076 .85206 .96076 .85206	NEW 1 0.0 0.1 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.	OGK 17 56 70 70 70 17 70 17 70 17 70 17 70 17 70

600	Pb+2	9.241E-17	7.874E-17	-16.10381	0.85206	0.070
800	Sr+2	5.707E-07	4.862E-07	-6.31314	0.85206	0.070
950	Zn+2	7.953E-13	6.776E-13	-12.16901	0.85206	0.070
811	ADS1TYP1	6.585E-05	6.585E-05	-4.18143	1.00000	0.000
140	CO3-2	2.394E-05	2.039E-05	-4.69048	0.85206	0.070
281	Fe+3	7.461E-28	5.204E-28	-27.28367	0.69751	0.156
812	ADS1TYP2	5.872E-03	5.872E-03	-2.23123	1.00000	0.000
Type II	- OTHER SPECIE	S IN SOLUTI	ON OR ADSOR	BED		
ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
8121000	=SO2Ba+	8.367E-09	8.367E-09	-8.07742	1.00000	-7.200
2113302	Cr(OH) 3 AQ	1.818E-09	1.819E-09	-8.74025	1.00030	-7.130
2113303	Cr(OH)4-	5.716E-12	5.492E-12	-11.26026	0.96076	-18.133
2113304	Cr02-	1.451E-11	1.394E-11	-10.85585	0.96076	-17.728
3300020	OH-	2.132E-06	2.048E-06	-5.68865	0.96076	-14.171
4603300	MgOH +	3.880E-08	3.728E-08	-7.42857	0.96076	-11.987
4601400	MgCO3 AQ	2.121E-06	2.122E-06	-5.67330	1.00030	2.942
4601401	MgHCO3 +	2.174E-06	2.089E-06	-5.68012	0.96076	11.452
1503300	CaOH +	1.948E-10	1.872E-10	-9.72773	0.96076	-12.788
1501400	CaHCO3 +	5.348E-08	5.139E-08	-7.28916	0.96076	11.341
1501401	CaCO3 AQ	9.742E-08	9.745E-08	-7.01120	1.00030	3.101
5001400	NaCO3 -	5.882E-08	5.651E-08	-7.24788	0.96076	1.158
202200	Nahcus AQ	1.353E-07	1.354E-07	-0.80858	1.00030	10.080
303300	ALOH +2	1.303E-13	1.101E-13 1.216E-12	-11 27514	0.05200	-3.090
303301	AI(OH)2 +	4.300E-12 1 207E-09	4.210E-12 1.246E-08	-7 90159	0.96076	-23 612
303302	A1 (OH) 3 AO	1.678E-00	1.240E-00	-8 77515	1 00030	-16 000
2803300	FOH +	1.354E - 28	1.300E - 28	-27 88589	0.96076	-9 671
2803301	FeOH3 -1	2.439E-33	2.343E-33	-32,63021	0.96076	-31,415
2803302	FeOH2 AO	2.111E-31	2.111E-31	-30.67542	1.00030	-20,978
2813300	FeOH +2	8.857E-22	7.547E-22	-21.12223	0.85206	-2.269
2813301	FeOH2 +	1.158E-16	1.113E-16	-15.95368	0.96076	-5.653
2813302	FeOH3 AQ	4.132E-16	4.133E-16	-15.38369	1.00030	-13.600
2813303	FeOH4 -	1.360E-15	1.307E-15	-14.88369	0.96076	-21.583
2813304	Fe2(OH)2+4	3.698E-41	1.949E-41	-40.71021	0.52707	-2.865
2813305	Fe3(OH)4+5	1.200E-54	4.413E-55	-54.35531	0.36764	-6.070
8003300	SrOH +	6.594E-12	6.335E-12	-11.19822	0.96076	-13.368
1003300	BaOH +	1.401E-13	1.346E-13	-12.87101	0.96076	-13.556
2311400	CuCO3 AQ	7.357E-13	7.359E-13	-12.13320	1.00030	6.730
2311401	Cu(CO3)2-2	2.217E-14	1.889E-14	-13.72367	0.85206	9.900
2313300	CuOH +	2.211E-14	2.125E-14	-13.67273	0.96076	-7.983
2313301	Cu(OH)2 AQ	1.403E-11	1.404E-11	-10.85273	1.00030	-13.680
2313302	Cu(OH) 3 -	2.790E-16	2.681E-16	-15.5/1/4	0.96076	-26.882
2313303	Cu(OH) 4 - 2	1.981E-20	1.688E-20	-19.77275	0.85206	-39.530
2313304	Cuz(OH)Z+Z	1.505E-22	1.2220-15	-21.95452	0.85206	-10.540
2511402	ZDOH +	4.510E - 13 1 574F - 13	4.335E = 13 1 512E = 13	-12 82043	0.96076	-9 134
9503301	$Zn(OH) 2 \Delta O$	8 548E-13	8 550E-13	-12.02043	1 00030	-16 899
9503302	Zn(OH) 3 -	8.899E-16	8.550E-16	-15.06803	0.96076	-28 382
9503303	2n(OH) 4 -2	5.029E-20	4.285E-20	-19 36803	0.85206	-41 129
9501400	ZnHCO3 +	1.143E-13	1.098E-13	-12,95949	0.96076	12.417
9501401	ZnCO3 AO	2.757E-12	2.758E-12	-11.55948	1.00030	5.300
9501402	Zn (CO3) 2-2	1.411E-12	1.202E-12	-11.91996	0.85206	9.700
1601400	Cd(CO3)3-4	1.019E-21	5.372E-22	-21.26983	0.52707	6.498
1603300	CdOH +	6.789E-16	6.523E-16	-15.18555	0.96076	-10.250
1603301	Cd(OH)2 AQ	1.704E-17	1.704E-17	-16.76841	1.00030	-20.350
1603302	Cd(OH)3 -	6.295E-22	6.048E-22	-21.21842	0.96076	-33.283
1603303	Cd(OH)4 -2	2.000E-27	1.704E-27	-26.76842	0.85206	-47.280
1603304	Cd2OH +3	1.879E-28	1.311E-28	-27.88250	0.69751	-9.389
1601400	CdHCO3 +	6.434E-15	6.182E-15	-14.20887	0.96076	12.417
1601401	CdCO3 AQ	1.950E-13	1.950E-13	-12.70987	1.00030	5.399
6001400	Pb(CO3)2-2	1.678E-15	1.430E-15	-14.84477	0.85206	10.710
6003300	PbOH +	5.053E-16	4.855E-16	-15.31382	0.96076	-7.693
6003301	Pb(OH)2 AQ	5.971E-17	5.973E-17	-16.22382	1.00030	-17.120

6003302	Pb(OH)3 -	2.257E-19	2.169E-19	-18.66383	0.96076	-28.043	
6003303	Pb20H +3	1.227E-30	8.558E-31	-30.06763	0.69751	-6.204	
6003304	Pb3 (OH) 4+2	3.159E-39	2.691E-39	-38.57003	0.85206	-24.189	
6001401	PbCO3 AQ	2.790E-14	2.791E-14	-13.55429	1.00030	7.240	
6003305	Pb(OH)4 -2	1.848E-22	1.575E-22	-21.80284	0.85206	-39.629	
6001402	PbHCO3 +	8.377E-17	8.048E-17	-16.09429	0.96076	13.217	
5403300	NiOH +	7.560E-15	7.263E-15	-14.13886	0.96076	-10.020	
5403301	Ni(OH)2 AQ	2.503E-15	2.504E-15	-14.60144	1.00030	-19.000	
5403302	Ni(OH)3 -	8.240E-18	7.917E-18	-17.10145	0.96076	-29.983	
5401400	NiHCO3 +	4.960E-14	4.765E-14	-13.32190	0.96076	12.487	
5401401	NiCO3 AQ	3.784E-11	3.785E-11	-10.42190	1.00030	6.870	
5401402	Ni(CO3)2-2	1.575E-12	1.342E-12	-11.87238	0.85206	10.180	
3301400	нсоз –	1.624E-03	1.560E-03	-2.80680	0.96076	10.401	
3301401	H2CO3 AQ	1.053E-05	1.053E-05	-4.97738	1.00030	16.713	
2113300	Cr+3	8.994E-18	6.273E-18	-17.20252	0.69751	10.064	
2113301	Cr(OH)+2	1.200E-13	1.023E-13	-12.99024	0.85206	5.690	
8123301	=SO2-	1.031E-03	1.031E-03	-2.98681	1.00000	-8.930	
8123302	=SO2H2+	7.662E-04	7.662E-04	-3.11564	1.00000	7.290	
8113301	=S01-	1.156E-05	1.156E-05	-4.93701	1.00000	-8.930	
8113302	=SO1H2+	8.593E-06	8.593E-06	-5.06584	1.00000	7.290	
8129500	=SO2Zn+	2.725E-08	2.725E-08	-7.56466	1.00000	-1.990	
8119500	=SO1Zn+	2.787E-07	2.787E-07	-6.55485	1.00000	0.970	
8121600	=S02Cd+	1.888E-10	1.888E-10	-9.72405	1.00000	-2.900	
8111600	=SO1Cd+	4.526E-09	4.526E-09	-8.34424	1.00000	0.430	
8112310	=SO1Cu+	2.096E-07	2.096E-07	-6.67857	1.00000	2.850	
8122310	=SO2Cu+	1.051E-07	1.051E-07	-6.97837	1.00000	0.600	
8115400	=SO1Ni+	1.559E-08	1.559E-08	-7.80727	1.00000	0.150	
8125400	=SO2Ni+	3.111E-09	3.111E-09	-8.50708	1.00000	-2.500	
8116000	=SO1Pb+	1.780E-07	1.780E-07	-6.74966	1.00000	4.710	
8126000	=SO2Pb+	6.174E-10	6.174E-10	-9.20946	1.00000	0.300	
8121500	=SO2Ca+	2.100E-05	2.100E-05	-4.67773	1.00000	-5.850	
8111500	=SO1HCa++	1.042E-04	1.042E-04	-3.98234	1.00000	4.970	
8111000	=SO1HBa++	1.356E-06	1.356E-06	-5.86762	1.00000	5.460	
Type II: ID 330 3301403 3300021 2802810	I - SPECIES W NAME H2O H+1 CO2 (g) O2 (g) Fe+2/Fe+3	VITH FIXED ACT CALC MOL -1.458E-03 1.549E-03 -1.244E-03 1.001E-04 -5.372E-07	LOG MOI -2.836 -2.810 -2.905 -4.000 -6.270	NEW LOGK 0.000 8.500 21.690 -84.354 13.175	DH 0.000 0.000 -0.530 133.830 -10.000		
Type IV	- FINITE SOL	IDS (present	at equilibri	um)	DH		
3028100	HEMATITE	2.686E-07	-6.571	3.567	30.845		
2003002	DIASPORE	4 804E-06	-5.318	-7.225	24,630		
3021102	CR203	1.299E-08	-7.886	3 220	12 125		
0021102	011200	1.2001 00		0.220	10.100		
		PAR	T 4 of OUTPU	T FILE			
	PERC	ENTAGE DISTRI	BUTION OF CC	MPONENTS AMO	NG		
	TYPE I	and TYPE II (dissolved an	d adsorbed)	species		
ADS1PSIO							
	>1000.	PERCENT B	OUND IN SPEC	IES #8123301	=S02-		
	33.3	PERCENT B	OUND IN SPEC	IES #8113301	=S01-		
ADS1TYP2							
	76.4	·PERCENT B	OUND IN SPEC	IES # 812	ADS1TYP2		
	13.4	PERCENT B	OUND IN SPEC	IES #8123301	=S02-		
	10.0	PERCENT B	OUND IN SPEC	IES #8123302	=SO2H2+		
Ba+2							
	1.4	PERCENT B	OUND IN SPEC	IES # 100	Ba+2		
	98.0	PERCENT B	OUND IN SPEC	IES #8111000	=SO1HBa++		
Ca+2							
	2 1	DEDCENT D	OUND TH ODEC	TEC # 150	0-10		
	16.2	PERCENT	BOUND	IN	SPECIES	#8121500	=SO2Ca+
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	80.3	PERCENT	BOUND	IN	SPECIES	#8111500	=SO1HCa++
Cd+2							
	4.0	PERCENT	BOUND	IN	SPECIES	#8121600	=SO2Cd+
	96.0	PERCENT	BOUND	IN	SPECIES	#8111600	=SO1Cd+
Zn+2							
	8.9	PERCENT	BOUND	IN	SPECIES	#8129500	=SO2Zn+
	91.1	PERCENT	BOUND	IN	SPECIES	#8119500	=SO1Zn+
Cu+2	<i>cc c</i>	DDD GDMM	DOUND		apparpa	10110010	0010-1
	66.6	PERCENT	BOUND	IN	SPECIES	#8112310	=SOICu+
a pot mund	33.4	PERCENT	BOUND	ΙN	SPECIES	#8122310	=SO2Cu+
ADSITYPI	24.2	DEDODUM	DOUND	TN	ADDATES	4 011	ADO10001
	34.3	PERCENT	BOUND	IN	SPECIES	# 011	ADSITIPT
	6.0	PERCENT	BOUND	IN	SPECIES	#0113301	=501-
	4.5	PERCENT	BOUND	IN	SPECIES	#01115002	=501H2+
77 - 1	54.2	PERCENT	BOOND	TIN	SPECIES	#8111300	=50InCa++
K+1	100 0	DEDCENT	DOUND	TN	ODECTEC	# 410	V+1
Mala	100.0	PERCENT	BOOND	TIN	SECTES	# 410	I(+1
Mg+2	97 0	DEDCENT	BOUND	TN	SPECTES	# 460	Ma+2
	1 5	PERCENT	BOUND	TN	SPECIES	#4601400	MgCO3 AO
	1.5	PERCENT	BOUND	TN	SPECIES	#4601401	MaHCO3 +
Na+1	1.0	LEKCENT	DOOND	TIA	DIPCIPO	#1001101	rigiteos
Nail	99 9	PERCENT	BOUND	TN	SPECTES	# 500	Na+1
Ni+2	55.5	I BROBRI	DOOND	4.14	OT HOTHO	1 000	
NI 12	83 2	PERCENT	BOUND	TN	SPECTES	#8115400	=SO1Ni+
	16.6	PERCENT	BOUND	TN	SPECIES	#8125400	=SO2Ni+
Pb+2	10.0	1 Divobili	Doom		01 DOLLO	TOLLOYOU	
2.0.2	99.7	PERCENT	BOUND	ΤN	SPECIES	#8116000	=SO1Pb+
Sr+2							
	100.0	PERCENT	BOUND	IN	SPECIES	# 800	Sr+2
Cr(OH)2+							
	4.2	PERCENT	BOUND	IN	SPECIES	# 211	Cr(OH)2+
	94.7	PERCENT	BOUND	IN	SPECIES	#2113302	Cr(OH) 3 AQ
A1+3							
	88.5	PERCENT	BOUND	IN	SPECIES	# 303302	Al(OH)4 -
	11.5	PERCENT	BOUND	IN	SPECIES	# 303303	Al(OH)3 AQ
CO3-2							
	1.4	PERCENT	BOUND	IN	SPECIES	# 140	CO3-2
	97.6	PERCENT	BOUND	IN	SPECIES	#3301400	HCO3 -
Fe+2							
	94.6	PERCENT	BOUND	IN	SPECIES	# 280	Fe+2
	5.4	PERCENT	BOUND	IN	SPECIES	#2803300	FeOH +
E-1							
Fe+3							
	6.1	PERCENT	BOUND	IN	SPECIES	#2813301	FeOH2 +
	21.9	PERCENT	BOUND	IN	SPECIES	#2813302	FeOH3 AQ
	72.0	PERCENT	BOUND	IN	SPECIES	#2813303	FeOH4 -
H+1				-			
	119.8	PERCENT	BOUND	IN	SPECIES	#3301400	HCO3 -
	1.6	PERCENT	BOUND	IN	SPECIES	#3301401	H2CO3 AQ
	56.5	PERCENT	BOUND	IN	SPECIES	#8123302	=S02H2+
H20	CO O	DEDODUT	DOUND	T	apportes	12200000	011
	69.8	PERCENT	ROOND	LN	SPECIES	#3300020	UH-
	1.3	PERCENT	BOUND	IN	SPECIES	# 303300	MOUN +
	1.7	PERCENT	BOUND	TN	OPECIES	# 303302	AI (UR) 4 -
	9.1	PERCENT	BOUND	TN	SPECIES	#0112210	-501211+
	0.9	PERCENT	BOUND	TN	SPECIES	#0112310	-501Cu+
	5.4	PERCENT	BOUND	TN	SPECIES	#0122310	-502CU+
	0.0	FERCENT	DUUND	TIN	SECTES	#0110000	-POTED+

			PART 5	of OUTPUT	FILE				
		EQUI	LIBRATED N	ASS DISTR	IBUTION -				
TDX	NAME	DISS	DIVED	SOF	RBED	1	PRECIPI	TATE	D
1 Dir	111 11 111	MOL/KG	PERCENT	MOL/K	G PERCE	NT MO	OL/KG	PER	CENT
100	Ba+2	1.871E-08	3 1.4	1.365E-0	06 98.	6 0.00	00E-01		0.0
150	Ca+2	4.592E-06	5 3.5	1.252E-0	04 96.	5 0.00	00E-01		0.0
160	Cd+2	2.469E-13	3 0.0	4.715E-0	09 100.	0.0	00E-01		0.0
950	Zn+2	6.090E-12	2 0.0	3.060E-0	07 100.	0.0	00E-01		0.0
231	Cu+2	1.483E-11	L 0.0	3.147E-0	07 100.	0.0	00E-01		0.0
410	K+1	6.647E-05	5 100.0	0.000E-0	01 0.	0.0	00E-01		0.0
460	Mg+2	1.440E-04	1 100.0	0.000E-0	01 0.	0.0	00E-01		0.0
500	Na+1	2.088E-04	1 100.0	0.000E-0	01 0.	0.00	00E-01		0.0
540	Ni+2	3.977E-11	L 0.2	1.870E-0	99.	8 0.00	00E-01		0.0
600	Pb+2	3.032E-14	1 0.0	1.786E-0	07 100.	0 0.00	00E-01		0.0
800	Sr+2	5.707E-0	100.0	0.000E-0	01 0.	0 0.00	00E-01	-	0.0
211	Cr(OH)2+	1.919E-09	6.9	0.000E-0	0.	0 2.5	99E-08	9.	3.1
140	A1+3	1.465E-00		0.000E-0	JI 0.	4.80	J4E-06	9	9.7
200	CU3-2	2 1025-2		0.000E-0			00E - 01		0.0
200	F=1	0.000E-0	100.0	0.000E-0			10E-01		0.0
281	Fe+3	1.889E-15	5 0.0	0.000E-0		0 5.3	72E - 07	10	0.0
330	H+1	1.645E-03	3 121.3	-2.894E-0	04 -21.	3 0.00	DOE-01		0.0
2	H2O	2.229E-06	5 73.0	8.227E-0	27.	0 0.00	00E-01	,	0.0
**** *** El Sp	NON-CARBONAT EQUILIBRIUM EQUILIBRIUM EQUILIBRIUM *** DIFFUSE L * Parameters ectrostatic V sorbent Conce ecific Surfac	E ALKALINITY IONIC STRENG pH pe AYER ADSORPT For Adsorber ariables: p F ntration (g/ e Area (sq.	<pre>CION MODEL CION CION</pre>	2.129E-(1.289E-(8.500 12.589 ************************************	or Eh = sig0 = - sigb = 0 sigd = 0	730.4 .001622 .000000 .000000	45 mv		
Satu	ration indice	e and stoich	PART 6 0	f OUTPUT E	FILE				
oucu	ID # NAME	S and Secret Sat. 1	Index	Stoichi	ometry in	n [brac]	kets]		
20	03000 ALOH3 (A) -3.5	642 [1.000] 30	0 [3.0	00] 2	[-3.	000]	330
50	15000 ARAGONI	TE -1.8	27 [1.000] 150) [1.0	00] 140			
50	46000 ARTINIT	E -5.5	50 [- [2.000] 330 5.000] 2	2.00	00] 460	[1.	000]	140
20	03001 BOEHMIT	E -1.7	55 [-	3.000] 330) [1.00	00] 30	[2.	000]	2
20	46000 BRUCITE	-4.0	86 [1.000] 460	[2.00	200] 2	[-2.	000]	330
50	15001 CALCITE	-1.6	570 [1.000] 150) [1.00	00] 140			
20	03002 DIASPOR	E 0.0	000 [-	3.000] 330) [1.00	00] 30	[2.	000]	2
50	15002 DOLOMIT	E -1.8	46 [1.000] 150) [1.00	00] 460	[2.	000]	140
20	28100 FERRIHY	DRITE -6.6	675 [-	3.000] 330) [1.00	00] 281	[3.	000]	2
20	28101 FE3(OH)	8 -33.4	87 [- [8.000] 330 8.000] 2	2.00	00] 281	[1.	000]	280
20	03003 GIBBSIT	E (C) -1.8	[-	3.000] 330		JU] 30	[3.	000]	2
30	03000 A1203	-8.5	130 L .	2.000] 30		JU] 2	ι-6.	[000]	330
20	20100 UEMARTE	E -2.4	AT [-	3.000] 330		JUJ 281	ι 2.	[000]	2
50	15003 HINTTE	E U.U	50 [-			JUJ 281	[3.	0001	140
50	46001 HYDRMAC	-0.3 NESTT -13 3	64 r	5 0001 460		101 140	[_2	0001	230
00			[6.000] 2	2	20] TIO	1 2.	0001	550

3028101	MAGHEMITE	-9.953	I	-6.000]	330	[2.000]	281	[3.000]	2
5046002	MAGNESITE	-0.674	[1.000]	460	[1.000]	140			
3028000	MAGNETITE	-17.723]	-8.000] 4.000]	330 2]	2.000]	281	[1.000]	280
3050000	NATRON	-10.551	[2.000]	500	[1.000]	140	[10.000]	2
5046003	NESQUEHONITE	-3.077	[1.000]	460]	1.000]	140]	3.000]	2
5028000	SIDERITE	-20.914]	1.000]	280	I	1.000]	140			
5080000	STRONTIANITE	-1.763	ſ	1.000]	800	[1.000]	140			
5050001	THERMONATR	-12.252	ſ	2.0001	500	ſ	1.0001	140	ſ	1.0001	2
5010000	WITHERITE	-3.898	ſ	1,0001	100	ſ	1,0001	140			
5023100	CUC03	-9.233	ſ	1,0001	231	ſ	1,0001	140			
2023100	CU(OH) 2	-6.031	ſ	-2,0001	330	ſ	1,0001	231	Г	2,0001	2
2023101	TENORTTE	-5.010	F	-2 0001	330	ſ	1 0001	231	r	1 0001	2
2023101	CHORTCEEDIT	-7 173	L	-8 0001	330	L L	1 0001	231	r	2 0001	281
3023100	CUPRICIENTI	1.115	r	4 0001	220	ι	1.000]	201	L	2.000]	201
95000	7N METAT	-63 628	L r	1 0001	950	Г	2 0001	1			
93000	ONTELICONTER	-03.020	L	1.000]	950	L	2.000]	140			
5095000	SMITHSONITE	-0.922	L	1.000]	950	L	1.000]	140	r	1 0001	2
5095001	ZNCO3, IHZO	-6.599	l	1.000]	950	L	1.000]	140	L	1.000]	2
2095000	ZN (OH) 2 (A)	-7.619	l	-2.000]	330	L	1.000]	950	L	2.000]	2
2095001	ZN (OH) 2 (C)	-7.369	l	-2.000]	330	L	1.000]	950	L	2.000]	2
2095002	ZN (OH) 2 (B)	-6.919	l	-2.000]	330	l	1.000]	950	L	2.000]	2
2095003	ZN (OH) 2 (G)	-6.879	[-2.000]	330	[1.000]	950	l	2.000]	2
2095004	ZN (OH) 2 (E)	-6.669	[-2.000]	330	[1.000]	950	[2.000]	2
2095005	ZNO(ACTIVE)	-6.479	[-2.000]	330	[1.000]	950	[1.000]	2
ID #	NAME	Sat. Index		Sto.	ichic	met	try in []	brack	cets	5]	
2095006	ZINCITE	-6.621	[-2.000]	330	[1.000]	950	[1.000]	2
16000	CD METAL	-52.343	1	1.000]	160	ſ	2.000]	1			
16001	GAMMA CD	-52.445	ſ	1.0001	160	ſ	2.0001	1			
5016000	OTAVITE	-4.377	[1.0001	160	ſ	1.0001	140			
2016000	CD(OH)2(A)	-10.445	ſ	-2,0001	330	ſ	1,0001	160	٢	2,0001	2
2016001	CD(OH) 2 (C)	-10.068	ſ	-2.0001	330	ſ	1.0001	160	Г	2,0001	2
2016002	MONTEPONITE	-11 892	ſ	-2 0001	330	ſ	1 0001	160	ſ	1,0001	2
600002	DD METAI	-15 515	r r	1 0001	600	L L	2 0001	100	L	1.000]	2
506000	CEDDUCTOE	-7 595	L	1 0001	600	L F	1 0001	140			
3060000	MAGATCOT	12 254	L	2.000]	220	L L	1.000]	600	r	1 0001	2
2060000	MASSICOI	-12.234	L	-2.000]	220	L	1.000]	600	L	1.000]	2
2060001	LI INAKGE	-12.000	L	-2.000]	220	L r	1.000]	600	L r	1 2201	2
2060002	PB0, .3H20	-12.084	L	-2.000]	220	L	1.000]	600	L r	1.0001	2
5060001	PB20C03	-19.562	l	-2.000]	330	L	2.000]	600	L	1.000]	Z
500000	22000000	20.200	L	1.000]	140	r	2 0001	600	r	1 0001	1 1 0
5060002	PB302C03	-30.399	l	-4.000]	330	L	3.000]	600	l	1.000]	140
			L	2.000]	2		0 0001	7		1 0001	600
2060003	PLATTNERITE	-7.237	l	-4.000]	330	l	-2.000]	T	L	1.000]	600
			L	2.000]	2		0 0001	7		0.0001	600
3060000	PB203	-17.071	L	-6.000]	330	L	-2.000]	T	L	2.000]	600
			L	3.000]	2						
3060001	MINIUM	-30.292	[-8.000]	330	[-2.000]	1	L	3.000]	600
			[4.000]	2						
2060004	PB(OH)2 (C)	-7.454	[-2.000]	330	[1.000]	600	[2.000]	2
5060003	HYDCERRUSITE	-23.232	[-2.000]	330	[3.000]	600	[2.000]	140
			[2.000]	2						
2060005	PB20 (OH) 2	-24.408	[-4.000]	330	[2.000]	600	[3.000]	2
5054000	NICO3	-10.594	[1.000]	540	[1.000]	140			
2054000	NI(OH)2	-5.966	[-2.000]	330]	1.000]	540	J	2.000]	2
2054001	BUNSENITE	-8.393	[-2.000]	330	[1.000]	540	[1.000]	2
5023101	MALACHITE	-11.079]	2.000]	231	[2.000]	2	[1.000]	140
			ſ	-2.0001	330						
5023102	AZURITE	-18.319	ſ	3.0001	231	٢	2.0001	2	ſ	2.0001	140
			ſ	-2.0001	330	L]	-	L]	
2015000	LIME	-21.880	ſ	-2.0001	330	٢	1.0001	150	٢	1.0001	2
2015001	PORTLANDITE	-11.536	ſ	-2,0001	330	ſ	1,0001	150	Г	2.0001	2
2028000	WIISTITE	-20 324	Г	-2 0001	330	ſ	0 9471	280	Г	1 0001	2
2046001	DEBICINCE	-8 951	r L	-2 0001	330	r	1 0001	460	Г	1 0001	2
2040001	HEDOVNITTE	-23 520	L	-8 0001	330	L	1 0001	280	L	2 0001	20
JU20001	MERCINTIE	-23.329	L	4 0001	220	L	T.000]	200	Ł	2.000]	50
			L	4.000]	2						

3046000	SPINEL	-10.081	[-8.000]	330	[1.000]	460	[2.000]	30
			[4.000]	2						
3046001	MAG-FERRITE	-8.209	[-8.000]	330	[1.000]	460]	2.000]	281
			[4.000]	2						
3028102	LEPIDOCROCIT	-3.155	[-3.000]	330]	1.000]	281	[2.000]	2
3021100	FECR204	-12.371	[2.000]	211	[1.000]	280]	-4.000]	330
3021101	MGCR204	-2.794]	2.000]	211	[1.000]	460	I	-4.000]	330
3021102	CR203	0.000	[2.000]	211	[-2.000]	330	[-1.000]	2
2021102	CR (OH) 3 (A)	-0.860	[1.000]	211	[1.000]	2]	-1.000]	330
2021101	CR (OH) 3 (C)	-3.412	[1.000]	211	[1.000]	2	I	-1.000]	330

APPENDIX III

EFFECT OF DISSOLVED ORGANIC MATTER (DOM) CHANGES IN METALS ADSORPTION AND PRECIPITATION IN THE WATER OF THE CHICAMBA DAM (SITE 14): Output files of modelling with the Minteqa2 Program

Extended output files of the site 14 water quality modelling with different DOM values. The modelling was undertaken with the geochemical speciation program MINTEQA2 only for site 14 in order to see what would be the influence of DOM changes in the water quality supplied to Chimoio City from the Chicamba Dam. DOM values of 0.001 to 0.005 mol/l were introduced in the model after the four runs were undertaken. The output file has been reduced.

1 - Modelling with DOM = 0.001 mol/l

		PART 1 of (OUTPUT FILE		
Revuè ri	ver water-Si	te 14 - DOM = 0.001 m	mol/l -		
Entered	PCO_2 , PO_2 , 1	fixed pH, solids al	lowed to pre	cipitate, Fe	redox pair,
adsorpti	on and disso	lved organic matter			
Tempera Units of Ionic s Carbona Do not Precipi the p The max The met Interme Adsorpt	ture (Celsiu of concentrat trength to be te concentrat automaticall tation is all rint option imum number hod used to diate output ion model: D	s): 19.30 ion: MG/L e computed. tion represents carbo y terminate if charge lowed for all solids for solids is set to of iterations is: 200 compute activity coe: file iffuse Layer	onate alkalin e imbalance e in the therm : 1) fficients is:	ity. xceeds 30% odynamic data Davies equat	ubase and
Number	of adsorbing	surfaces: 1			
INPUT DA ID	TA BEFORE TY NAME	PE MODIFICATIONS ACTIVITY GUESS	LOG GUESS	ANAL TOTAL	
330	H+1	2.512E-08	-7.600	0.000E-01	
30	A1+3	4.786E-06	-5.320	1.300E-01	
100	Ba+2	1.380E-06	-5.860	1.900E-01	
150	Ca+2	1.288E-04	-3.890	5.200E+00	
160	Cd+2	4.677E-09	-8.330	5.300E-04	
211	Cr(OH)2+	2.818E-08	-7.550	2.400E-03	
231	Cu+2	3.162E-07	-6.500	2.000E-02	
280	Fe+2	5.370E-07	-6.270	3.000E-02	
410	K+1	6.607E-05	-4.180	2.599E+00	
460	Mg+2	1.445E-04	-3.840	3.500E+00	
500	Na+1	2.089E-04	-3.680	4.800E+00	
540	Ni+2	1.862E-08	-7.730	1.100E-03	
600	Pb+2	1.778E-07	-6.750	3.700E-02	
800	Sr+2	5.754E-07	-6.240	5.000E-02	
950	Zn+2	3.090E-07	-6.510	2.000E-02	
1	E-1	1.000E-16	-16.000	0.000E-01	
140	CO3-2	2.188E-04	-3.660	1.310E+01	
281	Fe+3	1.778E-21	-20.750	0.000E-01	
813	ADS1PSIO	1.000E+00	0.000	0.000E-01	
811	ADS1TYP1	1.905E-04	-3.720	1.922E-04	

812	ADS1TYP2	7.762E-03	-2.110	7.690E-03
145	DOM	1.000E-03	-3.000	1.000E-03
2	H20	1.000E+00	0.000	0.000E-01

Charge Balance: UNSPECIATED Sum of CATIONS= 8.438E-04 Sum of ANIONS = 3.237E-03 PERCENT DIFFERENCE = 5.864E+01 (ANIONS - CATIONS)/(ANIONS + CATIONS)

		PART	3 of OUTPU	T FILE		
Type I -	COMPONENTS AS	SPECIES IN	SOLUTION			
ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
330	H+1	2.686E-08	2.512E-08	-7.60000	0.93502	0.029
30	A1+3	4.869E-16	2.660E-16	-15.57513	0.54627	0.263
100	Ba+2	1.136E-07	8.685E-08	-7.06122	0.76435	0.117
150	Ca+2	1.798E-05	1.375E-05	-4.86184	0.76435	0.117
160	Cd+2	1 322E - 12	1 010E - 12	-11,99559	0.76435	0.117
211	Cr(OH)2+	6.591E - 10	6 162E-10	-9 21025	0 93502	0 029
231	C_{11+2}	2.751E - 13	2 102E - 13	-12 67727	0 76435	0.117
280	Fo+2	1.657E - 25	1 267E - 25	-24 89733	0.76435	0 117
110	K+1	6 647E-05	6 215F - 05	-1 20656	0 93502	0.029
410	Ma+2	9 180F-05	7 246E - 05	-1 13989	0.76435	0.117
500	Na±1	2 0885-04	1 952F-04	-3 70950	0.93502	0.029
540	Ni+2	2.000E-04	7.075E - 12	-11 15024	0.76435	0.117
540	NITZ Db12	2 607E 15	2 05/E-15	-11.10024	0.76435	0.117
800	PD+2	2.007E-13	2.034E-13	-14.00741	0.76435	0.117
800	SI+Z	5.707E-07	4.362E-07	-0.30033	0.76435	0.117
950	ZII+Z	Z.413E-11	1.844E-11	-10.73416	0.76435	0.117
812	ADSITYP2	5.901E-03	5.901E-03	-2.22906	1.00000	0.000
140	C03-2	4.229E-07	3.232E-07	-6.49048	0.76435	0.117
281	re+3	4.774E-25	2.608E-25	-24.58367	0.54627	0.263
145	DOM	8.553E-04	5.051E-04	-3.29663	0.59055	0.229
811	ADSITYPI	1.333E-04	1.333E-04	-3.87502	1.00000	0.000
Type II	- OTHER SPECI	ES IN SOLUTI	ON OR ADSOR	BED		
ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
8121000	=SO2Ba+	1.309E - 10	1.309E-10	-9.88322	1,00000	-7,200
2113302	Cr(OH)3 A0	1.817E-09	1.819E-09	-8.74025	1.00089	-7.130
2113303	Cr(OH)4-	7.395E-13	6.914E-13	-12.16026	0.93502	-18,121
2113304	CrO2-	1.876E - 12	1.755E-12	-11.75585	0.93502	-17.716
1453300	H DOM	1.887E-06	1.518E-06	-5.81881	0.80439	3,965
1450300	Al DOM	3.445E-13	3.436E-13	-12.46394	0.99732	5.201
1451000	Ba DOM	9.303E-07	8.912E-07	-6.05003	0.95791	3,119
1451500	Ca DOM	9.290E-05	8.899E-05	-4.05065	0.95791	2,919
1451600	Cd DOM	1.715E - 11	1.643E-11	-10.78440	0.95791	3.319
1452110	Cr DOM	5.274E-12	5.259E-12	-11,27906	0.99732	15.221
1452310	Cu DOM	1.421E - 10	1.361E - 10	-9.86608	0.95791	4,919
1452810	Fe DOM	1.068E - 19	1.065E - 19	-18 97248	0 99732	7.701
1454600	Ma DOM	4.898E-05	4.691E - 05	-4 32870	0 95791	1,919
1455400	Ni DOM	1.201E - 10	1.051E - 10	-9 93905	0 95791	3,319
1456000	Pb DOM	2.770E - 12	2.653E-12	-11 57622	0 95791	5.219
1459500	Zn DOM	4 963E-10	4.754E - 10	-9 32297	0.95791	3 519
3300020	OH-	2.758E - 07	2.578E - 07	-6.58865	0.93502	-14 159
1603300	MaOH +	3 0575-09	2 858F-09	-8 5/393	0.93502	-11 975
4603300	MgCO3 AO	2 046E-09	2.030E-09	-7 69966	1 00089	2 9/1
4001400	Maucos +	1.712E-07	2.040E-00	6 70547	1.00009	11 161
1503300	CaOH +	9 156F-11	9 561F-11	-10.06749	0.93502	_12 776
1501400	CaUCO2 L	2 512E 00	0.JULE-11	-10.00749	0.93502	11 252
1501400		2.013E-08	2.330E-08	- 1.02092	1 00000	2 101
5001401	Nacos AU	0.330E-10	9 72/E 10	-0.20095	1.00009	1 170
5001400	Nacus -	9.330E-10	1 00CE 00	-9.03928	1 00000	10 000
202200	Nancus AQ	1.904E-08	1.900E-08	-7.71998	1.00089	TO.080
303300	ALUH +2	9.000E-14	7.320E-14	-13.13512	0.76435	-5.043
303301	AL (OH) Z +	3.301E-11	3.3496-11	-10.4/514	0.93502	-10.0/1
303302	AL (OH) 2 PO	1.077E-09	1.500E-09	-0.80458	1.00000	-23.600
303303	AL (OH) 3 AQ	1.07/E-09	1.0785-09	-8.77515	1.00089	-10.000
2803300	reon +	1.105E-27	1.033E-27	-26.98589	0.93502	-9.659

2803301	FeOH3 -1	3.155E-34	2.950E-34	-33.53021	0.93502	-31.404
2803302	FOOH2 DO	2 110F - 31	2 111E - 31	-30 67542	1,00089	-20.978
2003302	Fooli 12	6 220E 20	1 7628-20	-10 32223	0 76435	-2 222
2813300	FEOR +2	0.230E-20	4.7026-20	-19.52225	0.70435	E CA1
2813301	FeOH2 +	9.451E-16	8.83/E-10	-15.05368	0.93502	-5.641
2813302	FeOH3 AQ	4.130E-16	4.133E-16	-15.38369	1.00089	-13.600
2813303	FeOH4 -	1.760E-16	1.646E-16	-15.78369	0.93502	-21.571
2813304	Fe2 (OH) 2+4	2.273E-37	7.759E-38	-37.11021	0.34133	-2.676
2813305	Fe3 (OH) 4+5	7.483E-50	1.395E-50	-49.85531	0.18646	-5.775
2013300	CrOU +	7 6525-12	7 1555-13	-12 1/5/1	0 93502	-13 356
8003300	SIOH +	7.0326-13	7.155E-15	12.02407	0.93502	12 544
1003300	BaOH +	9.870E-14	9.229E-14	-13.03487	0.93502	-13.544
2311400	CuCO3 AQ	3.646E-13	3.650E-13	-12.43774	1.00089	6.730
2311401	Cu(CO3)2-2	1.943E-16	1.485E-16	-15.82822	0.76435	9.947
2313300	CuOH +	8.952E-14	8.370E-14	-13.07727	0.93502	-7.971
2313301	C11(OH)2 AO	6.956E-12	6.962E-12	-11,15728	1.00089	-13.680
2212202	C11 (OU) 2 -	1 700E-17	1.674E - 17	-16 77629	0 93502	-26 870
2313302	Cu(OH) = 0	1.7906-17	1.0746-17	-10.77029	0.76425	20.070
2313303	Cu(OH)4 - 2	1.735E-22	1.326E-22	-21.87729	0.76433	-39.403
2313304	Cu2 (OH) 2+2	2.255E-21	1.723E-21	-20.76361	0.76435	-10.492
2311402	CuHCO3 +	1.826E-14	1.707E-14	-13.76775	0.93502	13.029
9503300	ZnOH +	5.541E-13	5.181E-13	-12.28558	0.93502	-9.122
9503301	Zn(OH)2 AO	3.685E-13	3.688E-13	-12.43317	1.00089	-16.899
9503302	7n(0H)3 -	4 966F-17	4 643E - 17	-16 33318	0 93502	-28 370
9505502		2 0225 22	2.0205 22	21 52210	0.76425	41 002
9503303	Zn(OH)4 - 2	3.833E-22	2.930E-22	-21.55516	0.76433	-41.002
9501400	ZnHCO3 +	4.023E-13	3.762E-13	-12.42464	0.93502	12.429
9501401	ZnCO3 AQ	1.188E-12	1.190E-12	-11.92463	1.00089	5.300
9501402	Zn(CO3)2-2	1.075E-14	8.220E-15	-14.08511	0.76435	9.747
1601400	Cd(CO3)3-4	1.659E-25	5.662E-26	-25.24702	0.34133	6.687
1603300	COOH +	2 325E-15	2 174E-15	-14 66274	0.93502	-10.238
1603301	Cd(04)2 70	7 1455-18	7 152F - 18	-17 14560	1 00089	-20 350
1003301	CU(OII)2 AQ	7.14JE-10 2.41CE 22	7.1JZE 10	22 40561	1.00000	20.000
1603302	Ca(OH)3 -	3.416E-23	3.1946-23	-22.49561	0.95502	-33.271
1603303	Cd(OH)4 -2	1.483E-29	1.133E-29	-28.94561	0.76435	-47.233
1603304	Cd20H +3	2.117E-26	1.156E-26	-25.93688	0.54627	-9.283
1601400	CdHCO3 +	2.203E-14	2.060E-14	-13.68607	0.93502	12.429
1601401	CdCO3 AO	8.176E-14	8.183E-14	-13.08707	1.00089	5.399
6001400	Ph(CO3)2-2	1.226E - 17	9 368E-18	-17.02836	0.76435	10.757
6003300	PhOH +	1 7055-15	1.594F - 15	-11 79711	0 93502	-7 681
6003300	FDOIL T	1.7036-13	1.394E 13	16 60742	1 00000	17 120
6003301	PD(OH)Z AQ	2.4076-17	2.4096-17	-10.00742	1.00009	-17.120
6003302	PD (OH) 3 -	1.207E-20	1.129E-20	-19.94/43	0.93502	-28.031
6003303	Pb2OH + 3	1.342E-28	7.331E-29	-28.13482	0.54627	-6.097
6003304	Pb3(OH)4+2	1.570E-38	1.200E-38	-37.92082	0.76435	-24.142
6001401	PbCO3 AQ	1.153E-14	1.154E-14	-13.93789	1.00089	7.240
6003305	Pb(OH)4 -2	1.350E-24	1.032E-24	-23.98643	0.76435	-39.582
6001402	PhHCO3 +	2827E - 16	2 643E-16	-15 57789	0 93502	13 229
5402200	N;OU +	2.0271 10 2.764F - 14	2.594F = 14	-13 58768	0.93502	-10 008
5403300	NIOH +	2.7046-14	2.JO4E-14	-13.30700	0.93302	-10.008
5403301	N1 (OH) Z AQ	1.120E-15	1.121E-15	-14.95026	1.00089	-19.000
5403302	Ni(OH)3 -	4.774E-19	4.464E-19	-18.35026	0.93502	-29.971
5401400	NiHCO3 +	1.813E-13	1.695E-13	-12.77072	0.93502	12.499
5401401	NiCO3 AQ	1.694E-11	1.695E-11	-10.77072	1.00089	6.870
5401402	Ni(CO3)2-2	1.246E-14	9.524E-15	-14.02120	0.76435	10.227
3301400	HCO3 -	2.101E-04	1.964E - 04	-3.70680	0.93502	10,413
3301401	H2CO3 NO	1 0538-05	1 053E-05	-1 97738	1 00089	16 713
3301401	HZCOS HQ	1.0356-05	1.0356-05	14 50050	1.00009	10.715
2113300	Cr+3	5.755E-15	3.144E-15	-14.50252	0.54627	10.170
2113301	Cr(OH)+2	8.442E-12	6.453E-12	-11.19024	0.76435	5.737
8123301	=S02-	8.658E-04	8.658E-04	-3.06258	1.00000	-8.930
8123302	=SO2H2+	9.214E-04	9.214E-04	-3.03553	1.00000	7.290
8113301	=S01-	1.956E-05	1.956E-05	-4.70854	1.00000	-8.930
8113302	=S01H2+	2.082E-05	2.082E-05	-4,68149	1,00000	7.290
8129500	= \$027p+	1 1115-00	1 4145-00	-7 8/970	1 00000	-1 990
0129500	-002011	1.414C-00	2 0125 07	6 53566	1 00000	1.990
8119500	=SUIZN+	2.913E-07	2.913E-07	-0.53566	1.00000	0.970
8121600	=SO2Cd+	9.525E-11	9.525E-11	-10.02113	1.00000	-2.900
8111600	=SO1Cd+	4.602E-09	4.602E-09	-8.33709'	1.00000	0.430
8112310	=SO1Cu+	2.519E-07	2.519E-07	-6.59877	1.00000	2.850
8122310	=SO2Cu+	6.269E-08	6.269E-08	-7.20281	1.00000	0.600
8115400	=SO1Ni+	1.691E-08	1.691E-08	-7,77174	1.00000	0.150
8125400	= SO2Ni +	1 6765-00	1 6765-00	-8 77579	1 00000	-2 500
0110000	-0010-	1.7020 07	1 7020 07	6.71010	1.00000	2.500
0TT0000	=SOIPD+	1. /83E-0/	1.183E-0/	-6.14891	T.00000	4./10

8126000	=SO2Pb+	3.069E-10	3.0	69E	-10	-9.5129	95	1.00000	0.300
8121500	=SO2Ca+	1.454E-00	5 1.4	54E	-06	-5.8373	37	1.00000	-5.850
8111500	=SOIHCa++	1.739E-0	D 1./.	39E	-05	-4./598	80	1.00000	4.970
8111000	=SOIHBa++	3.395E-0	/ 3.3	955	-07	-6.4691	.8	T.00000	5.460
Type II	I - SPECIES WI	TH FIXED AC	CTIVIT	Y	C MOT	NITILI T (OF	DU	
ID	NAME	CALC MOL	-	LO	G MOL	NEW LO	JGK	DH	
220	H20	-1.423E-0:	1	-4	.847	7.60	0	0.000	
2201402	$\Pi + I$	-2.001E-04	± 1	-3	.515	21 60	0	-0.530	
3300021	O_{2}^{2} (g)	1 1395-0	1	-3	913	-84 35	54	133 830	
2802810	Fe+2/Fe+3	-5.372E-0	7	-6	.270	13.17	15	-10.000	
Type IV	- FINITE SOLI	DS (present	t at e	qui	librium)			
ID	NAME	CALC MOL		LO	G MOL	NEW LO)GK	DH	
3028100	HEMATITE	2.686E-0	7	-6	.571	3.56	57	30.845	
2003002	DIASPORE	4.815E-06	5	-5	.317	-7.22	25	24.630	
3021102	CR203	1.271E-08	3	-7	.896	3.22	20	12.125	
		DI		of		PTTP			
	PERCE	NTAGE DISTR	RIBUTI(ON (OF COMP	ONENTS	AMO	NG	
	TYPE I a	nd TYPE II	(disso	olv	ed and a	adsorbe	ed) :	species	
ADS1TYP1	CO 1	DEDORM	DOUND	TN	ODECTE	- ш	011	ND01mVD1	
	69.4	PERCENT	BOUND	IN	SPECIES	⊃ ₩ 2 ₩0117	811	ADSTTYP1	
	10.2	PERCENT	BOUND	IN	SPECIES	5 #8113	10202	=501-	
	10.8	PERCENT	BOUND	IN	SPECIES	5 #8113	5302	=SOIH2+	
NDC1 TVD2	9.0	PERCENT	BOOND	TIN	SPECIES	5 #8111	.500	=501HCa++	
ADSITIFZ	76 7	DEDCENT	BOUND	TN	SDECTES	3 #	812	209177202	
	11.3	DEDCENT	BOUND	TN	CDECIE	2 #0123	301	-SO2-	
	12.0	DEDCENT	BOUND	TN	SPECIES	= #0123	10201	-502-	
Ba+2	12.0	FERCENT	BOUND	TIN	DECCL	5 #0120	502	-302112+	
Darz	8 2	PERCENT	BOUND	TN	SPECTES	3 #	100	Ba+2	
	67.2	PERCENT	BOUND	TN	SPECIES	5 #1451	000	Ba DOM	
	24.5	PERCENT	BOUND	TN	SPECIES	5 #1401 5 #8111	000	=SO1HBa++	
Ca+2	21.0	LIKOLKI	DOOLD		OLDOID			boimbarr	
	13.9	PERCENT	BOUND	IN	SPECIES	5 #	150	Ca+2	
	71.6	PERCENT	BOUND	IN	SPECIES	5 #1451	500	Ca DOM	
	1.1	PERCENT	BOUND	IN	SPECIES	5 #8121	500	=SO2Ca+	
	13.4	PERCENT	BOUND	IN	SPECIES	5 #8111	500	=SO1HCa++	
Cd+2									
	2.0	PERCENT	BOUND	IN	SPECIES	\$ #8121	600	=SO2Cd+	
	97.6	PERCENT	BOUND	IN	SPECIES	5 #8111	600	=S01Cd+	
ADS1PSIO									
	973.8	PERCENT	BOUND	IN	SPECIES	#8123	302	=SO2H2+	
	22.0	PERCENT	BOUND	IN	SPECIES	5 #8113	302	=SO1H2+	
	1.5	PERCENT	BOUND	IN	SPECIES	5 #8121	500	=SO2Ca+	
	36.7	PERCENT	BOUND	IN	SPECIES	5 #8111	500	=SO1HCa++	
Cu+2									
	80.0	PERCENT	BOUND	IN	SPECIES	5 #8112	310	=SO1Cu+	
Print (127-112)	19.9	PERCENT	BOUND	IN	SPECIES	5 #8122	2310	=SO2Cu+	
DOM	0.5.5								
	85.5	PERCENT	BOUND	IN	SPECIES	5 #	145	DOM	
	9.3	PERCENT	ROUND	IN	SPECIES	5 #1451	.500	Ca DOM	
V 1 1	4.9	PERCENT	BOUND	IN	SPECIES	5 #1454	600	Mg DOM	
N+1	100 0	DEDODUM	DOUND	TN	ODEGTE	- Ш	110	1211	
Mat 2	100.0	PERCENT	BOUND	ΤN	SPECIES	> #	410	V+1	
NYTZ	65 0	DEDCEME	BOUND	TN	OPECTEC	2 #	160	Ma+2	
	34 0	DEDCENT	BOUND	TN	SPECIES	2 #14E4	400	Mg DOM	
Na+1	54.0	LEVCENT	DOOND	TIN	DIECIES	π1404	000	Mg DOM	
	100.0	PERCENT	BOUND	TN	SPECIES	5 #	500	Na+1	
Ni+2	200.0	2 21/02/11	200110		JEDULUK		550		

8.9 PERCENT BOUND IN SPECIES #8125400 =SO2Ni+ Pb+2 99.8 PERCENT BOUND IN SPECIES #8116000 =SO1Pb+ Sr+2 100.0 PERCENT BOUND IN SPECIES #8116000 =SO1Pb+ Sn+2 100.0 PERCENT BOUND IN SPECIES #8119500 =SO2Zn+ 95.2 PERCENT BOUND IN SPECIES #8119500 =SO1Zn+ Cr (OH) 2+ 26.4 PERCENT BOUND IN SPECIES #211 Cr (OH) 2+ 72.9 PERCENT BOUND IN SPECIES #2113302 Cr (OH) 3 AQ Al+3 1.1 PERCENT BOUND IN SPECIES # 303301 A1 (OH) 2 + 49.5 PERCENT BOUND IN SPECIES # 303301 A1 (OH) 4 - 49.5 PERCENT BOUND IN SPECIES # 303303 A1 (OH) 3 AQ C03-2 94.9 PERCENT BOUND IN SPECIES #301400 HCO3 - 4.8 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ Fe+2 99.3 PERCENT BOUND IN SPECIES #2813301 Fe0H4 - H+1 73.0 PERCENT BOUND IN SPECIES #2813301 Fe0H4 - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 320.4 PERCENT BOUND IN SPECIES #3101401 HCO3 - - 11.5 PER		90.3	PERCENT	BOUND	IN	SPECIES	#8115400	=SO1Ni+
Pb+2 99.8 PERCENT BOUND IN SPECIES #8116000 =SO1Pb+ Sr+2 100.0 PERCENT BOUND IN SPECIES #8116000 =SO1Pb+ Zn+2 4.6 PERCENT BOUND IN SPECIES #8129500 =SO2Zn+ 95.2 PERCENT BOUND IN SPECIES #8119500 =SO1Zn+ 95.2 PERCENT BOUND IN SPECIES #8119500 =SO1Zn+ Cr (OH)2+ 26.4 PERCENT BOUND IN SPECIES #211 Cr (OH)2+ Al+3 1.1 PERCENT BOUND IN SPECIES #30301 Al(OH)2 + 49.5 PERCENT BOUND IN SPECIES #3030302 Al(OH)4 - 49.5 PERCENT BOUND IN SPECIES #303101 Al(OH)3 AQ C03-2 94.9 PERCENT BOUND IN SPECIES #3301400 HCO3 - 4.8 PERCENT BOUND IN SPECIES #2813301 Fe0H2 + Fe+2 99.3 PERCENT BOUND IN SPECIES #2813301 Fe0H2 + 11.5 PERCENT BOUND IN SPECIES #2813301 Fe0H4 - H+1 7.0 PERCENT BOUND IN SPECIES #3301401 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301401 HCO3 - 7.2 PERCENT BOUND IN SPECIES #3301401 HCO3 - <td></td> <td>8.9</td> <td>PERCENT</td> <td>BOUND</td> <td>IN</td> <td>SPECIES</td> <td>#8125400</td> <td>=SO2Ni+</td>		8.9	PERCENT	BOUND	IN	SPECIES	#8125400	=SO2Ni+
99.8 PERCENT BOUND IN SPECIES #8116000 =S01Pb+ Sr+2 100.0 PERCENT BOUND IN SPECIES # 800 Sr+2 2n+2 4.6 PERCENT BOUND IN SPECIES # 8129500 =S02Zn+ 95.2 PERCENT BOUND IN SPECIES #8119500 =S01Zn+ Cr (OH)2+ 26.4 PERCENT BOUND IN SPECIES # 211 Cr (OH)2+ 72.9 PERCENT BOUND IN SPECIES # 211 Cr (OH)3 AQ Al+3 1.1 PERCENT BOUND IN SPECIES # 303301 Al (OH)4 - 49.5 PERCENT BOUND IN SPECIES # 303302 Al (OH)4 - 49.5 PERCENT BOUND IN SPECIES # 303303 Al (OH)3 AQ CO3-2 94.9 PERCENT BOUND IN SPECIES # 3031400 HCO3 - 4.8 PERCENT BOUND IN SPECIES # 3031400 HCO3 - 4.8 PERCENT BOUND IN SPECIES # 280 Fe+2 E-1 Fe+3 61.6 PERCENT BOUND IN SPECIES # 2813301 FeOH2 + 26.9 PERCENT BOUND IN SPECIES # 2813302 FeOH3 AQ 11.5 PERCENT BOUND IN SPECIES #2813303 FeOH4 - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #31302 =S02H2+ 7.2 PERCENT BOUND IN SPECIES #31302 =S02H2+ 7.2 PERCENT BOUND IN SPECIES #311302 =S02H2+ 24.7 PERCENT BOUND IN SPECIES #311302 =S02H2+ 22.6 PERCENT BOUND IN SPECIES #31200 OH- 1.3 PERCENT BOUND IN SPECIES #31200 =S01Zn+ 22.6 PERCENT BOUND IN SPECIES #8112310 =S01Zn+ 22.6 PERCENT BOUND IN SPECIES #811200 =S01Zn+ 22.6 PERCENT BOUND IN SPECIES #811200 =S01Zn+ 25.6 PERCENT BOUND IN SPECIES #811200 =S01Zn+ 26.6 PERCENT BOUND IN SPECIES #811200 =S01Zn+ 27	Pb+2							
Sr+2 100.0 PERCENT BOUND IN SPECIES # 800 Sr+2 Zn+2 4.6 PERCENT BOUND IN SPECIES #8129500 =S02Zn+ 95.2 PERCENT BOUND IN SPECIES #8119500 =S01Zn+ Cr (OH) 2+ 26.4 PERCENT BOUND IN SPECIES # 211 Cr (OH) 2+ Al+3 1.1 PERCENT BOUND IN SPECIES # 303301 Al (OH) 2 + 49.5 PERCENT BOUND IN SPECIES # 303302 Al (OH) 4 - 49.5 PERCENT BOUND IN SPECIES # 303303 Al (OH) 4 - 49.5 PERCENT BOUND IN SPECIES # 303303 Al (OH) 3 AQ C03-2 94.9 PERCENT BOUND IN SPECIES # 3031400 HCO3 - 4.8 PERCENT BOUND IN SPECIES # 3301400 HCO3 - Fe+2 99.3 PERCENT BOUND IN SPECIES #2813301 FeoH2 + 26.9 PERCENT BOUND IN SPECIES #2813302 FeoH4 - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ <td></td> <td>99.8</td> <td>PERCENT</td> <td>BOUND</td> <td>IN</td> <td>SPECIES</td> <td>#8116000</td> <td>=SO1Pb+</td>		99.8	PERCENT	BOUND	IN	SPECIES	#8116000	=SO1Pb+
100.0 PERCENT BOUND IN SPECIES # 800 Sr+2 Zn+2 4.6 PERCENT BOUND IN SPECIES #8129500 =SO2Zn+ 95.2 PERCENT BOUND IN SPECIES #8119500 =SO1Zn+ Cr (OH) 2+ 26.4 PERCENT BOUND IN SPECIES # 211 Cr (OH) 2+ Al+3 1.1 PERCENT BOUND IN SPECIES # 303301 Al (OH) 2 + 49.5 PERCENT BOUND IN SPECIES # 303303 Al (OH) 4 - 49.5 PERCENT BOUND IN SPECIES # 303303 Al (OH) 4 - 49.5 PERCENT BOUND IN SPECIES # 3031400 HCO3 - C03-2 94.9 PERCENT BOUND IN SPECIES # 301400 HCO3 - Fe+2 99.3 PERCENT BOUND IN SPECIES # 2813301 FeOH2 + 26.9 PERCENT	Sr+2							
Zn+2 4.6 PERCENT BOUND IN SPECIES #8129500 =SO2Zn+ 95.2 PERCENT BOUND IN SPECIES #8119500 =SO1Zn+ Cr (OH) 2+ 26.4 PERCENT BOUND IN SPECIES # 211 Cr (OH) 2+ 72.9 PERCENT BOUND IN SPECIES # 211 Cr (OH) 3 AQ Al+3 1.1 PERCENT BOUND IN SPECIES # 303301 Al (OH) 2 + 49.5 PERCENT BOUND IN SPECIES # 303302 Al (OH) 4 - 49.5 PERCENT BOUND IN SPECIES # 303303 Al (OH) 3 AQ C03-2 94.9 PERCENT BOUND IN SPECIES # 3031400 HCO3 - 4.8 PERCENT BOUND IN SPECIES # 3301400 HCO3 - Fe+2 99.3 PERCENT BOUND IN SPECIES # 2813301 Fe0H2 + Fe+3 61.6 PERCENT BOUND IN SPECIES #2813301 Fe0H2 + 11.5 PERCENT BOUND IN SPECIES #2813301 Fe0H4 - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #31301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #330020 OH- <td></td> <td>100.0</td> <td>PERCENT</td> <td>BOUND</td> <td>IN</td> <td>SPECIES</td> <td># 800</td> <td>Sr+2</td>		100.0	PERCENT	BOUND	IN	SPECIES	# 800	Sr+2
4.6 PERCENT BOUND IN SPECIES #8129500 =S022n+ 95.2 PERCENT BOUND IN SPECIES #8119500 =S012n+ 2Cr (OH) 2+ 26.4 PERCENT BOUND IN SPECIES # 211 Cr (OH) 2+ 72.9 PERCENT BOUND IN SPECIES # 211 Cr (OH) 3 AQ Al+3 1.1 PERCENT BOUND IN SPECIES # 303301 Al (OH) 2 + 49.5 PERCENT BOUND IN SPECIES # 303303 Al (OH) 3 AQ CO3-2 94.9 PERCENT BOUND IN SPECIES # 3031400 HCO3 - 4.8 PERCENT BOUND IN SPECIES #3301400 HCO3 - 4.8 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ Fe+2 99.3 PERCENT BOUND IN SPECIES #2813301 FeOH2 + 26.9 PERCENT BOUND IN SPECIES #2813301 FeOH2 + 26.9 PERCENT BOUND IN SPECIES #2813303 FeOH4 - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #313012 =S01H2+ 7.2	Zn+2							
95.2 PERCENT BOUND IN SPECIES #8119500 =S012n+ 26.4 PERCENT BOUND IN SPECIES # 211 Cr (OH) 2+ 72.9 PERCENT BOUND IN SPECIES # 2113302 Cr (OH) 3 AQ A1+3 1.1 PERCENT BOUND IN SPECIES # 303301 A1 (OH) 2 + 49.5 PERCENT BOUND IN SPECIES # 303303 A1 (OH) 4 - 49.5 PERCENT BOUND IN SPECIES # 303303 A1 (OH) 3 AQ CO3-2 94.9 PERCENT BOUND IN SPECIES # 3031400 HCO3 - 4.8 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ Fe+2 99.3 PERCENT BOUND IN SPECIES # 280 Fe+2 E-1 Fe+3 61.6 PERCENT BOUND IN SPECIES #2813301 FeOH2 + 26.9 PERCENT BOUND IN SPECIES #2813303 FeOH4 - H+1 73.0 PERCENT BOUND IN SPECIES #2813303 FeOH4 - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 10.5 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.2 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 24.7 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 24.7 PERCENT BOUND IN SPECIES #31302 =S01H2+ H2O 24.7 PERCENT BOUND IN SPECIES #3100020 OH- 1.3 PERCENT BOUND IN SPECIES #3100020 OH- 1.5 PERCENT BOUND IN SPECIES #310200 =S012n+ 26.6 PERCENT BOUND IN SPECIES #310400 =S01Ni+ 5.6 PERCENT BOUND IN SPECIES #310400 =S01Ni+ 5.6 PERCENT BOUND IN SPECIES #310400 =S01Ni+ 5.6 PERCENT BOUND IN SPECIES #310400 =S012n+ 5.6 PERCENT BOUND IN SPECIES #310400 =S012n+ 5.6 PERCENT BOUND IN SPECIES #310400 =S012n+ 5.6 PERC		4.6	PERCENT	BOUND	IN	SPECIES	#8129500	=SO2Zn+
Cr (OH) 2+ 26.4 PERCENT BOUND IN SPECIES # 211 Cr (OH) 2+ 72.9 PERCENT BOUND IN SPECIES # 2113302 Cr (OH) 3 AQ A1+3 1.1 PERCENT BOUND IN SPECIES # 303301 A1 (OH) 2 + 49.5 PERCENT BOUND IN SPECIES # 303302 A1 (OH) 4 - 49.5 PERCENT BOUND IN SPECIES # 303303 A1 (OH) 3 AQ CO3-2 94.9 PERCENT BOUND IN SPECIES # 3031400 HCO3 - 4.8 PERCENT BOUND IN SPECIES # 3301401 H2CO3 AQ Fe+2 99.3 PERCENT BOUND IN SPECIES # 280 Fe+2 E-1 Fe+3 61.6 PERCENT BOUND IN SPECIES # 2813301 FeOH2 + 26.9 PERCENT BOUND IN SPECIES #2813302 FeOH3 AQ 11.5 PERCENT BOUND IN SPECIES #2813303 FeOH4 - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.2 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #8123302 =SO2H2+ 7.2 PERCENT BOUND IN SPECIES #8113302 =SO1H2+ H2O 24.7 PERCENT BOUND IN SPECIES #8119500 =SO1Zn+ 26.1 PERCENT BOUND IN SPECIES #8119500 =SO1Zn+ 26.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 5.6 PERCENT BOUND IN SPECIES #811		95.2	PERCENT	BOUND	IN	SPECIES	#8119500	=SO1Zn+
26.4 PERCENT BOUND IN SPECIES # 211 Cr (OH) 2+ 72.9 PERCENT BOUND IN SPECIES # 2113302 Cr (OH) 3 AQ Al+3 1.1 PERCENT BOUND IN SPECIES # 303301 Al (OH) 2 + 49.5 PERCENT BOUND IN SPECIES # 303302 Al (OH) 4 - 49.5 PERCENT BOUND IN SPECIES # 303303 Al (OH) 3 AQ C03-2 94.9 PERCENT BOUND IN SPECIES # 3031400 HCO3 - 4.8 PERCENT BOUND IN SPECIES # 3301401 H2CO3 AQ Fe+2 99.3 PERCENT BOUND IN SPECIES # 280 Fe+2 E-1 Fe+3 61.6 PERCENT BOUND IN SPECIES # 281301 Fe0H2 + 7.3 PERCENT BOUND IN SPECIES # 2813002 Fe0H3 AQ H+1 73.0	Cr(OH)2+							
72.9 PERCENT BOUND IN SPECIES #2113302 Cr (OH) 3 AQ A1+3 1.1 PERCENT BOUND IN SPECIES # 303301 A1 (OH) 2 + 49.5 PERCENT BOUND IN SPECIES # 303302 A1 (OH) 4 - 49.5 PERCENT BOUND IN SPECIES # 303303 A1 (OH) 3 AQ CO3-2 94.9 PERCENT BOUND IN SPECIES # 3031400 HCO3 - 4.8 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ Fe+2 99.3 PERCENT BOUND IN SPECIES # 2813301 Fe0H2 + Fe+3 61.6 PERCENT BOUND IN SPECIES #2813302 Fe0H2 + Fe+3 73.0 PERCENT BOUND IN SPECIES #2813303 Fe0H4 - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #31302 =SO2H2+ 7.2 PERCENT BOUND IN SPECIES #8112302 =SO2H2+ 7.2 PERCENT BOUND IN SPECIES #8112300 =SO1H2+ 4.6 PERCENT BOUND IN SPECIES #8111500 =SO12n+	a second to the second second	26.4	PERCENT	BOUND	IN	SPECIES	# 211	Cr(OH)2+
A1+3 1.1 PERCENT BOUND IN SPECIES # 303301 A1 (OH)2 + 49.5 PERCENT BOUND IN SPECIES # 303302 A1 (OH)4 - 49.5 PERCENT BOUND IN SPECIES # 303303 A1 (OH)3 AQ CO3-2 94.9 PERCENT BOUND IN SPECIES # 301400 HCO3 - 4.8 PERCENT BOUND IN SPECIES # 3301401 H2CO3 AQ Fe+2 99.3 PERCENT BOUND IN SPECIES # 280 Fe+2 E-1 Fe+3 61.6 PERCENT BOUND IN SPECIES # 2813301 FeOH2 + 26.9 PERCENT BOUND IN SPECIES #2813302 FeOH3 AQ 11.5 PERCENT BOUND IN SPECIES #2813303 FeOH4 - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #31302 =SO2H2+ 7.2 PERCENT BOUND IN SPECIES #8113302 =SO1H2+ H2O 24.7 PERCENT BOUND IN SPECIES #8112310 =S012n+ 26.1 PERCENT BOUND IN SPECIES #8112310 =S012n+ 26.6 PERCENT BOUND IN SPECIES #8112310 =S012n+ 26.6 PERCENT BOUND IN SPECIES #8112310 =S012n+ 26.6 PERCENT BOUND IN SPECIES #8112310 =S012n+ 5.6 PERCENT BOUND IN SPECIES #8112310 =S012n+ 1.5 PERCENT BOUND IN SPECIES #8112400 =S01N+ 1.5 PER		72.9	PERCENT	BOUND	IN	SPECIES	#2113302	Cr(OH) 3 AQ
1.1 PERCENT BOUND IN SPECIES # 303301 A1(0H)2 + 49.5 PERCENT BOUND IN SPECIES # 303302 A1(0H)4 - 49.5 PERCENT BOUND IN SPECIES # 303303 A1(0H)3 AQ C03-2 94.9 PERCENT BOUND IN SPECIES # 3031400 HCO3 - 4.8 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ Fe+2 99.3 PERCENT BOUND IN SPECIES # 280 Fe+2 E-1 Fe+3 61.6 PERCENT BOUND IN SPECIES # 2813301 Fe0H2 + 7e+3 PERCENT BOUND IN SPECIES #2813301 Fe0H4 - - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #8113302 =S01H2+ 7.2 PERCENT BOUND IN SPECIES #811302 =S01H2+ H2O 24.7 PERCENT BOUND IN SPECIES #8129500 =S02Zn+ 26.1 PERCENT BOUND IN SPECIES #8119500 =S01Zn+	A1+3							
49.5 PERCENT BOUND IN SPECIES # 303302 A1(0H)4 - 49.5 PERCENT BOUND IN SPECIES # 303303 A1(0H)3 AQ C03-2 94.9 PERCENT BOUND IN SPECIES # 301400 HC03 - 4.8 PERCENT BOUND IN SPECIES # 3301401 H2C03 AQ Fe+2 99.3 PERCENT BOUND IN SPECIES # 280 Fe+2 E-1 Fe+3 61.6 PERCENT BOUND IN SPECIES # 2813301 Fe0H2 + 26.9 PERCENT BOUND IN SPECIES #2813303 Fe0H4 - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HC03 - 7.3 PERCENT BOUND IN SPECIES #3301400 HC03 - 7.3 PERCENT BOUND IN SPECIES #3301400 HC03 - 7.3 PERCENT BOUND IN SPECIES #3301400 HC03 - 7.2 PERCENT BOUND IN SPECIES #3301401 H2C03 AQ 320.4 PERCENT BOUND IN SPECIES #330020 OH- 1.3 PERCENT BOUND IN SPECIES #8113302 =S02H2+ 7.2 PERCENT BOUND IN SPECIES #8112310 =S01Zn+ 26.1 PERCENT BOUND IN SPECIES #8112310 =S01Zn+ 26.1 PERCENT BOUND IN SPECIES #8112310 =S01Zn+ 26.6 PERCENT BOUND IN SPECI		1.1	PERCENT	BOUND	IN	SPECIES	# 303301	Al(OH)2 +
49.5 PERCENT BOUND IN SPECIES # 303303 A1(0H)3 AQ CO3-2 94.9 PERCENT BOUND IN SPECIES #3301400 HCO3 - 4.8 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ Fe+2 99.3 PERCENT BOUND IN SPECIES # 280 Fe+2 E-1 Fe+3 61.6 PERCENT BOUND IN SPECIES # 2813301 Fe0H2 + Yee 26.9 PERCENT BOUND IN SPECIES #2813302 Fe0H3 AQ 11.5 PERCENT BOUND IN SPECIES #2813303 Fe0H4 - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #31302 =SO2H2+ 7.2 PERCENT BOUND IN SPECIES #8113302 =SO2H2+ 7.2 PERCENT BOUND IN SPECIES #310020 OH- 1.3 PERCENT BOUND IN SPECIES #310020 OH- 1.3 PERCENT BOUND IN SPECIES #81129500 =SO2Zn+ 26.1 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 26.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 26.6 PERCE		49.5	PERCENT	BOUND	IN	SPECIES	# 303302	Al (OH) 4 -
CO3-2 94.9 PERCENT BOUND IN SPECIES #3301400 HCO3 - 4.8 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ Fe+2 99.3 PERCENT BOUND IN SPECIES # 280 Fe+2 E-1 Fe+3 61.6 PERCENT BOUND IN SPECIES # 2813301 FeOH2 + 26.9 PERCENT BOUND IN SPECIES #2813302 FeOH3 AQ 11.5 PERCENT BOUND IN SPECIES #2813303 FeOH4 - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #31301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #8123302 =SO2H2+ 7.2 PERCENT BOUND IN SPECIES #8113302 =SO1H2+ H2O 24.7 PERCENT BOUND IN SPECIES #3300020 OH- 1.3 PERCENT BOUND IN SPECIES #8129500 =SO2Zn+ 26.1 PERCENT BOUND IN SPECIES #8119500 =SO1Zn+ 22.6 PERCENT BOUND IN SPECIES #8112310 =S01Cu+ 5.6 PERCENT BOUND IN SPECIES #8112310 =S01Cu+ 5.6 PERCENT BOUND IN SPECIES #8112310 =S01Cu+ 1.5 PERCENT BOUND IN SPECIES #811400 =SO1Ni+ 16 O PERCENT BOUND IN SPECIES #8115400 =SO1Ni+		49.5	PERCENT	BOUND	IN	SPECIES	# 303303	Al (OH) 3 AQ
94.9 PERCENT BOUND IN SPECIES #3301400 HCO3 - 4.8 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ Fe+2 99.3 PERCENT BOUND IN SPECIES #280 Fe+2 E-1 Fe+3 61.6 PERCENT BOUND IN SPECIES #2813301 FeOH2 + 26.9 PERCENT BOUND IN SPECIES #2813303 FeOH4 - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #8112302 =SO2H2+ 7.2 PERCENT BOUND IN SPECIES #3300020 OH- 1.3 PERCENT BOUND IN SPECIES #811300 =SO1H2+ 42.0 24.7 PERCENT BOUND IN SPECIES #8119500 =SO2Zn+ 26.1 PERCENT BOUND IN SPECIES #8112310 =SO1Zn+ 26.1 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 2.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 5.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 5.6 PERCENT BOUND IN SPECIES #81	CO3-2							
4.8 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ Fe+2 99.3 PERCENT BOUND IN SPECIES # 280 Fe+2 E-1 Fe+3 61.6 PERCENT BOUND IN SPECIES #2813301 FeOH2 + Action 1.5 PERCENT BOUND IN SPECIES #2813302 FeOH3 AQ H+1 73.0 PERCENT BOUND IN SPECIES #2813303 FeOH4 - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #33001401 H2CO3 AQ 4.20 24.7 PERCENT BOUND IN SPECIES #8123302 =SO2H2+ 7.2 PERCENT BOUND IN SPECIES #3300020 OH- 1.3 PERCENT BOUND IN SPECIES #8112300 =SO2Zn+ 26.1 PERCENT BOUND IN SPECIES #8112310 =SO1Zn+ 26.1 PERCENT BOUND IN SPECIES #8112310 =SO1Zn+ 26.6 PERCENT BOUND IN SPECIES #8112310 =SO1Zn+ 26.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 5.6 PERCENT BOUND IN SPECIES #8112300 =SO1Zn+ 5.6		94.9	PERCENT	BOUND	IN	SPECIES	#3301400	нсоз –
Fe+2 99.3 PERCENT BOUND IN SPECIES # 280 Fe+2 E-1 Fe+3 61.6 PERCENT BOUND IN SPECIES #2813301 Fe0H2 + 26.9 PERCENT BOUND IN SPECIES #2813302 Fe0H3 AQ 11.5 PERCENT BOUND IN SPECIES #2813303 Fe0H4 - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HC03 - 7.3 PERCENT BOUND IN SPECIES #3301401 H2C03 AQ 320.4 PERCENT BOUND IN SPECIES #8123302 =S02H2+ 7.2 PERCENT BOUND IN SPECIES #8113302 =S01H2+ H20 24.7 PERCENT BOUND IN SPECIES #8129500 =S02Zn+ 26.1 PERCENT BOUND IN SPECIES #8119500 =S01Zn+ 26.1 PERCENT BOUND IN SPECIES #8119500 =S01Zn+ 22.6 PERCENT BOUND IN SPECIES #8112310 =S01Cu+ 5.6 PERCENT BOUND IN SPECIES #8112310 =S01Cu+ 5.6 PERCENT BOUND IN SPECIES #8112310 =S02Cu+ 1.5 PERCENT BOUND IN SPECIES #8112400 =S01Ni+ 1.6 PERCENT BOUND IN SPECIES #811200 =S01Ni+		4.8	PERCENT	BOUND	IN	SPECIES	#3301401	H2CO3 AO
99.3 PERCENT BOUND IN SPECIES # 280 Fe+2 E-1 Fe+3 61.6 PERCENT BOUND IN SPECIES #2813301 FeOH2 + 26.9 PERCENT BOUND IN SPECIES #2813302 FeOH3 AQ 11.5 PERCENT BOUND IN SPECIES #2813303 FeOH4 - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #8123302 =SO2H2+ 7.2 PERCENT BOUND IN SPECIES #8113302 =SO2H2+ 420 24.7 PERCENT BOUND IN SPECIES #3300020 OH- 1.3 PERCENT BOUND IN SPECIES #8129500 =SO2Zn+ 26.1 PERCENT BOUND IN SPECIES #8129500 =SO1Zn+ 26.1 PERCENT BOUND IN SPECIES #8119500 =S01Zn+ 26.6 PERCENT BOUND IN SPECIES #8112310 =S01Cu+ 5.6 PERCENT BOUND IN SPECIES #8112310 =S01Cu+ 5.6 PERCENT BOUND IN SPECIES #8115400 =S01Ni+ 1.5 PERCENT BOUND IN SPECIES #8115400 =S01Ni+	Fe+2							
E-1 Fe+3 61.6 PERCENT BOUND IN SPECIES #2813301 FeOH2 + 26.9 PERCENT BOUND IN SPECIES #2813302 FeOH3 AQ 11.5 PERCENT BOUND IN SPECIES #2813303 FeOH4 - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #8123302 =SO2H2+ 7.2 PERCENT BOUND IN SPECIES #8113302 =SO1H2+ H2O 24.7 PERCENT BOUND IN SPECIES #3300020 OH- 1.3 PERCENT BOUND IN SPECIES #8129500 =SO2Zn+ 26.1 PERCENT BOUND IN SPECIES #8129500 =SO1Zn+ 26.1 PERCENT BOUND IN SPECIES #8119500 =SO1Zn+ 26.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 5.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 5.6 PERCENT BOUND IN SPECIES #811240 =SO1Cu+ 1.5 PERCENT BOUND IN SPECIES #8115400 =SO1Ni+		99.3	PERCENT	BOUND	IN	SPECIES	# 280	Fe+2
Fe+3 61.6 PERCENT BOUND IN SPECIES #2813301 FeOH2 + 26.9 PERCENT BOUND IN SPECIES #2813302 FeOH3 AQ 11.5 PERCENT BOUND IN SPECIES #2813303 FeOH4 - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #8123302 =SO2H2+ 7.2 PERCENT BOUND IN SPECIES #8113302 =SO1H2+ H2O 24.7 PERCENT BOUND IN SPECIES #3300020 OH- 1.3 PERCENT BOUND IN SPECIES #8129500 =SO2Zn+ 26.1 PERCENT BOUND IN SPECIES #8119500 =SO1Zn+ 22.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 2.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 5.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 5.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 5.6 PERCENT BOUND IN SPECIES #8112400 =SO1Ni+ 1.5 PERCENT BOUND IN SPECIES #8115400 =SO1Ni+ 1.6 PERCENT BOUND IN SPECIES #8115400 =SO1Ni+	E-1							
61.6 PERCENT BOUND IN SPECIES #2813301 FeOH2 + 26.9 PERCENT BOUND IN SPECIES #2813302 FeOH3 AQ 11.5 PERCENT BOUND IN SPECIES #2813303 FeOH4 - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3123302 =SO2H2+ 7.2 PERCENT BOUND IN SPECIES #8113302 =SO1H2+ H2O 24.7 PERCENT BOUND IN SPECIES #3300020 OH- 1.3 PERCENT BOUND IN SPECIES #3100020 OH- 1.3 PERCENT BOUND IN SPECIES #8129500 =SO2Zn+ 26.1 PERCENT BOUND IN SPECIES #8129500 =SO1Zn+ 22.6 PERCENT BOUND IN SPECIES #8119500 =SO1Zn+ 22.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 5.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 5.6 PERCENT BOUND IN SPECIES #8115400 =SO1Ni+ 1.5 PERCENT BOUND IN SPECIES #8115400 =SO1Ni+	Fe+3							
26.9 PERCENT BOUND IN SPECIES #2813302 FeOH3 AQ 11.5 PERCENT BOUND IN SPECIES #2813303 FeOH4 - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #3101401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #8123302 =SO2H2+ 7.2 PERCENT BOUND IN SPECIES #8113302 =SO1H2+ H2O 24.7 PERCENT BOUND IN SPECIES #3300020 OH- 1.3 PERCENT BOUND IN SPECIES #3100020 OH- 26.1 PERCENT BOUND IN SPECIES #8129500 =SO2Zn+ 26.1 PERCENT BOUND IN SPECIES #8119500 =SO1Zn+ 22.6 PERCENT BOUND IN SPECIES #8119500 =SO1Zn+ 22.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 5.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 5.6 PERCENT BOUND IN SPECIES #8115400 =SO1Ni+ 1.5 PERCENT BOUND IN SPECIES #8115400 =SO1Ni+	2020	61.6	PERCENT	BOUND	IN	SPECIES	#2813301	FeOH2 +
11.5 PERCENT BOUND IN SPECIES #2813303 FeOH4 - H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #8123302 =SO2H2+ 7.2 PERCENT BOUND IN SPECIES #8113302 =SO1H2+ H2O 24.7 PERCENT BOUND IN SPECIES #3300020 OH- 1.3 PERCENT BOUND IN SPECIES #8129500 =SO2Zn+ 26.1 PERCENT BOUND IN SPECIES #8119500 =SO1Zn+ 22.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 5.6 PERCENT BOUND IN SPECIES #8122310 =SO2Cu+ 1.5 PERCENT BOUND IN SPECIES #8115400 =SO1Ni+ 16.0 PERCENT BOUND IN SPECIES #8115400 =SO1Ni+		26.9	PERCENT	BOUND	IN	SPECIES	#2813302	FeOH3 AO
H+1 73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #8123302 =SO2H2+ 7.2 PERCENT BOUND IN SPECIES #8113302 =SO1H2+ H2O 24.7 PERCENT BOUND IN SPECIES #3300020 OH- 1.3 PERCENT BOUND IN SPECIES #8129500 =SO2Zn+ 26.1 PERCENT BOUND IN SPECIES #8129500 =SO1Zn+ 22.6 PERCENT BOUND IN SPECIES #8119500 =SO1Zn+ 22.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 5.6 PERCENT BOUND IN SPECIES #8122310 =SO2Cu+ 1.5 PERCENT BOUND IN SPECIES #8115400 =SO1Ni+ 1.6 O PERCENT BOUND IN SPECIES #8115400 =SO1Ni+		11.5	PERCENT	BOUND	IN	SPECIES	#2813303	FeOH4 -
73.0 PERCENT BOUND IN SPECIES #3301400 HCO3 - 7.3 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #8123302 =SO2H2+ 7.2 PERCENT BOUND IN SPECIES #8113302 =SO1H2+ H2O 24.7 PERCENT BOUND IN SPECIES #3300020 OH- 1.3 PERCENT BOUND IN SPECIES #8129500 =SO2Zn+ 26.1 PERCENT BOUND IN SPECIES #8119500 =SO1Zn+ 22.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 5.6 PERCENT BOUND IN SPECIES #8122310 =SO2Cu+ 1.5 PERCENT BOUND IN SPECIES #8115400 =SO1Ni+ 1.6 PERCENT BOUND IN SPECIES #8115400 =SO1Ni+	H+1	1110		200112				
7.3 PERCENT BOUND IN SPECIES #3301401 H2CO3 AQ 320.4 PERCENT BOUND IN SPECIES #8123302 =SO2H2+ 7.2 PERCENT BOUND IN SPECIES #8113302 =SO1H2+ H2O 24.7 PERCENT BOUND IN SPECIES #3300020 OH- 1.3 PERCENT BOUND IN SPECIES #8129500 =SO2Zn+ 26.1 PERCENT BOUND IN SPECIES #8119500 =SO1Zn+ 22.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 5.6 PERCENT BOUND IN SPECIES #8122310 =SO2Cu+ 1.5 PERCENT BOUND IN SPECIES #8115400 =SO1Ni+ 1.6 PERCENT BOUND IN SPECIES #8115400 =SO1Ni+		73.0	PERCENT	BOUND	IN	SPECIES	#3301400	HCO3 -
320.4 PERCENT BOUND IN SPECIES #8123302 =SO2H2+ 7.2 PERCENT BOUND IN SPECIES #8113302 =SO1H2+ H2O 24.7 PERCENT BOUND IN SPECIES #3300020 OH- 1.3 PERCENT BOUND IN SPECIES #8129500 =SO2Zn+ 26.1 PERCENT BOUND IN SPECIES #8119500 =SO1Zn+ 22.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 5.6 PERCENT BOUND IN SPECIES #8122310 =SO2Cu+ 1.5 PERCENT BOUND IN SPECIES #8115400 =SO1Ni+ 16.0 PERCENT BOUND IN SPECIES #8115400 =SO1Ni+		7.3	PERCENT	BOUND	IN	SPECIES	#3301401	H2CO3 AO
7.2PERCENT BOUND IN SPECIES #8113302=SO1H2+H2O24.7PERCENT BOUND IN SPECIES #3300020OH-1.3PERCENT BOUND IN SPECIES #8129500=SO2Zn+26.1PERCENT BOUND IN SPECIES #8119500=SO1Zn+22.6PERCENT BOUND IN SPECIES #8112310=SO1Cu+5.6PERCENT BOUND IN SPECIES #8122310=SO2Cu+1.5PERCENT BOUND IN SPECIES #8115400=SO1Ni+1.60PERCENT BOUND IN SPECIES #8115400=SO1Ni+		320.4	PERCENT	BOUND	TN	SPECIES	#8123302	=SO2H2+
H2O 24.7 PERCENT BOUND IN SPECIES #3300020 OH- 1.3 PERCENT BOUND IN SPECIES #8129500 =SO2Zn+ 26.1 PERCENT BOUND IN SPECIES #8119500 =SO1Zn+ 22.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 5.6 PERCENT BOUND IN SPECIES #8122310 =SO2Cu+ 1.5 PERCENT BOUND IN SPECIES #8115400 =SO1Ni+ 1.6 O PERCENT BOUND IN SPECIES #8115400 =SO1Ni+		7.2	PERCENT	BOUND	IN	SPECIES	#8113302	=SO1H2+
24.7 PERCENT BOUND IN SPECIES #3300020 OH- 1.3 PERCENT BOUND IN SPECIES #8129500 =SO2Zn+ 26.1 PERCENT BOUND IN SPECIES #8119500 =SO1Zn+ 22.6 PERCENT BOUND IN SPECIES #8112310 =SO1Cu+ 5.6 PERCENT BOUND IN SPECIES #8122310 =SO2Cu+ 1.5 PERCENT BOUND IN SPECIES #8115400 =SO1Ni+ 1.6 O DERCENT BOUND IN SPECIES #8115400 =SO1Ni+	H20							
1.3PERCENT BOUND IN SPECIES #8129500=SO2Zn+26.1PERCENT BOUND IN SPECIES #8119500=SO1Zn+22.6PERCENT BOUND IN SPECIES #8112310=SO1Cu+5.6PERCENT BOUND IN SPECIES #8122310=SO2Cu+1.5PERCENT BOUND IN SPECIES #8115400=SO1Ni+1.6ODERCENT BOUND IN SPECIES #8116000=SO1Ni+		24.7	PERCENT	BOUND	TN	SPECIES	#3300020	OH-
26.1PERCENT BOUND IN SPECIES #8119500=SO1Zn+22.6PERCENT BOUND IN SPECIES #8112310=SO1Cu+5.6PERCENT BOUND IN SPECIES #8122310=SO2Cu+1.5PERCENT BOUND IN SPECIES #8115400=SO1Ni+1.6ODERCENT BOUND IN SPECIES #8116000=SO1Ni+		1.3	PERCENT	BOUND	TN	SPECIES	#8129500	=SO2Zn+
22.6 PERCENT BOUND IN SPECIES #8112310 =SOlCu+ 5.6 PERCENT BOUND IN SPECIES #8122310 =SO2Cu+ 1.5 PERCENT BOUND IN SPECIES #8115400 =SOlNi+		26.1	PERCENT	BOUND	TN	SPECIES	#8119500	=SO1Zn+
5.6 PERCENT BOUND IN SPECIES #8122310 =SO2Cu+ 1.5 PERCENT BOUND IN SPECIES #8115400 =SO1Ni+		22.6	PERCENT	BOUND	TN	SPECIES	#8112310	=SO1Cu+
1.5 PERCENT BOUND IN SPECIES #8115400 =SOINi+		5.6	PERCENT	BOUND	IN	SPECIES	#8122310	=SO2Cu+
1.0 DEDCENT DOUND IN CREATES #0116000 _COID54		1.5	PERCENT	BOUND	TN	SPECIES	#8115400	=SO1Ni+
10.0 PERCENT BOUND IN SPECIES #0110000 =S01PDT		16.0	PERCENT	BOUND	IN	SPECIES	#8116000	=SO1Pb+

PART 5 of OUTPUT FILE ______

IDX	NAME	DISSOI	VED	SORBE	D	PRECIPI	TATED
		MOL/KG	PERCENT	MOL/KG	PERCENT	MOL/KG	PERCENT
100	Ba+2	1.044E-06	75.5	3.396E-07	24.5	0.000E-01	0.0
150	Ca+2	1.109E-04	85.5	1.884E-05	14.5	0.000E-01	0.0
160	Cd+2	1.858E-11	0.4	4.697E-09	99.6	0.000E-01	0.0
231	Cu+2	1.498E-10	0.0	3.146E-07	100.0	0.000E-01	0.0
145	DOM	1.000E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	6.647E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	1.440E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	2.088E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
540	Ni+2	1.465E-10	0.8	1.859E-08	99.2	0.000E-01	0.0
600	Pb+2	2.786E-12	0.0	1.786E-07	100.0	0.000E-01	0.0
800	Sr+2	5.707E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
950	Zn+2	5.229E-10	0.2	3.054E-07	99.8	0.000E-01	0.0
211	Cr(OH)2+	2.492E-09	8.9	0.000E-01	0.0	2.541E-08	91.1
30	A1+3	3.390E-09	0.1	0.000E-01	0.0	4.815E-06	99.9
140	CO3-2	2.213E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
280	Fe+2	1.668E-25	100.0	0.000E-01	0.0	0.000E-01	0.0
1	E-1	0.000E-01	0.0	0.000E-01	0.0	0.000E-01	0.0
281	Fe+3	1.534E-15	0.0	0.000E-01	0.0	5.372E-07	100.0
330	H+1	2.330E-04	81.0	5.462E-05	19.0	0.000E-01	0.0
2	H20	2.925E-07	26.2	8.219E-07	73.8	0.000E-01	0.0

Charge Balance: SPECIATED Sum of CATIONS = 1.482E-03 Sum of ANIONS 3.609E-03 PERCENT DIFFERENCE = 4.177E+01 (ANIONS - CATIONS)/(ANIONS + CATIONS) NON-CARBONATE ALKALINITY = 2.490E-07 EQUILIBRIUM IONIC STRENGTH (m) = 3.872E-03 EQUILIBRIUM pH = 7.600 = 13.489 or Eh = 782.67 mv EQUILIBRIUM pe ****** DIFFUSE LAYER ADSORPTION MODEL ******* **** Parameters For Adsorbent Number 1 **** sig0 = 0.004421Electrostatic Variables: psi0 = 0.028808 sigb = 0.000000psib = 0.000000psid = 0.000000sigd = 0.000000Adsorbent Concentration (g/l): 3.442 Specific Surface Area (sq. meters/g): 600.00 PART 6 of OUTPUT FILE Saturation indices and stoichiometry of all minerals ID # NAME Sat. Index Stoichiometry in [brackets]

 -3.542
 [1.000] 30
 [3.000] 2
 [-3.000] 330

 -3.067
 [1.000] 150
 [1.000] 140

 -9.581
 [-2.000] 330
 [2.000] 460
 [1.000] 140

 2003000 ALOH3(A) 5015000 ARAGONITE 5046000 ARTINITE [5.000] 2 2003001 BOEHMITE [-3.000] 330 [1.000] 30 [2.000] -1.755 2 [1.000] 460 [2.000] 2 [-2.000] 330 2046000 BRUCITE -6.101 5015001 CALCITE -2.910 [1.000] 150 [1.000] 140 [1.000] 30 [2.000] 2 2003002 DIASPORE 5015002 DOLOMITE 0.000 [-3.000] 330
 5015002
 DOLOMITE
 -5.101
 [1.000]
 150

 2028100
 FERRIHYDRITE
 -6.675
 [-3.000]
 330

 2028101
 FE3(OH)8
 -33.487
 [-8.000]
 330
 [1.000] 460 [2.000] 140 [1.000] 281 [2.000] 281 [3.000] 2 [1.000] 280 8.000] 2 Ι 2003003 GIBBSITE (C) -1.871 [-3.000] 330 [1.000] 30 [3.000] 2 3003000 A1203 -8.530 [2.000] 30 [3.000] 2 [-6.000] 330 [-3.000] 330 [1.000] 281 [2.000] 2 2028102 GOETHITE -2.491 [2.000] 281 [3.000] 3028100 HEMATITE 0.000 [-6.000] 330 2 [3.000] 460 [1.000] 150 [4.000] 140 [4.000] 140 [-2.000] 330 5015003 HUNTITE -13.643 [5.000] 460 [6.000] 2 5046001 HYDRMAGNESIT -23.441 Γ [-6.000] 330 3028101 MAGHEMITE -9.953 [2.000] 281 [3.000] 2 [1.000] 460 [1.000] 140 5046002 MAGNESITE -2.689 3028000 MAGNETITE -17.723 [-8.000] 330 [2.000] 281 [1.000] 280 [4.000] 2 -12.374 [2.000] 500 [1.000] 140 [10.000] 3050000 NATRON 2 [1.000] 460 [1.000] 140 [10.000] [1.000] 460 [1.000] 140 [3.000] [1.000] 280 [1.000] 140 [1.000] 800 [1.000] 140 5046003 NESQUEHONITE -5.092 2 5028000 SIDERITE -20.914] 5080000 STRONTIANITE -3.611 [2.000] 500 [1.000] 140 [1.000] 5050001 THERMONATR -14.075 2 5010000 WITHERITE -4.962 [1.000] 100 [1.000] 140 5023100 CUCO3 -9.538 [1.000] 231 [1.000] 140 -6.335 [-2.000] 330 [1.000] 231 [2.000] 2 2023100 CU(OH)2 2023101 TENORITE -5.315 [-2.000] 330 [1.000] 231 [1.000] 2 3023100 CUPRICFERIT [-8.000] 330 [1.000] 231 [2.000] 281 -7.477 [4.000] [1.000] 950 95000 ZN METAL -63.994 [2.000] 1 [1.000] 950 [1.000] 140 5095000 SMITHSONITE -7.287 5095001 ZNCO3, 1H20 -6.965 [1.000] 950 [1.000] 140 [1.000] 2 -7.984 2095000 ZN(OH)2 (A) [-2.000] 330 [1.000] 950 [2.000] 2 -7.734 2095001 ZN(OH)2 (C) [-2.000] 330 [1.000] 950 [2.000] 2 2095002ZN(OH)2(B)-7.284[-2.000]330[1.000]950[2.000]2095003ZN(OH)2(G)-7.244[-2.000]330[1.000]950[2.000]2095004ZN(OH)2(E)-7.034[-2.000]330[1.000]950[2.000]2095005ZNO(ACTIVE)-6.844[-2.000]330[1.000]950[1.000] 2 2 2 2

ID #	NAME	Sat. Index		Sto	ichic	met	ry in	[brac]	kets	3]	
2095006	ZINCITE	-6.986	E	-2.000]	330	[1.000	950	[1.000]	2
16000	CD METAL	-52.720	Ε	1.000]	160	[2.000] 1			
16001	GAMMA CD	-52.822	[1.000]	160	[2.000] 1			
5016000	OTAVITE	-4.754	ſ	1.0001	160	ſ	1.000	140			
2016000	CD(OH)2(A)	-10.822	ſ	-2,0001	330	ſ	1.000	160	I	2.0001	2
2016001	CD(OH) 2 (C)	-10.446	ſ	-2.0001	330	Г	1,000	160	ſ	2.0001	2
2016002	MONTEPONITE	-12 269	ſ	-2 0001	330	ſ	1 000	160	ſ	1,0001	2
600002	DB METAI	-15 929	ſ	1 0001	600	Г	2 000	1 1		2.0000]	
506000	CEDDUCTE	-7 978	ſ	1 0001	600	ſ	1 000	1 140			
3060000	MACOTCOT	12 627	L r	-2 000]	330	L.	1 000	600	ſ	1 0001	2
2060000	MASSICOI	-12.037	L	-2.000]	220	r	1 000	600	L F	1.000]	2
2060001	LITHARGE	-12.441	L	-2.000]	220	L	1.000	600	L	1 2201	2 0
2060002	PBO, .3H20	-12.467	L	-2.000]	330	L	1.000	600	L	1.330]	4
5060001	PB2OCO3	-20.329	L	-2.000]	330	1	2.000	500	L	1.000]	2
			L	1.000]	140		0 000	600		1 0001	1.40
5060002	PB302C03	-31.550	[-4.000]	330	L	3.000	600	L	1.000]	140
			[2.000]	2						22.2
2060003	PLATTNERITE	-7.621	[-4.000]	330	[-2.000] 1	[1.000]	600
			[2.000]	2						
3060000	PB203	-17.838	[-6.000]	330	[-2.000] 1	[2.000]	600
			[3.000]	2						
3060001	MINIUM	-31.443	[-8.000]	330	[-2.000] 1	[3.000]	600
]	4.000]	2						
2060004	PB(OH)2 (C)	-7.837	[-2.000]	330]	1.000	600	[2.000]	2
5060003	HYDCERRUSITE	-24.383	I	-2.000]	330	[3.000	600	I	2.000]	140
			[2.000]	2						
2060005	PB20 (OH) 2	-25.175]	-4.000]	330	[2.000	600	l	3.000]	2
5054000	NICO3	-10.943	ſ	1.000]	540	[1.000	140			
2054000	NI (OH) 2	-6.315	ſ	-2.0001	330	ī	1.000	540	٦	2.0001	2
2054001	BUNSENITE	-8.742	ſ	-2.0001	330	Ĩ	1.000	540	1	1.000]	2
5023101	MALACHITE	-11.688	ſ	2.0001	231	ſ	2.000	1 2	ſ	1.0001	140
			ſ	-2,0001	330						
5023102	AZURITE	-19,232	Г	3,0001	231	ſ	2.000	2	ſ	2,0001	140
0020202	10011212		ſ	-2,0001	330	L		, -	L	,	
2015000	T.TME.	-23,120	ſ	-2.0001	330	Г	1.000	1 150	٢	1,0001	2
2015001	PORTLANDITE	-12 775	ſ	-2 0001	330	ſ	1 000	1 150	Г	2 0001	2
2028000	WIISTITE	-20 420	ſ	-2 0001	330	Г	0.947	280	ſ	1 0001	2
2046001	PERTCIASE	-10 966	ſ	-2 0001	330	ſ	1 000	460	r	1 0001	2
3028001	HEDCANTTE	-23 529	L L	-8 0001	330	L L	1 000	1 280	ſ	2 0001	30
5020001	IIERCINTIE	23.525	L	4 0001	220	L	1.000	200	L	2.000]	50
3046000	CDINET	-12 096	L	-8.0001	330	r	1 000	1 460	Г	2 0001	30
3046000	SPINCL	-12.090	L	-8.000]	330	L	1.000	400	L	2.000]	50
2046001	MAC DEDDIME	10 224	L	4.000]	220	r	1 000	1 460	г	2 0001	201
3046001	MAG-FERRITE	-10.224	L	-8.000]	330	L	1.000	400	L	2.000]	201
2020102	TERTROOPOOT	2 155	L	4.000]	220	r	1 000	1 201	r	2 0001	0
3028102	LEPIDOCROCIT	-3.155	L	-3.000]	330	L	1.000	1 201	l	2.000]	220
3021100	FECR204	-12.3/1	L	2.000]	211	L	1.000	1 280	L	-4.000]	330
3021101	MGCR204	-4.809	L	2.000]	211	L	1.000	460	L	-4.000]	330
3021102	CR203	0.000	Ĺ	2.000]	211	[-2.000	330	L	-1.000]	2
2021102	CR (OH) 3 (A)	-0.860	[1.000]	211	[1.000	2	C	-1.000]	330
2021101	CR (OH) 3 (C)	-3.412	[1.000]	211	[1.000] 2]	-1.000]	330

2 - Modelling with DOM = 0.002 mol/l

		PART	1 of OUTPU	JT FILE			
Revue ri	ver water-Si	te 14 - DOM =	0.002 mol/J	, to pro-	ainitata I	Fo moder	main
Entered	PCO_2 , PO_2 , I	lixed pH, SOL	ids allowed	a to pre	cipitate, i	redox	pair,
adsorpti	on and disso.	ived organic m	aller				
Tempera Units o	ture (Celsius of concentrat	s): 19.30 ion: MG/L					
Ionic s	trength to be	e computed.					
Carbona	te concentrat	tion represent	s carbonate	alkalini	ity.		
Do not	automatically	y terminate if	charge imb	alance ex	ceeds 30%		
Precipi	tation is al.	lowed for all	solids in t	he thermo	odynamic da	tabase ar	nd
the p	rint option :	for solids is	set to: 1				
The max	imum number o	of iterations	is: 200				
The met	hod used to a	compute activi	ty coeffici	ents is:	Davies equa	ation	
Interme	diate output	file					
Adsorpt	ion model: D:	iffuse Layer					
Number	of adsorbing	surfaces: 1					
INPUT DA	TA BEFORE TY	PE MODIFICATIO	NS				
ID	NAME	ACTIVITY G	UESS LOG	GUESS	ANAL TOTAL		
330	H+1	2.512	E-08	-7.600	0.000E-01		
30	A1+3	4.786	E-06	-5.320	1.300E-01		
100	Ba+2	1.380	E-06	-5.860	1.900E-01		
150	Ca+2	1.288	E-04	-3.890	5.200E+00		
160	Cd+2	4.677	E-09	-8.330	5.300E-04		
211	Cr(OH)2+	2.818	E-08	-7.550	2.400E-03		
231	Cu+2	5.102	E-07	-6.300	2.000E-02		
410	K+1	6.607	E-05	-4 180	2 599E+00		
460	Ma+2	1.445	E = 0.4	-3.840	3.500E+00		
500	Na+1	2.089	E-04	-3.680	4.800E+00		
540	Ni+2	1.862	E-08	-7.730	1.100E-03		
600	Pb+2	1.778	E-07	-6.750	3.700E-02		
800	Sr+2	5.754	E - 07	-6.240	5.000E-02		
950	Zn+2	3.090	E-07	-6.510	2.000E-02		
1	E-1	1.000	E-16	-16.000	0.000E-01		
140	CO3-2	2.188	E-04	-3.660	1.310E+01		
281	Fe+3	1.778	E-21	-20.750	0.000E-01		
813	ADS1PSIO	1.000	E+00	0.000	0.000E-01		
811	ADSITIPI ADSITIPI	1.905	E-04	-3.720	1.922E-04		
145	DOM	1 995	E-03	-2.700	2 000E-03		
240	H2O	1 000	E+00	0.000	0.000E-01		
2	1120	1.000	ЦТОО	0.000	0.0001 01		
Cha	rge Balance:	UNSPECIATED					
S	um of CATIONS	S= 8.438E-04	Sum of ANIC	NS = 6.0)37E-03		
P	ERCENT DIFFER	RENCE = 7.547	E+01 (ANIC	NS - CATI	CONS) / (ANIO	NS + CATI	(ONS)
			0				
Turno T	COMPONENTS	PART	3 OT OUTPU	T FILE			
Type I -	NAME	AS SPECIES IN	SOLUTION				TOCK
330	H+1	2751E-08	2512E-08	-7 600	000 0 913	23 (1 039
30	A1+3	6.021E - 16	2.660E-16	-15.575	513 0.441	81 ().355
100	Ba+2	5.296E-08	3.683E-08	-7.433	375 0.695	55 ().158
150	Ca+2	8.112E-06	5.642E-06	-5.248	0.695	55 ().158
160	Cd+2	1.330E-12	9.254E-13	-12.033	0.695	55 ().158
211	Cr(OH)2+	6.748E-10	6.162E-10	-9.210	0.913	23 ().039
231	Cu+2	2.810E-13	1.955E-13	-12.708	0.695	55 ().158
280	Fe+2	1.821E-25	1.267E-25	-24.897	0.695	55 ().158
410	K+1	6.647E-05	6.070E-05	-4.216	580 0.913	23 ().039
460	Mg+2	6.010E-05	4.181E-05	-4.378	0.695	55 (1.158
500	Na+1	2.088E-04	1.90/E-04	-3./19	9/4 0.913	23 (1.039

540	Ni+2	9.308E-12	6.474E-12	-11.18882	0.69555	0.158
600	Ph+2	2710E - 15	1 8015-15	-14 72321	0 69555	0 158
000	EDIZ Guild	E 7070 07	2.0000 07	(10120	0.00000	0.150
800	Sr+2	5.707E-07	3.969E-07	-6.40129	0.69555	0.158
950	Zn+2	2.441E-11	1.698E-11	-10.77016	0.69555	0.158
812	ADS1TYP2	5.900E-03	5.900E-03	-2.22914	1.00000	0.000
140	C03-2	4.647E-07	3.232E-07	-6.49048	0.69555	0.158
281	Fe+3	5 903E-25	2 608E-25	-24 58367	0.44181	0.355
115	DOM	1 706E-03	0 016E-04	-3 05471	0.19086	0.309
140	DOM	1.1906-03	0.0102-04	-3.03471	1.00000	0.309
811	ADSITIPI	1.4076-04	1.407E-04	-3.85183	1.00000	0.000
Type II	- OTHER SPEC	IES IN SOLUTI	ON OR ADSOR	BED		
ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
8121000	=SO2Ba+	5.881E-11	5.881E-11	-10,23055	1.00000	-7.200
2113302	Cr (04) 3 70	1 8165-09	1 8195-09	-8 74025	1 00173	-7 131
2113302	CI (OII) J AQ	7 5715 12	C 014E 12	12 16026	0.01222	10 111
2113303	Cr (OH) 4-	7.571E-13	6.914E-13	-12.16026	0.91323	-18.111
2113304	Cr02-	1.921E-12	1.755E-12	-11.75585	0.91323	-11.106
1453300	H DOM	5.946E-06	4.431E-06	-5.35346	0.74522	3.998
1450300	Al DOM	1.007E-12	1.003E-12	-11.99859	0.99638	5.202
1451000	Ba DOM	1.170E-06	1.104E-06	-5.95721	0.94357	3.125
1451500	Ca DOM	1.130E-04	1.067E-04	-3.97202	0.94357	2.925
1451600	Cd DOM	4 657E - 11	4 394E-11	-10 35715	0 94357	3 325
1452110	Cm DOM	1 5410 11	1 52CE 11	10 01271	0.00620	15 220
1452110	CI DOM	1.5416-11	1.3366-11	-10.013/1	0.99030	13.222
1452310	Cu DOM	3.916E-10	3.695E-10	-9.43237	0.94357	4.925
1452810	Fe DOM	3.122E-19	3.111E-19	-18.50713	0.99638	7.702
1454600	Mg DOM	8.375E-05	7.903E-05	-4.10223	0.94357	1.925
1455400	Ni DOM	3.258E-10	3.074E-10	-9.51229	0.94357	3.325
1456000	Pb DOM	7.561E-12	7.134E-12	-11.14668	0.94357	5.225
1459500	Zn DOM	1.354E - 0.9	1 278E-09	-8 89362	0 94357	3 525
3300020		2 8235-07	2 5785-07	-6 58865	0 91323	-14 149
160220	MaOU I	2.023E-07	2.J/0E-07	-0.30003	0.01222	11 065
4603300	MGOH +	1.806E-09	1.649E-09	-8.78281	0.91323	-11.965
4601400	MgCO3 AQ	1.180E-08	1.182E-08	-7.92754	1.00173	2.941
4601401	MgHCO3 +	1.012E-07	9.239E-08	-7.03436	0.91323	11.474
1503300	CaOH +	3.848E-11	3.514E-11	-10.45421	0.91323	-12.766
1501400	CaHCO3 +	1.056E-08	9.646E-09	-8.01564	0.91323	11.363
1501401	CaCO3 AO	2.299E-09	2.303E-09	-8,63768	1.00173	3.101
5001400	NaCO3 -	9 330F-10	8 521E-10	-9 06952	0 91323	1 180
5001400	Naucos No	1 0500 10	1 0615-00	7 73022	1 00173	10.079
202200	Nancos AQ	1.0506-00	1.001E-00	-7.73022	1.00175	10.079
303300	AIOH +2	1.053E-13	7.326E-14	-13.13512	0.69555	-5.002
303301	AI(OH)2 +	3.66/E-11	3.349E-11	-10.4/514	0.91323	-10.061
303302	Al(OH)4 -	1.717E-09	1.568E-09	-8.80458	0.91323	-23.590
303303	Al(OH)3 AQ	1.675E-09	1.678E-09	-8.77515	1.00173	-16.001
2803300	FeOH +	1.131E-27	1.033E-27	-26.98589	0.91323	-9.649
2803301	FeOH3 -1	3.230E-34	2.950E-34	-33.53021	0.91323	-31.393
2803302	FeoH2 AO	2 108E-31	2.111E-31	-30,67542	1.00173	-20,979
2813300	FOOH +2	6 846F-20	4 762E-20	-19 32223	0 69555	-2 181
2013300	Feolio 1	0.677E 16	9.027E 16	15 05260	0.01222	5 621
2813301	FEOHZ +	9.077E-10	0.037E-10	-15.05566	0.91323	-5.631
2813302	FEOH3 AQ	4.126E-16	4.133E-16	-15.38369	1.00173	-13.601
2813303	FeOH4 -	1.802E-16	1.646E - 16	-15.78369	0.91323	-21.561
2813304	Fe2(OH)2+4	3.315E-37	7.759E-38	-37.11021	0.23405	-2.512
2813305	Fe3(OH)4+5	1.349E-49	1.395E-50	-49.85531	0.10341	-5.519
8003300	SrOH +	7.129E-13	6.511E-13	-12.18637	0.91323	-13.346
1003300	BaOH +	4 286E-14	3 914E-14	-13 40740	0.91323	-13 534
2211400	CUCO3 NO	3 207E-13	3 3035-13	-12 16939	1 00173	6 729
2311400	CUCOS AQ	1.00FP 10	1. 201E 10	-12.40930	1.00175	0.729
2311401	Cu(CO3) Z-2	1.985E-10	1.381E-16	-15.85986	0.69555	9.988
2313300	CuOH +	8.521E-14	7.782E-14	-13.10891	0.91323	-7.961
2313301	Cu(OH)2 AQ	6.462E-12	6.473E-12	-11.18892	1.00173	-13.681
2313302	Cu(OH)3 -	1.704E-17	1.556E-17	-16.80792	0.91323	-26.860
2313303	Cu(OH) 4 -2	1.773E-22	1.233E-22	-21.90893	0.69555	-39.442
2313304	Cu2 (OH) 2+2	2.142E-21	1.490E-21	-20,82688	0.69555	-10.451
2311402	CuHCO3 +	1.738E-14	1.587E - 14	-13 79938	0.91323	13 039
9503300	ZnOH +	5 222E-12	A 760F-12	-12 22150	0 01323	_0 112
0503300		2 2005 12	2.7096-13	12.02100	1 00173	- 9.112
9203301	Zn (OH)Z AQ	3.309E-13	3.393E-13	-12.4691/	1.001/3	-10.900
9503302	Zn(OH)3 -	4.680E-17	4.2/4E-17	-16.36918	0.91323	-28.360
9503303	Zn(OH)4 -2	3.877E-22	2.697E-22	-21.56918	0.69555	-41.041

9501400	ZnHCO3 +	3.791E-13	3.462E-13	-12.46064	0.91323	12.439
9501401	ZnCO3 AQ	1.093E-12	1.095E-12	-11.96064	1.00173	5.299
9501402	Zn(CO3)2-2	1.088E-14	7.566E-15	-14.12111	0.69555	9.788
1601400	Cd(CO3)3-4	2.216E-25	5.187E-26	-25.28512	0.23405	6.851
1603300	CdOH +	2.181E-15	1.991E-15	-14.70084	0.91323	-10.228
1603301	Cd(OH)2 AQ	6.540E-18	6.551E-18	-17.18370	1.00173	-20.351
1603302	Cd(OH)3 -	3.204E-23	2.926E-23	-22.53371	0.91323	-33.261
1603303	Cd(OH)4 -2	1.493E-29	1.038E-29	-28,98371	0.69555	-47.192
1603304	Cd20H +3	2.196E-26	9.703E-27	-26,01308	0.44181	-9.191
1601400	CdHCO3 +	2.067E-14	1.887E-14	-13.72417	0.91323	12,439
1601401	CdCO3 AO	7.483E-14	7.496E-14	-13,12516	1.00173	5.398
6001400	Pb(CO3)2-2	1.240E - 17	8.626E-18	-17.06417	0.69555	10.798
6003300	PbOH +	1.608E - 15	1.468E - 15	-14.83322	0.91323	-7.671
6003301	Pb(0H)2 A0	2.270E-17	2.274E - 17	-16,64322	1.00173	-17,121
6003302	Pb(0H)3 -	1.138E - 20	1 039E-20	-19 98323	0 91323	-28 021
6003303	Pb20H + 3	1.407E - 28	6.217E-29	-28 20643	0 44181	-6.005
6003304	Pb3 (0H) 4+2	1.347E - 38	9 371E-39	-38 02823	0 69555	-24 101
6001401	PbC03 A0	1.047E - 14	1.062E - 14	-13 97369	1 00173	7 239
6003305	Ph (0H) A -2	1.366F-24	9.501E - 25	-24 02224	0.69555	-39 541
6001402	PhHCO3 +	2 6655-16	2 A34E-16	-15 61369	0.00000	13 239
5403300	NiOH +	2.000E 10 2.589E - 14	2.354E 10 2.365E - 14	-13 62626	0.91323	-9 998
5403301	Ni (OH) 2 AO	1.024E - 15	1.026E - 15	-14 98884	1 00173	-19 001
5403302	Ni (OH) 3 -	4 473E-19	4.085E - 19	-18 38885	0 91323	-29 961
5401400	NiHCO3 +	1 600F-13	1.551E - 13	-12 90930	0.91323	12 509
5401400	Nicos AO	1.099E - 13 1.549E - 11	1.551E-11	-10 80930	1 00173	6 869
5401402	Ni (CO3) 2-2	1.040E 11 1.253E-14	8 714E-15	-14 05978	0 69555	10 268
3301402	HC03 -	2.151F - 04	1 964E-04	-3 70680	0.09000	10.200
3301400	H2CO3 NO	1 0528-05	1.904E-04	-1 07730	1 00173	16 712
2113300	Cr+3	7.116F - 15	3 144E - 15	-14.50252	0 44181	10.712
2113301	Cr(OH) + 2	9 278F-12	6 453E-12	-11 19021	0 69555	5 778
8123301	=\$02-	8 408F-04	8 408E-04	-3 07532	1 00000	-8 930
8123302	=502H2+	9 485F-04	9 485E-04	-3 02297	1 00000	7 290
8113301	=5021121	2 004F-05	2.004E-05	-1 69801	1.00000	-8 930
8113302	-50142+	2.004E 05 2.261E - 05	2.004E-05 2.261E-05	-4.64566	1 00000	7 290
8129500	= SO27n +	1 3395-08	1 339E-08	-7 87314	1.00000	-1 990
8119500	-S017n+	2.912F - 07	2.912E - 07	-6 53583	1 00000	0.970
8121600	= 502Cd+	8 981F-11	8 981F-11	-10.04667	1 00000	-2 900
8111600	=S01Cd+	4 578E-09	4 578E-09	-8 33936	1 00000	0.430
8112310	=501Cu+	2 543E-07	2.543E-07	-6 59157	1.00000	2 850
8122310	=502011+	6 000F-08	6 000E-08	-7 22188	1 00000	0.600
8115400	=S01Ni+	1 681F-08	1.681E - 08	-7 77119	1.00000	0.000
8125400	-502Ni+	1.578E-09	1.578E - 09	-8 80180	1 00000	-2 500
8116000	=S01Pb+	1 783F-07	1.783E-07	-6 74888	1 00000	4 710
8126000	-502Pb+	2 909E-10	2 909E-10	-9 53619	1.00000	0.300
8121500	=502Ca+	6.144F-07	6.144E = 07	-6 21153	1 00000	-5.850
8111500	= 502Ca +	7 979E-06	7 979E-06	-5 09805	1 00000	1 970
8111000	=SO1HBa++	1.610E - 07	1.610E - 07	-6 79324	1 00000	5.460
	-50111ba++	1.0101 07	1.0102 07	0.75524	1.00000	5.400
Type II	I - SPECIES	WITH FIXED ACT	IVITY			
ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH	
2	H20	-1.918E-05	-4.717	0.000	0.000	
330	H+1	-3.194E-04	-3.496	7.600	0.000	
3301403	CO2 (g)	2.202E-04	-3.657	21.690	-0.530	
3300021	02 (a)	1.139E-04	-3.943	-84.354	133.830	
2802810	Fe+2/Fe+3	-5.372E-07	-6.270	13.175	-10.000	
Type IV	- FINITE SO	LIDS (present	at equilibriu	ım)		
ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH	
3028100	HEMATITE	2.686E-07	-6.571	3.567	30.845	
2003002	DIASPORE	4.815E-06	-5.317	-7.225	24.630	
3021102	CR203	1.269E-08	-7.896	3.220	12.125	

		P.	ART 4	OÍ	OULDAL F.	11E	
	PERCEN	NTAGE DIST	RIBUTI	ON	OF COMPO	NENTS AMONG	3
	TYPE I ar	nd TYPE II	(diss	olv	ed and a	dsorbed) sr	pecies
ADS1TYP1			1				
	73 2	PFRCENT	BOUND	TN	SPECTES	# 811	ADS1TYP1
	10.4	DEDCENT	DOUND	TN	CDECTEC	#0112201	-201
	10.4	PERCENT	BOUND	TN	SPECIES	#0113301	=501-
	11.8	PERCENT	BOUND	TN	SPECIES	#8113302	=S01H2+
	4.2	PERCENT	BOUND	IN	SPECIES	#8111500	=SO1HCa++
ADS1TYP2							
	76.7	PERCENT	BOUND	IN	SPECIES	# 812	ADS1TYP2
	10.9	PERCENT	BOUND	IN	SPECIES	#8123301	=S02-
	12.3	PERCENT	BOUND	TN	SPECIES	#8123302	=SO2H2+
Ba+2	12.0	1 DICODICI	DOOLD	- L 1	0100100	10120002	DOLITE
Datz	2 0	DEDOEM	DOUND	T 37	ODEGTEG	# 100	D- 10
	3.8	PERCENT	BOUND	TIN	SPECIES	# 100	Ba+2
	84.5	PERCENT	BOUND	IN	SPECIES	#1451000	Ba DOM
	11.6	PERCENT	BOUND	IN	SPECIES	#8111000	=SO1HBa++
Ca+2							
	6.3	PERCENT	BOUND	IN	SPECIES	# 150	Ca+2
	87.1	PERCENT	BOUND	TN	SPECTES	#1451500	Ca DOM
	6 1	PERCENT	BOUND	TN	SPECTES	#8111500	=SO1HCa++
C212	0.1	T DICOUNT	DOOND	T 14	DEFCIED	#0111300	= SOTTICA + +
Ca+2	1 0	DED OF ME	DOMID	-	apporta	10101000	
	1.9	PERCENT	BOUND	TN	SPECIES	#8121600	=SO2Cd+
	97.1	PERCENT	BOUND	IN	SPECIES	#8111600	=SO1Cd+
ADS1PSIO							
	741.1	PERCENT	BOUND	IN	SPECIES	#8123302	=SO2H2+
	17.7	PERCENT	BOUND	IN	SPECIES	#8113302	=S01H2+
	12.5	PERCENT	BOUND	TN	SPECTES	#8111500	=SO1HCa++
$C_{11}+2$		LERCERT	DOOLD		DITOTIO	10111000	boinda
CUIZ	00 0	DEDCENT	DOUND	TN	OPECTER	#0110010	-001000
	80.8	PERCENT	BOUND	TN	SPECIES	#8112310	=501Cu+
and shall as	19.1	PERCENT	BOUND	IN	SPECIES	#8122310	=SO2Cu+
DOM							
	89.8	PERCENT	BOUND	IN	SPECIES	# 145	DOM
	5.7	PERCENT	BOUND	IN	SPECIES	#1451500	Ca DOM
	4.2	PERCENT	BOUND	IN	SPECIES	#1454600	Mg DOM
K+1							5
	100 0	PERCENT	ROUND	TN	SPECIES	# 410	K+1
Ma+2	100.0	I BRODITI	DOOND	T14	DIDCIDO	11 410	RHI
My 12	41 7	DEDODNE	DOUND	TN	ODDOTDO	11 1.00	Marko
	41.7	PERCENT	BOUND	TIN	SPECIES	# 460	Mg+2
	58.2	PERCENT	BOUND	IN	SPECIES	#1454600	Mg DOM
Na+1							
	100.0	PERCENT	BOUND	IN	SPECIES	# 500	Na+1
Ni+2							
	1.7	PERCENT	BOUND	IN	SPECIES	#1455400	Ni DOM
	89.7	PERCENT	BOUND	TN	SPECTES	#8115400	=SO1Ni+
	8 4	PERCENT	BOUND	TN	SPECIES	#8125400	=\$02Ni+
Db+2	0.1	LUKCHKI	DOOLD	TIA	DIDCIDD	#0125400	-502111
ED12	00 0	DEDODM	DOUND	TNI	ODDOTEO	10110000	001 DI 1
-	99.8	PERCENT	ROOND	IN	SPECIES	#8110000	=SOIPD+
Sr+2							
	100.0	PERCENT	BOUND	IN	SPECIES	# 800	Sr+2
Zn+2							
	4.4	PERCENT	BOUND	IN	SPECIES	#8129500	=SO2Zn+
	95.2	PERCENT	BOUND	TN	SPECIES	#8119500	=SO17n+
Cr(OH) 2+	2012	LERODIT	DOOLD		0110110	10119000	DOTHIC
	26 0	DEDODM	DOUND	-	ODDOTDO		G (OT) O .
	20.8	PERCENT	BOUND	IN	SPECIES	# 211	Cr (OH) 2+
	12.1	PERCENT	BOUND	IN	SPECIES	#2113302	Cr(OH) 3 AQ
AL+3							
	1.1	PERCENT	BOUND	IN	SPECIES	# 303301	Al(OH)2 +
	50.1	PERCENT	BOUND	IN	SPECIES	# 303302	Al(OH)4 -
	48.8	PERCENT	BOUND	IN	SPECIES	# 303303	AL (OH) 3 AO
CO3-2							
000 2	05 1	DEDOENT	BUIND	TN	CDECTEC	#2201400	4003
	55.I	FERCENT	BOUND	TIN	SPECIES	#3301400	ncus -
D -10	4.0	PERCENT	ROOND	TN	SPECIES	#3301401	HZCO3 AQ
re+Z							
	99.4	PERCENT	BOUND	IN	SPECIES	# 280	Fe+2

E-1							
Fe+3							
	62.0	PERCENT	BOUND	IN	SPECIES	#2813301	FeOH2 +
	26.4	PERCENT	BOUND	IN	SPECIES	#2813302	FeOH3 AQ
	11.5	PERCENT	BOUND	IN	SPECIES	#2813303	FeOH4 -
H+1							
	1.7	PERCENT	BOUND	IN	SPECIES	#1453300	H DOM
	61.3	PERCENT	BOUND	IN	SPECIES	#3301400	нсоз –
	6.0	PERCENT	BOUND	IN	SPECIES	#3301401	H2CO3 AQ
	270.4	PERCENT	BOUND	IN	SPECIES	#8123302	=SO2H2+
	6.4	PERCENT	BOUND	IN	SPECIES	#8113302	=SO1H2+
H20							
	25.2	PERCENT	BOUND	IN	SPECIES	#3300020	OH-
	1.2	PERCENT	BOUND	IN	SPECIES	#8129500	=SO2Zn+
	26.0	PERCENT	BOUND	IN	SPECIES	#8119500	=SO1Zn+
	22.7	PERCENT	BOUND	IN	SPECIES	#8112310	=SO1Cu+
	5.4	PERCENT	BOUND	IN	SPECIES	#8122310	=SO2Cu+
	1.5	PERCENT	BOUND	IN	SPECIES	#8115400	=SO1Ni+
	15.9	PERCENT	BOUND	IN	SPECIES	#8116000	=SO1Pb+

PART 5 of OUTPUT FILE

----- EQUILIBRATED MASS DISTRIBUTION -----

IDX NAME DISSOLVED SORBED PRECIPITATED									
		MOL/KG	PERCENT	MOL/KG	PERCENT	MOL/KG	PERCENT		
100	50	1 00000 0.6	00.4	1 (105 05	11 5	0.0000.01	0.0		
100	Ba+2	1.223E-06	88.4	1.610E-07	11.6	0.000E-01	0.0		
150	Ca+2	1.212E-04	93.4	8.593E-06	6.6	0.000E-01	0.0		
160	Cd+2	4.799E-11	1.0	4.66/E-09	99.0	0.000E-01	0.0		
231	Cu+2	3.988E-10	1.0	3.143E-07	99.9	0.000E-01	0.0		
145	DOM	2.000E-03	100.0	0.000E-01	0.0	0.000E-01	0.0		
410	K+1	6.647E-05	100.0	0.000E-01	0.0	0.000E-01	0.0		
460	Mg+2	1.440E-04	100.0	0.000E-01	0.0	0.000E-01	0.0		
500	Na+1	2.088E-04	100.0	0.000E-01	0.0	0.000E-01	0.0		
540	Ni+2	3.508E-10	1.9	1.839E-08	98.1	0.000E-01	0.0		
600	Pb+2	7.576E-12	0.0	1.786E-07	100.0	0.000E-01	0.0		
800	Sr+2	5.707E-07	100.0	0.000E-01	0.0	0.000E-01	0.0		
950	Zn+2	1.381E-09	0.5	3.046E-07	99.5	0.000E-01	0.0		
211	Cr(OH)2+	2.518E-09	9.0	0.000E-01	0.0	2.539E-08	91.0		
30	A1+3	3.430E-09	0.1	0.000E-01	0.0	4.815E-06	99.9		
140	CO3-2	2.262E-04	100.0	0.000E-01	0.0	0.000E-01	0.0		
280	Fe+2	1.832E-25	100.0	0.000E-01	0.0	0.000E-01	0.0		
1	E-1	0.000E-01	0.0	0.000E-01	0.0	0.000E-01	0.0		
281	Fe+3	1.561E-15	0.0	0.000E-01	0.0	5.372E-07	100.0		
330	H+1	2.419E-04	69.0	1.088E-04	31.0	0.000E-01	0.0		
2	H20	2.979E-07	26.6	8.206E-07	73.4	0.000E-01	0.0		
	Chause Dalars	CDDCTABED							
	Charge Balanc	e: SPECIATED	E 02 Cum	of ANTONO	6 2755 0	10			
	DEDCENT DIE	ONS = 1.402	E-03 Sum	OI ANIONS	6.2/SE-C	/ (DNTONG)	CAMITONO		
	PERCENT DIF	FERENCE =	6.348E+UI	(ANIONS -	CATIONS)	/ (ANIONS +	CATIONS)		
	NON-CARBONATE	ALKALINITY	=	2.549E-07					
	EQUILIBRIUM I	ONIC STRENGT	H(m) =	7.498E-03					
	EQUILIBRIUM P	Н	=	1.600					
	EQUILIBRIUM p	е	=	13.489 or	Eh =	782.67 mv			
* * * *	*** DIFFUSE LA	YER ADSORPTT	ON MODEL	* * * * * * * *					
***	* Parameters F	or Adsorbent	Number 1	* * * *					
El	ectrostatic Va	riables: ps	i0 = 0.02	8075 si	$a_0 = 0.00$	15979			
	psib = 0.000000 $sigb = 0.000000$								
		ps	id = 0.00	0000 si	qd = 0.00	0000			
Ad	sorbent Concen	tration (g/l): 3.44	2	5.00				
Sp	Specific Surface Area (sa meters/a): 600 00								
DP.	Contract			000.00					

		PART 6	of	OUTP	UT FI	LE					
Saturation	indices and	stoichiometry	of	all	miner	cals					
ID #	NAME	Sat. Index		Sto	ichic	ometi	ry in []	orack	cets	5]	
2003000	ALOH3(A)	-3.542 [1	.000]	30	[3.000]	2	[-3.000]	330
5015000	ARAGONITE	-3.453 [1	.000]	150	[1.000]	140			
5046000	ARTINITE	-10.059 [-2	.000]	330]	2.000]	460	[1.000]	140
		[5	.000]	2						
2003001	BOEHMITE	-1.755 [-3	.0001	330	٦	1.0001	30	[2.0001	2
2046000	BRUCTTE	-6.340 [1	0001	460	ſ	2.0001	2	ſ	-2.0001	330
5015001	CALCITE	-3 297 [1	0001	150	ſ	1 0001	140	Ľ	210001	000
2003002	DIAGDODE	0.000 [-3		330	ſ	1 0001	30	٢	2 0001	2
2003002	DIASPORE	5.000 [1	.0001	150	r	1 0001	160	r	2.000]	110
5015002	DOLOMITE	-3.121	1	.000]	100	L	1.0001	201	L	2.000]	140
2028100	FERRIHYDRITE	-6.675 [-3	.000]	330	L	1.000]	201	L	3.000]	200
2028101	FE3 (OH) 8	-33.48/ [-8	.000]	330	L	2.000]	281	1	1.000]	280
		L	8	.000]	2						-
2003003	GIBBSITE (C)	-1.871 [-3	.000]	330	[1.000]	30	L	3.000]	2
3003000	A1203	-8.530 [2	.000]	30	[3.000]	2	[-6.000]	330
2028102	GOETHITE	-2.491 [-3	.000]	330	[1.000]	281]	2.000]	2
3028100	HEMATITE	0.000 [-6	.000]	330	J	2.000]	281	[3.000]	2
5015003	HUNTITE	-14.747 [3	.000]	460	[1.000]	150	I	4.000]	140
5046001	HYDRMAGNESIT	-24.636	5	.0001	460	ſ	4.000]	140	ſ	-2.000]	330
		[6	.0001	2						
3028101	MACHEMITE	-9 953 [-6	0001	330	ſ	2.0001	281	٢	3,0001	2
5046002	MACNESTTE	-2 928	1	0001	460	ſ	1 0001	140	L	0.000]	-
2020002	MAGNEDITE	17 700 [0	.000]	220	r	2 0001	201	Г	1 0001	290
3028000	MAGNETITE	-11.123 [-0	.0001	330	L	2.000]	201	L	1.000]	200
		L	4	.000]	2		1 0001	1 10		10 0003	0
3050000	NATRON	-12.394 [2	.000]	500	l	1.000]	140	L	10.000]	2
5046003	NESQUEHONITE	-5.331 [1	.000]	460	- E	1.000]	140	Ĺ	3.000]	2
5028000	SIDERITE	-20.914 [1	.000]	280	[1.000]	140			
5080000	STRONTIANITE	-3.652 [1	.000]	800	[1.000]	140			
5050001	THERMONATR	-14.095 [2	.000]	500	[1.000]	140	[1.000]	2
5010000	WITHERITE	-5.334 [1	.0001	100	[1.000]	140			
5023100	CUCO3	-9 569 [1	0001	231	r	1.0001	140			
2023100	CII (OH) 2	-6.367 [-2	0001	330	ſ	1 0001	231	ſ	2 0001	2
2023101	TENODITE	E 247 [2		220	r	1 0001	231	r r	1 0001	2
2023101	CUPDIORDIE	-5.547 [-2	.000]	220	L	1.000]	231	L	2.000]	201
3023100	CUPRICEERIT	-7.509 [-8	.000]	330	L	1.000]	231	L	2.000]	281
		l	4	.000]	2						
95000	ZN METAL	-64.030 [1	.000]	950	l	2.000]	T			
5095000	SMITHSONITE	-7.323 [1	.000]	950	[1.000]	140			
5095001	ZNCO3, 1H2O	-7.001 [1	.000]	950	[1.000]	140	[1.000]	2
2095000	ZN(OH)2 (A)	-8.020 [-2	.000]	330	[1.000]	950	I	2.000]	2
2095001	ZN(OH)2 (C)	-7.770 [-2	.000]	330	[1.000]	950]	2.000]	2
2095002	ZN (OH) 2 (B)	-7.320 [-2	.000]	330	ſ	1.000]	950]	2.000]	2
2095003	ZN (OH) 2 (G)	-7.280	-2	.0001	330	ſ	1.0001	950	ſ	2.0001	2
2095004	ZN(OH) 2 (E)	-7.070 [-2	0001	330	ſ	1.0001	950	ſ	2,0001	2
2095005	ZNO(ACTIVE)	-6.880 [-2	0001	330	ſ	1 0001	950	ſ	1,0001	2
2000000	ZNO (ACIIVE)	0.000	4	.000]	550	L	1.000]	550	L	1.000]	2
TD #	NAME	Cat Indox		Sto	ichic	mot	ry in [hracl	rot	e]	
2095006	TNCTTE	-7 022 [_2	0001	330	r r	1 0001	950	rec.	1 0001	2
2095006	ZINCITE	-7.022 [-2	.000]	330	L	1.000]	950	L	1.000]	2
16000	CD METAL	-52.758 [T	.000]	160	L	2.000]	T			
16001	GAMMA CD	-52.860 [1	.000]	160	L	2.000]	1			
5016000	OTAVITE	-4.792 [1	.000]	160	[1.000]	140			
2016000	CD(OH)2 (A)	-10.860 [-2	.000]	330	[1.000]	160	[2.000]	2
2016001	CD (OH) 2 (C)	-10.484 [-2	.000]	330	[1.000]	160]	2.000]	2
2016002	MONTEPONITE	-12.307	-2	.0001	330	I	1.0001	160]	1.000]	2
60000	PB METAL	-45.965	1	.0001	600	ſ	2.0001	1		-	
5060000	CERRUSITE	-8,014	1	.0001	600	ſ	1,0001	140			
2060000	MASSICOT	-12 673	- 2	0001	220	r	1 0001	600	r	1 0001	2
2060000	TTUNDOD	-12.073	-2		220	r	1 0001	600	L	1 0001	2
2060001	DDO DWOO	-12.4// [-2	.0001	220	L	1.000]	600	L	1.000]	4
2060002	PBO, .3H20	-12.503 [-2	.000]	330	L	1.000]	600	L	1.330]	2
5060001	PB20C03	-20.401 [-2	.000]	330	l	2.000]	600	[1.000]	2
		[1	.000]	140						
5060002	PB302C03	-31.658 [-4	.000]	330	[3.000]	600	[1.000]	140
]	2	.000]	2						

2060003	PLATTNERITE	-7.657	[-4.000]	330	[-2.000]	1	[1.000]	600
3060000	PB203	-17.909	[-6.000]	330	[-2.000]	1]	2.000]	600
3060001	MINIUM	-31.551	[-8.000]	330	[-2.000]	1	[3.000]	600
2060004	PB(OH)2 (C)	-7.873	[-2.000]	330	[1.000]	600	[2.000]	2
5060003	HYDCERRUSITE	-24.491	[-2.000]	330	[3.000]	600	[2.000]	140
2060005	PB20 (OH) 2	-25,246	ſ	-4.0001	330	١	2.0001	600	ſ	3,0001	2
5054000	NICO3	-10.981	ſ	1.0001	540	ſ	1.000]	140		,	
2054000	NI (OH) 2	-6.354	ſ	-2.000]	330	Ĩ	1.000]	540	[2.000]	2
2054001	BUNSENITE	-8.781	[-2.000]	330	Ĩ	1.000]	540	[1.000]	2
5023101	MALACHITE	-11.751	[2.000]	231]	2.000]	2	[1.000]	140
			[-2.000]	330						
5023102	AZURITE	-19.327]	3.000]	231	[2.000]	2	[2.000]	140
]	-2.000]	330						
2015000	LIME	-23.506]	-2.000]	330	[1.000]	150]	1.000]	2
2015001	PORTLANDITE	-13.162	[-2.000]	330]	1.000]	150	[2.000]	2
2028000	WUSTITE	-20.420	[-2.000]	330	[0.947]	280	I	1.000]	2
2046001	PERICLASE	-11.205]	-2.000]	330]	1.000]	460	[1.000]	2
3028001	HERCYNITE	-23.529	[-8.000]	330	[1.000]	280	[2.000]	30
			[4.000]	2						
3046000	SPINEL	-12.335	[-8.000]	330	[1.000]	460]	2.000]	30
			[4.000]	2						
3046001	MAG-FERRITE	-10.463]	-8.000]	330	[1.000]	460	[2.000]	281
			[4.000]	2						
3028102	LEPIDOCROCIT	-3.155	[-3.000]	330	[1.000]	281	[2.000]	2
3021100	FECR204	-12.371	[2.000]	211	[1.000]	280	[-4.000]	330
3021101	MGCR204	-5.048	[2.000]	211	[1.000]	460]	-4.000]	330
3021102	CR203	0.000	[2.000]	211	[-2.000]	330	I	-1.000]	2
2021102	CR(OH)3 (A)	-0.860	[1.000]	211	[1.000]	2	[-1.000]	330
2021101	CR (OH) 3 (C)	-3.412	ſ	1.0001	211	Γ	1.0001	2	Γ	-1.0001	330

3 - Modelling with DOM = 0.003 mol/l

Entered FCO2, PO2, fixed pH, solids allowed to precipitate, Fe redox pair, adsorption and dissolved organic matter Temperature (Calsius): 19.30 Units of concentration: MG/L Tonic strength to be computed. Carbonate concentration represents carbonate alkalinity. Do not automatically terminate if charge imbalance exceeds 30% Precipitation is allowed for all solids in the thermodynamic database and the print option for solids is set to: 1 The maximum number of iterations is: 200 The method used to compute activity coefficients is: Davies equation Intermediate output file Adsorption model: Diffuse Layer Number of adsorbing surfaces: 1 INPUT DATA BEFORE TYPE MODIFICATIONS ID NAME ACTIVITY GUESS LOG GUESS ANAL TOTAL 330 H+1 2.5128-08 -7.600 0.000E-01 100 Ba+2 1.300E-06 -5.820 1.300E-01 100 Ba+2 1.300E-06 -5.820 1.300E-01 100 Ba+2 1.300E-06 -5.820 1.300E-01 100 Ba+2 1.300E-06 -5.820 2.400E-03 231 Cu+2 3.162E-07 -6.500 2.000E-02 410 K+1 6.60TE-05 -4.180 2.599E+00 160 Cd+2 4.67TE-09 -6.330 5.300E-04 410 K+1 6.60TE-05 -4.180 2.599E+00 160 DP+2 1.478E-04 -3.840 4.800E+00 540 Ni+2 1.862E-08 -7.730 1.100E-03 540 Ni+2 1.862E-08 -7.7510 0.3705E-03 541 ADSITYPI 1.905E-04 -3.720 1.922E-04 181 ADSITYPI 1.905E-04 -3.720 1.922E-04 181 ADSITYPI 1.905E-04 -3.720 1.922E-04 181 ADSITYPI 1.905E-04 -3.720 1.922E-04 30 Al+3 7.774E-21 -20.750 0.0000E-01 Charge Balance: UNSPECIAED Sum of CATIONS = 8.438E-04 Sum of ANIONS = 8.837E-03 FERCENT DIPFREENCE = 8.257E+01 (ANIONS - 6.7100S)/(ANIONS + CATIO	Revuè river wa	PAR ter-Site 14 - DOM =	T 1 of OUTPU 0.003 mol/1	T FILE		
Temperature (Celsius): 19.30 Units of concentration: MG/L Ionic strength to be computed. Carbonate concentration represents carbonate alkalinity. Do not automatically terminate if charge imbalance exceeds 30% Precipitation is allowed for all solids in the thermodynamic database and the print option for solids is set to: 1 The maximum number of iterations is: 200 The method used to compute activity coefficients is: Davies equation Intermediate output file Adsorption model: Diffuse Layer Number of adsorbing surfaces: 1 The method used to compute activity coefficients is: Davies equation 10 NARE ACTIVITY GUESS LOG GUESS ANAL TOTAL 330 H+1 2.512E-08 0.30 Al+3 4.796E-06 150 Ca+2 1.288E-04 151 Ca+2 1.380E-06 152 Ca+2 3.162E-07 160 Cd+2 4.677E-09 211 Cr(OH)2+ 2.818E-08 212 Cr(OH)2+ 2.818E-08 213 Cr(H2 + 3.810E-05 410 K+1 6.607E-05 410 K+1 6.607E-05 410 K+1 2.098E-04 540 Na+2 1.862E-08 </td <td>Entered PCO₂, adsorption and</td> <td>PO_2, fixed pH, so dissolved organic</td> <td>lids allowed matter</td> <td>d to prec</td> <td>ipitate, Fe</td> <td>redox pair,</td>	Entered PCO ₂ , adsorption and	PO_2 , fixed pH, so dissolved organic	lids allowed matter	d to prec	ipitate, Fe	redox pair,
INFUT DATA BEFORE TYPE MODIFICATIONS ID NAME ACTIVITY GUESS LOG GUESS ANAL TOTAL 330 H+1 2.512E-08 -7.600 0.000E-01 30 Al+3 4.786E-06 -5.320 1.300E-01 100 Ba+2 1.300E-06 -5.860 1.900E-01 150 Ca+2 1.288E-04 -3.890 5.200E+00 160 Ca+2 4.677E-09 -8.330 5.300E-04 211 Cr(0H)2+ 2.816E-08 -7.550 2.400E-03 231 Cu+2 3.162E-07 -6.500 2.000E-02 240 Fe+2 5.370E-07 -6.500 2.000E-02 410 K+1 6.607E-05 -4.180 2.599E+00 460 Mg+2 1.445E-04 -3.840 3.500E+00 500 Na+1 2.089E-04 -3.680 4.800E+00 500 Na+1 2.089E-04 -3.680 4.800E+00 500 St+2 5.754E-07 -6.510 2.000E-02 950 Zn+2 3.090E-07 -6.510 2.000E-02 1 E-1 1.000E-16 -16.000 0.000E-01 140 CO3-2 2.188E-04 -3.660 1.310E+01 281 Fe+3 1.778E-21 -20.750 0.000E-01 811 ADSITYP1 1.905E-04 -3.720 1.922E-04 812 ADSITYP1 7.762E-03 -2.110 7.690E-03 145 DOM 3.020E-03 -2.520 3.000E-03 2 H20 1.000E+00 0.000 0.000E-01 Charge Balance: UNSPECIATED Sum of CATIONS 8.438E-04 Sum of ANIONS = 8.837E-03 PERCENT DIFFERENCE = 8.257E+01 (ANIONS = 8.837E-03 PERCENT DIFFERENCE = 8.257E+01 (ANIONS = 8.637E-03 PERCENT DIFFERENCE = 8.257E+01 (ANIONS = 6.6307 0.0474 30 Al+3 7.074E-16 2.660E-16 -15.57513 0.37599 0.2425 100 Ba+2 3.219E-08 2.0142-08 -7.60107 0.64743 0.189 150 Ca+2 4.870E-06 3.153E-06 -5.50126 0.64743 0.189 150 Ca+2 4.870E-06 3.153E-06 -5.50126 0.64743 0.189 150 Ca+2 4.870E-06 3.153E-06 -5.50126 0.64743 0.189 150 Ca+2 4.970E-06 3.153E-06 -5.50126 0.64743 0.189 150 Ca+2 4.970E-06 3.153E-06 -5.50126 0.64743 0.189 150 Ca+2 4.970E-05 2.692E-05 -4.22458 0.89701 0.047 231 Cu+2 2.920E-13 1.691E-13 -72.752 0.89701 0.047 241 Cr(0H)2+ 6.670E-10 6.162E-10 -9.21025 0.89701 0.047 251 Cu+2 4.159E-05 2.692E-05 -4.22458 0.89701 0.047 260 Na+1 2.008E-04 1.873E-04 -3.72752 0.89701 0.047	Temperature (Units of conc Ionic strengt Carbonate con Do not automa Precipitation the print o The maximum n The method us Intermediate Adsorption mo Number of ads	Celsius): 19.30 entration: MG/L h to be computed. centration represen tically terminate i is allowed for all option for solids is number of iterations ed to compute activ output file odel: Diffuse Layer orbing surfaces: 1	ts carbonate f charge imb solids in t set to: 1 is: 200 ity coeffici	e alkalini alance ex he thermo ents is:	ty. ceeds 30% dynamic data Davies equat:	base and
INFOU DATA BEFORE TYPE MODIFICATIONS ID NAME ACTIVITY GUESS LOG GUESS ANAL TOTAL 330 H+1 2.512E-08 -7.600 0.000E-01 30 Al+3 4.786E-06 -5.860 1.900E-01 150 Ca+2 1.288E-04 -3.890 5.200E+00 160 Cd+2 4.677E-09 -8.330 5.300E+04 211 Cr(0H)2+ 2.818E-08 -7.550 2.400E+03 231 Cu+2 3.162E+07 -6.500 2.000E+02 240 Fe+2 5.370E+07 -6.270 3.000E+02 240 Fe+2 5.370E+07 -6.270 3.000E+02 410 K+1 6.607E+05 -4.180 2.599E+00 460 Mg+2 1.445E+04 -3.860 4.800E+00 500 Na+1 2.089E+04 -3.680 4.800E+00 500 Na+1 2.089E+04 -3.680 4.800E+00 500 Na+1 2.089E+04 -3.680 4.800E+00 500 St+2 1.778E+07 -6.510 2.000E+02 950 Zn+2 3.090E+07 -6.510 2.000E+02 950 Zn+2 3.090E+07 -6.510 2.000E+02 950 Zn+2 3.090E+07 -6.510 2.000E+02 1 E-1 1.000E+16 -16.000 0.000E+01 140 CO3-2 2.188E+04 -3.660 1.310E+01 281 Fe+3 1.778E+21 -20.750 0.000E+01 141 ADS1TYP1 1.905E+04 -3.720 1.922E+04 812 ADS1TYP1 1.905E+04 -3.720 1.922E+04 813 ADS1FSIO 1.000E+00 0.0000 0.0000E+01 811 ADS1TYP1 1.905E+04 -3.720 1.922E+04 812 ADS1TYP2 7.762E+03 -2.110 7.690E+03 2 H20 1.000E+00 0.0000 0.0000E+01 145 DOM 3.020E+03 -2.520 3.000E+03 2 H20 1.000E+04 0.0000 0.0000E+01 145 DOM 3.020E+03 -2.5120 3.000E+03 2 H20 1.000E+04 0.0000 0.0000E+01 150 CA+2 4.870E+06 2.512E+08 -7.660107 0.64743 0.189 150 CA+2 4.870E+06 3.153E+06 -5.5113 0.37599 0.425 100 Ba+2 3.219E+08 2.084E+08 -7.66107 0.64743 0.189 150 CA+2 4.870E+06 3.153E+06 -5.5126 0.64743 0.189 150 CA+2 4.870E+05 5.962E+05 -4.26258 0.68701 0						
ID NAME ACTIVITY GUESS LOG GUESS ANAL TOTAL 330 Al+3 4.786E-06 -7.600 0.000E-01 100 Ba+2 1.300E-06 -5.860 1.900E-01 150 Ca+2 1.288E-04 -3.890 5.200E+00 160 Cd+2 4.677E-09 -8.330 5.300E-04 211 Cr(OH)2+ 2.818E-08 -7.550 2.400E-03 231 Cu+2 5.370E-07 -6.500 2.000E-02 240 Fe+2 5.370E-07 -6.270 3.000E-04 410 K+1 2.689E-04 -3.840 3.500E+00 540 Ni+2 1.862E-08 -7.730 1.100E-03 600 Eb+2 1.778E-07 -6.510 2.000E-02 950 Zn+2 3.090E-07 -6.510 2.000E-02 950 Zn+2 3.090E-07 -6.510 2.000E-01 140 CO3-2 2.188E-04 -3.600 1.310E+01 281 Fe+3 1.778E-2	INPUT DATA BEF	ORE TYPE MODIFICATI	ONS			
330 H+1 2.512E-08 -7.600 0.000E-01 300 Ba+2 1.380E-06 -5.320 1.300E-01 150 Ca+2 1.288E-04 -3.890 5.200E+00 160 Cd+2 4.677E-09 -8.330 5.300E-04 211 Cr(0H)2+ 2.818E-08 -7.550 2.400E+03 231 Cu+2 3.162E-07 -6.500 2.000E+02 280 Fe+2 5.370E-07 -6.270 3.000E+02 410 K+1 6.607E+05 -4.180 2.599E+00 460 Mg+2 1.445E+04 -3.840 3.500E+00 540 Ni+2 1.862E+06 -7.730 1.100E+03 600 Pb+2 1.778E+07 -6.510 2.000E+02 950 Zn+2 5.754E+07 -6.510 2.000E+02 960 Sx+2 5.754E+07 -6.510 0.000E+01 140 CO3-2 2.188E+04 -3.660 1.310E+01 281 Fe+3 1.778E+21 -20.750 0.000E+01 813 ADS1FFIO 1.000E+00	ID N	AME ACTIVITY	GUESS LOG	GUESS	ANAL TOTAL	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	330 H+1	2.51	2E-08	-7.600	0.000E-01	
100 Bar2 1.380E-00 -3.690 1.300E-01 150 Cd+2 4.677E-09 -8.330 5.300E-04 211 Cr(OH)2+ 2.818E-08 -7.550 2.400E-03 231 Cu+2 3.162E-07 -6.500 2.000E-02 280 Fe+2 5.370E-07 -6.270 3.000E-02 410 K+1 6.607E-05 -4.180 2.599E+00 460 Mg+2 1.445E-04 -3.680 4.800E+00 540 Ni+2 1.862E-08 -7.730 1.100E-03 600 Pb+2 1.778E-07 -6.750 3.700E-02 800 Sr+2 5.754E-07 -6.240 5.000E-02 950 Zn+2 3.090E-07 -6.510 2.000E-02 1 E-1 1.000E-16 -16.000 0.000E-01 140 CO3-2 2.188E-04 -3.660 1.310E+01 281 Fe+3 1.778E-21 -20.750 0.000E-01 813 ADS1PSTO 1.000E+00 0.000 0.000E-03 145 DOM 3.020E-03	30 AI+3	4.78	6E-06	-5.320	1.300E-01	
160 Cdt 2 4.677E-09 -8.330 5.300E-04 211 Cr (0H) 2+ 2.818E-08 -7.550 2.400E-03 231 Cu+2 3.162E-07 -6.500 2.000E-02 280 Fe+2 5.370E-07 -6.270 3.000E-02 410 K+1 6.607E-05 -4.180 2.599E+00 460 Mg+2 1.445E-04 -3.680 4.800E+00 500 Na+1 2.089E-04 -3.680 4.800E+00 500 Sr+2 5.754E-07 -6.510 2.000E-02 1 E=1 1.000E+16 -16.000 0.000E-01 140 CO3-2 2.188E-04 -3.720 1.922E-04 811 ADS1FYIO 1.762E-03 -2.110 7.692E-03 145 DOM 3.020E-03 <td>100 Ba+2 150 Ca+2</td> <td>1.30</td> <td>8E-04</td> <td>-3.890</td> <td>5,200E+00</td> <td></td>	100 Ba+2 150 Ca+2	1.30	8E-04	-3.890	5,200E+00	
211 Cr (OH) 2+ 2.818E-08 -7.550 2.400E-03 231 Cu+2 3.162E-07 -6.500 2.000E-02 280 Fe+2 5.370E-07 -6.270 3.000E-02 410 K+1 6.607E-05 -4.180 2.599E+00 460 Mg+2 1.445E-04 -3.840 3.500E+00 500 Na+1 2.099E-04 -3.680 4.800E+00 540 Ni+2 1.862E-08 -7.730 1.100E-03 600 Pb+2 1.778E-07 -6.510 2.000E-02 950 Zn+2 3.090E-07 -6.510 2.000E-02 950 Zn+2 3.090E-07 -6.610 2.000E-01 140 C03-2 2.188E-04 -3.720 1.922E-04 813 ADSIPSIO 1.000E+00 0.000 0.000E-01 811 ADSIPSIO 1.000E+03 -2.520 3.000E-03 145 DOM 3.020E-03 -2.520 3.000E-03 145 DOM 3.020E+03 -2.520 3.000E-03 145 DOM 3.020E+01	160 Cd+2	4.67	7E-09	-8.330	5.300E-04	
231 Cu+2 3.162E-07 -6.500 2.000E-02 280 Fe+2 5.370E-07 -6.270 3.000E-02 410 K+1 6.607E-05 -4.180 2.599E+00 460 Mg+2 1.445E-04 -3.680 4.800E+00 500 Na+1 2.099E-04 -3.680 4.800E+00 540 Ni+2 1.862E-08 -7.730 1.100E-03 600 Pb+2 1.778E-07 -6.510 2.000E-02 950 Zn+2 5.754E-07 -6.510 2.000E-02 1 E-1 1.000E-16 -16.000 0.000E-01 140 CO3-2 2.188E-04 -3.660 1.310E+01 281 Fe+3 1.778E-21 -20.750 0.000E-01 813 ADS1TYP1 1.905E-04 -3.720 1.922E-04 812 ADS1TYP2 7.762E-03 -2.110 7.690E-03 145 DOM 3.000E-06 2.512E-08 -7.60000 0.89701 0.047 30	211 Cr(OH)2+ 2.81	8E-08	-7.550	2.400E-03	
280 Fe+2 5.370E-07 -6.270 3.000E-02 410 K+1 6.607E-05 -4.180 2.599E+00 460 Mg+2 1.445E-04 -3.680 4.800E+00 500 Na+1 2.089E-04 -3.680 4.800E+00 540 Ni+2 1.862E-08 -7.730 1.100E-03 600 Pb+2 1.778E-07 -6.240 5.000E-02 950 Zn+2 3.090E-07 -6.510 2.000E-02 950 Zn+2 3.090E-07 -6.510 2.000E-02 950 Zn+2 3.090E-07 -6.600 0.000E-01 140 CO3-2 2.188E-04 -3.660 1.310E+01 281 Fe+3 1.778E-21 -20.750 0.000E-01 813 ADSITYP1 1.905E-04 -3.720 1.922E-04 812 ADSITYP2 7.762E-03 -2.110 7.690E-03 145 DOM 3.00E-02 3.00E-03 2 2 H20 1.000E+00 0.000 0.000E-01 STERENT SIGTONS <t< td=""><td>231 Cu+2</td><td>3.16</td><td>2E-07</td><td>-6.500</td><td>2.000E-02</td><td></td></t<>	231 Cu+2	3.16	2E-07	-6.500	2.000E-02	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	280 Fe+2	5.37	0E-07	-6.270	3.000E-02	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	410 K+1	6.60	7E-05	-4.180	2.599E+00	
	460 Mg+2	1.44	5E-04	-3.840	3.500E+00	
540Ni+21.662E-08-7.7301.100E-03600Pb+21.778E-07-6.7503.700E-02800Sr+25.754E-07-6.2405.000E-02950Zn+23.090E-07-6.5102.000E-021E-11.000E-16-16.0000.000E-01140C03-22.188E-04-3.6601.310E+01281Fe+31.778E-21-20.7500.000E-01813ADS1PSIO1.000E+000.0000.000E-01811ADS1TYP11.905E-04-3.7201.922E-04812ADS1TYP27.762E-03-2.1107.690E-032H201.000E+000.0000.000E-01Charge Balance: UNSPECIATED Sum of CATIONS=Sum of CATIONS=8.438E-04SUT of OUTPUT FILEType I - COMPONENTS AS SPECIES IN SOLUTIONIDNAMECALC MOLACTIVITYLOG ACTVTYGAMMA30Al+12.800E-082.512E-08-7.661070.647430.189150Ca+24.870E-063.153E-06-5.501260.647430.189160Cd+21.368E-128.859E-13-12.02640.647430.189160Cd+21.368E-128.859E-13-12.022640.647430.189211Cr(0H)2+6.870E-106.162E-10-9.210250.897010.047231Cu+22.920E-131.891E-13-12.723420.647430.189240Fe+2 <td>500 Na+1</td> <td>2.08</td> <td>9E-04</td> <td>-3.680</td> <td>4.800E+00</td> <td></td>	500 Na+1	2.08	9E-04	-3.680	4.800E+00	
	540 Ni+2	1.86	2E-08	-7.730	1.100E-03	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	600 Pb+2	1.77	8E-07	-6.750	3.700E-02	
950 $2n+2$ 3.090E-07 -6.510 2.000E-02 1 E-1 1.000E-16 -16.000 0.000E-01 140 C03-2 2.188E-04 -3.660 1.310E+01 281 Fe+3 1.778E-21 -20.750 0.000E-01 813 ADS1PSIO 1.000E+00 0.000 0.000E-01 811 ADS1TYP1 1.905E-04 -3.720 1.922E-04 812 ADS1TYP2 7.762E-03 -2.110 7.690E-03 145 DOM 3.020E-03 -2.520 3.000E-03 2 H2O 1.000E+00 0.000 0.000E-01 Charge Balance: UNSPECIATED Sum of CATIONS= 8.438E-04 Sum of ANIONS = 8.837E-03 PERCENT DIFFERENCE = 8.257E+01 (ANIONS - CATIONS) (ANIONS + CATIONS)	800 Sr+2	5.75	4E - 07	-6.240	5.000E-02	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	950 Zn+2	3.09	0E-07	-6.510	2.000E-02	
140 C03-2 2.188E-04 -3.660 1.310E+01 281 Fe+3 1.778E-21 -20.750 0.000E-01 813 ADS1PSIO 1.000E+00 0.000 0.000E-01 811 ADS1TYP1 1.905E-04 -3.720 1.922E-04 812 ADS1TYP2 7.762E-03 -2.110 7.690E-03 145 DOM 3.020E-03 -2.520 3.000E-03 2 H2O 1.000E+00 0.000 0.000E-01 Charge Balance: UNSPECIATED Sum of CATIONS= 8.438E-04 Sum of ANIONS = 8.837E-03 PERCENT DIFFERENCE = 8.257E+01 (ANIONS - CATIONS) / (ANIONS + CATIONS) PART 3 of OUTPUT FILE Type I - COMPONENTS AS SPECIES IN SOLUTION ID NAME CALC MOL ACTIVITY LOG ACTVTY GAMMA NEW LOGK 330 H+1 2.800E-08 2.512E-08 -7.60107 0.64743 0.189 100 Ba+2 3.219E-08 2.084E-08 -7.68107 0.64743 0.189 160 Cd+2 1.368E-12 8.859E-13		1.00	0E-16	-16.000	0.000E-01	
281 Perso 1.776E=21 -2.0750 0.000E=01 813 ADS1PSIO 1.000E+00 0.000 0.000E=01 811 ADS1TYP1 1.905E=04 -3.720 1.922E=04 812 ADS1TYP2 7.762E=03 -2.110 7.690E=03 145 DOM 3.020E=03 -2.520 3.000E=03 2 H2O 1.000E+00 0.000 0.000E=01 Charge Balance: UNSPECIATED Sum of CATIONS= 8.438E=04 Sum of ANIONS = 8.837E=03 PERCENT DIFFERENCE = PART 3 of OUTPUT FILE Type I - COMPONENTS AS SPECIES IN SOLUTION ID NAME CALC MOL ACTIVITY LOG ACTVTY GAMMA NEW LOGK 330 Alt3 7.074E=16 2.660E=16 -15.57513 0.37599 0.425 100 Ba+2 3.219E=08 2.084E=08 -7.68107 0.64743 0.189 160 Cd+2 1.368E=12 8.859E=13 -12.05264 0.64743 0.189	140 CO3-2	2.18	8E-04	-3.660	1.310E+01	
811 ADSIFYPD 1.000E-04 -3.720 1.922E-04 812 ADSITYP1 1.900E-03 -2.110 7.690E-03 145 DOM 3.020E-03 -2.520 3.000E-03 2 H20 1.000E+00 0.000 0.000E-01 Charge Balance: UNSPECIATED Sum of CATIONS= 8.438E-04 Sum of ANIONS = 8.837E-03 PERCENT DIFFERENCE = 8.257E+01 (ANIONS - CATIONS) / (ANIONS + CATIONS) DART 3 of OUTPUT FILE Type I - COMPONENTS AS SPECIES IN SOLUTION ID NAME CALC MOL ACTIVITY LOG ACTVTY GAMMA NEW LOGK 330 H+1 2.800E-08 2.512E-08 -7.60000 0.89701 0.047 30 AL+3 7.074E-16 2.660E-16 -15.57513 0.37599 0.425 100 Ba+2 3.219E-08 2.084E-08 -7.68107 0.64743 0.189 150 Ca+2 4.870E-06 3.153E-06 -5.50126 0.64743 0.189 160 Cd+2 1.368E-12 8.859E-13 -12	201 re+3 813 ADS1D	1.77	05-21	-20.750	0.000E-01	
812 ADSITYP2 7.762E-03 -2.110 7.690E-03 145 DOM 3.020E-03 -2.520 3.000E-03 2 H2O 1.000E+00 0.000 0.000E-01 Charge Balance: UNSPECIATED Sum of CATIONS= 8.438E-04 Sum of ANIONS = 8.837E-03 PERCENT DIFFERENCE = PART 3 of OUTPUT FILE Type I - COMPONENTS AS SPECIES IN SOLUTION ID NAME CALC MOL ACTIVITY LOG ACTVTY GAMMA NEW LOGK 330 H+1 2.800E-08 2.512E-08 -7.60000 0.89701 0.047 30 Al+3 7.074E-16 2.660E-16 -15.57513 0.37599 0.425 100 Ba+2 3.219E-08 2.084E-08 -7.68107 0.64743 0.189 150 Ca+2 4.870E-06 3.153E-06 -5.50126 0.64743 0.189 160 Cd+2 1.368E-12 8.859E-13 -12.05264 0.64743 0.189 211 Cr(OH)2+ 6.870E-10 -9.21025 0.89701 0.	811 ADS17	YP1 1.90	5E-04	-3.720	1.922E-04	
145DOM $3.020E-03$ -2.520 $3.000E-03$ 2H2O $1.000E+00$ 0.000 $0.000E-01$ Charge Balance: UNSPECIATED Sum of CATIONS=SUM of CATIONS= $8.438E-04$ PART 3 of OUTPUT FILEType I - COMPONENTS AS SPECIES IN SOLUTIONIDNAMECALC MOLACTIVITYLOG ACTVTYGAMMANEW LOGK330H+1 $2.800E-08$ $2.512E-08$ -7.60000 0.89701 0.047 30Al+3 $7.074E-16$ $2.660E-16$ -15.57513 0.37599 0.425 100Ba+2 $3.219E-08$ $2.084E-08$ -7.68107 0.64743 0.189 150Ca+2 $4.870E-06$ $3.153E-06$ -5.50126 0.64743 0.189 160Cd+2 $1.368E-12$ $8.59E-13$ -12.05264 0.64743 0.189 211Cr(OH)2+ $6.870E-10$ $6.162E-10$ -9.21025 0.89701 0.047 230Fe+2 $1.957E-25$ $1.267E-25$ -24.89733 0.64743 0.189 240K+1 $6.647E-05$ $5.962E-05$ -4.22458 0.89701 0.047 400K+1 $6.647E-05$ $2.692E-05$ -4.56986 0.64743 0.189 500Na+1 $2.088E-04$ $1.873E-04$ -3.72752 0.89701 0.047	812 ADS1T	YP2 7.76	2E-03	-2.110	7.690E-03	
2 H20 1.000E+00 0.000 0.000E-01 Charge Balance: UNSPECIATED Sum of CATIONS= 8.438E-04 Sum of ANIONS = 8.837E-03 PERCENT DIFFERENCE = 8.257E+01 (ANIONS - CATIONS)/(ANIONS + CATIONS) PART 3 of OUTPUT FILE Type I - COMPONENTS AS SPECIES IN SOLUTION ID NAME CALC MOL ACTIVITY LOG ACTVTY GAMMA NEW LOGK 330 H+1 2.800E-08 2.512E-08 -7.60000 0.89701 0.047 30 Al+3 7.074E-16 2.660E-16 -15.57513 0.37599 0.425 100 Ba+2 3.219E-08 2.084E-08 -7.68107 0.64743 0.189 150 Ca+2 4.870E-06 3.153E-06 -5.50126 0.64743 0.189 160 Cd+2 1.368E-12 8.859E-13 -12.05264 0.64743 0.189 211 Cr(OH)2+ 6.870E-10 6.162E-10 -9.21025 0.89701 0.047 231 Cu+2 2.920E-13 1.891E-13 -12.72342 0.64743 0.189 280 Fe+2 1.957E-25 1.267E-25 -24.89733 0.64743 0.189 240 K+1 6.647E-05 5.962E-05 -4.22458<	145 DOM	3.02	0E-03	-2.520	3.000E-03	
Charge Balance: UNSPECIATED Sum of CATIONS= 8.438E-04 Sum of ANIONS = 8.837E-03 PERCENT DIFFERENCE = 8.257E+01 (ANIONS - CATIONS)/(ANIONS + CATIONS) PART 3 of OUTPUT FILE Type I - COMPONENTS AS SPECIES IN SOLUTION ID NAME CALC MOL ACTIVITY LOG ACTVTY GAMMA NEW LOGK 330 H+1 2.800E-08 2.512E-08 -7.60000 0.89701 0.047 30 Al+3 7.074E-16 2.660E-16 -15.57513 0.37599 0.425 100 Ba+2 3.219E-08 2.084E-08 -7.68107 0.64743 0.189 150 Ca+2 4.870E-06 3.153E-06 -5.50126 0.64743 0.189 160 Cd+2 1.368E-12 8.859E-13 -12.05264 0.64743 0.189 211 Cr(OH)2+ 6.870E-10 6.162E-10 -9.21025 0.89701 0.047 231 Cu+2 2.920E-13 1.891E-13 -12.72342 0.64743 0.189 280 Fe+2 1.957E-25 1.267E-25 -24.89733 0.64743 0.189 410 K+1 6.647E-05 5.962E-05 -4.22458 0.89701 0.047 460 Mg+2 4.159E-05 2.692E-05 -4.56986 0.64743 0.189 500 Na+1 2.088E-04 1.873E-04 -3.72752 0.89701 0.047	2 H2O	1.00	0E+00	0.000	0.000E-01	
PART 3 of OUTPUT FILE Type I - COMPONENTS AS SPECIES IN SOLUTION ID NAME CALC MOL ACTIVITY LOG ACTVTY GAMMA NEW LOGK 330 H+1 2.800E-08 2.512E-08 -7.60000 0.89701 0.047 30 Al+3 7.074E-16 2.660E-16 -15.57513 0.37599 0.425 100 Ba+2 3.219E-08 2.084E-08 -7.68107 0.64743 0.189 150 Ca+2 4.870E-06 3.153E-06 -5.50126 0.64743 0.189 160 Cd+2 1.368E-12 8.859E-13 -12.05264 0.64743 0.189 211 Cr(OH)2+ 6.870E-10 6.162E-10 -9.21025 0.89701 0.047 231 Cu+2 2.920E-13 1.891E-13 -12.72342 0.64743 0.189 280 Fe+2 1.957E-25 1.267E-25 -24.89733 0.64743 0.189 410 K+1 6.647E-05 5.962E-05 -4.22458 0.89701 0.047 460 Mg+2 4.159E-05 2.692E-05 -4.56986 0.64743 0.189 500 Na+1 2.088E-04 1.873E-04 -3.72752 0.89701 0.047	Charge Ba Sum of PERCENT	lance: UNSPECIATED CATIONS= 8.438E-04 DIFFERENCE = 8.25	Sum of ANIO 7E+01 (ANIO	NS = 8.8 NS - CATI	37E-03 ONS)/(ANIONS	+ CATIONS)
Type I - COMPONENTS AS SPECIES IN SOLUTIONIDNAMECALC MOLACTIVITYLOG ACTVTYGAMMANEW LOGK330H+12.800E-082.512E-08-7.600000.897010.04730Al+37.074E-162.660E-16-15.575130.375990.425100Ba+23.219E-082.084E-08-7.681070.647430.189150Ca+24.870E-063.153E-06-5.501260.647430.189160Cd+21.368E-128.859E-13-12.052640.647430.189211Cr(OH)2+6.870E-106.162E-10-9.210250.897010.047231Cu+22.920E-131.891E-13-12.723420.647430.189280Fe+21.957E-251.267E-25-24.897330.647430.189410K+16.647E-055.962E-05-4.224580.897010.047460Mg+24.159E-052.692E-05-4.569860.647430.189500Na+12.088E-041.873E-04-3.727520.897010.047		PAR	T 3 of OUTPU	T FILE		
IDNAMECALC MOLACTIVITYLOG ACTVTYGAMMANEW LOGK330H+12.800E-082.512E-08-7.600000.897010.04730A1+37.074E-162.660E-16-15.575130.375990.425100Ba+23.219E-082.084E-08-7.681070.647430.189150Ca+24.870E-063.153E-06-5.501260.647430.189160Cd+21.368E-128.859E-13-12.052640.647430.189211Cr(OH)2+6.870E-106.162E-10-9.210250.897010.047231Cu+22.920E-131.891E-13-12.723420.647430.189280Fe+21.957E-251.267E-25-24.897330.647430.189410K+16.647E-055.962E-05-4.224580.897010.047460Mg+24.159E-052.692E-05-4.569860.647430.189500Na+12.088E-041.873E-04-3.727520.897010.047	Туре I - СОМРО	NENTS AS SPECIES IN	SOLUTION			
330 H+1 2.800E-08 2.512E-08 -7.60000 0.89701 0.047 30 Al+3 7.074E-16 2.660E-16 -15.57513 0.37599 0.425 100 Ba+2 3.219E-08 2.084E-08 -7.68107 0.64743 0.189 150 Ca+2 4.870E-06 3.153E-06 -5.50126 0.64743 0.189 160 Cd+2 1.368E-12 8.859E-13 -12.05264 0.64743 0.189 211 Cr(OH)2+ 6.870E-10 6.162E-10 -9.21025 0.89701 0.047 231 Cu+2 2.920E-13 1.891E-13 -12.72342 0.64743 0.189 280 Fe+2 1.957E-25 1.267E-25 -24.89733 0.64743 0.189 410 K+1 6.647E-05 5.962E-05 -4.22458 0.89701 0.047 460 Mg+2 4.159E-05 2.692E-05 -4.56986 0.64743 0.189 500 Na+1 2.088E-04 1.873E-04 -3.72752 0.89701 0.047	ID N	AME CALC MOL	ACTIVITY	LOG ACTV	TY GAMMA	NEW LOGK
30A1+37.074E-162.660E-16-15.575130.375990.425100Ba+23.219E-082.084E-08-7.681070.647430.189150Ca+24.870E-063.153E-06-5.501260.647430.189160Cd+21.368E-128.859E-13-12.052640.647430.189211Cr(OH)2+6.870E-106.162E-10-9.210250.897010.047231Cu+22.920E-131.891E-13-12.723420.647430.189280Fe+21.957E-251.267E-25-24.897330.647430.189410K+16.647E-055.962E-05-4.224580.897010.047460Mg+24.159E-052.692E-05-4.569860.647430.189500Na+12.088E-041.873E-04-3.727520.897010.047	330 H+1	2.800E-08	2.512E-08	-7.600	00 0.89701	0.047
100Ba+23.219E-082.084E-08-7.681070.647430.189150Ca+24.870E-063.153E-06-5.501260.647430.189160Cd+21.368E-128.859E-13-12.052640.647430.189211Cr(OH)2+6.870E-106.162E-10-9.210250.897010.047231Cu+22.920E-131.891E-13-12.723420.647430.189280Fe+21.957E-251.267E-25-24.897330.647430.189410K+16.647E-055.962E-05-4.224580.897010.047460Mg+24.159E-052.692E-05-4.569860.647430.189500Na+12.088E-041.873E-04-3.727520.897010.047	30 A1+3	7.074E-16	2.660E-16	-15.575	13 0.37599	0.425
150Ca+24.876E-065.155E-06-5.501260.647430.189160Cd+21.368E-128.859E-13-12.052640.647430.189211Cr(OH)2+6.870E-106.162E-10-9.210250.897010.047231Cu+22.920E-131.891E-13-12.723420.647430.189280Fe+21.957E-251.267E-25-24.897330.647430.189410K+16.647E-055.962E-05-4.224580.897010.047460Mg+24.159E-052.692E-05-4.569860.647430.189500Na+12.088E-041.873E-04-3.727520.897010.047	150 Ca+2	3.219E-08	2.084E-08	-/.681	0.64743	0.189
100Cut21.300E-120.0332E-13-12.032640.047430.189211Cr(OH)2+6.870E-106.162E-10-9.210250.897010.047231Cut22.920E-131.891E-13-12.723420.647430.189280Fe+21.957E-251.267E-25-24.897330.647430.189410K+16.647E-055.962E-05-4.224580.897010.047460Mg+24.159E-052.692E-05-4.569860.647430.189500Na+12.088E-041.873E-04-3.727520.897010.047	160 Cd+2	4.0/UE-00 1.260E-12	8 850F-12	-3.501	61 0 61713	0.109
231Cu+22.920E-131.891E-13-12.723420.647430.189280Fe+21.957E-251.267E-25-24.897330.647430.189410K+16.647E-055.962E-05-4.224580.897010.047460Mg+24.159E-052.692E-05-4.569860.647430.189500Na+12.088E-041.873E-04-3.727520.897010.047	211 Cr(OH)2+ 6 870E-12	6 162E-10	-12.032	25 0 89701	0.109
280Fe+21.957E-251.267E-25-24.897330.647430.189410K+16.647E-055.962E-05-4.224580.897010.047460Mg+24.159E-052.692E-05-4.569860.647430.189500Na+12.088E-041.873E-04-3.727520.897010.047	231 Cu+2	2.920E-13	1.891E - 13	-12 723	42 0 64743	0 189
410K+16.647E-055.962E-05-4.224580.897010.047460Mg+24.159E-052.692E-05-4.569860.647430.189500Na+12.088E-041.873E-04-3.727520.897010.047	280 Fe+2	1.957E-25	1.267E-25	-24.897	33 0.64743	0 189
460 Mg+24.159E-052.692E-05-4.569860.647430.189500 Na+12.088E-041.873E-04-3.727520.897010.047	410 K+1	6.647E-05	5.962E-05	-4.224	58 0.89701	0.047
500 Na+1 2.088E-04 1.873E-04 -3.72752 0.89701 0.047	460 Ma+2	4.159E-05	2.692E-05	-4.569	86 0.64743	0.189
	500 Na+1	2.088E-04	1.873E-04	-3.727	52 0.89701	0.047

540	Ni+2	9.525E-12	6.167E-12	-11.20994	0.64743	0.189
600	Ph+2	2 819E-15	1 825E - 15	-14 73876	0.64743	0.189
000	1012	C 7070 07	2.0000 07	C 42242	0 61712	0 100
800	Sr+Z	5.707E-07	3.695E-07	-6.43243	0.64743	0.189
950	Zn+2	2.523E-11	1.633E-11	-10.78696	0.64743	0.189
812	ADS1TYP2	5.899E-03	5.899E-03	-2.22926	1.00000	0.000
140	CO2 2	1 0025 07	2 2225-07	-6 10010	0 61713	0 100
140	005-2	4.9956-07	J.ZJZE-07	-0.49040	0.04745	0.105
281	Fe+3	6.937E-25	2.608E-25	-24.58367	0.37599	0.425
145	DOM	2.765E-03	1.179E-03	-2.92841	0.42651	0.370
811	ADS1TYP1	1 432E-04	1 432E - 04	-3 84412	1 00000	0 000
011		1.1526 01	1.1526 01			
Type II	- OTHER SPECIE	S IN SOLUTI	ON OR ADSOR	BED		
TD	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
0121000	-002Pal	2 1105-11	2 1105-11	-10 16232	1 00000	-7 200
0121000	-502Ba+	5.4496-11	5.4496-11	10.40252	1.00000	7.200
2113302	Cr(OH) 3 AQ	1.814E-09	1.819E-09	-8.74025	1.00260	-7.131
2113303	Cr(OH)4-	7.708E-13	6.914E-13	-12.16026	0.89701	-18.103
2113304	Cr02-	1.956E - 12	1.755E - 12	-11.75585	0.89701	-17.698
1452300	H DOM	1 1025-05	9 310E-06	-5 08042	0 70318	1 023
1455500	H DOM	1.1026-00	0.JIUE-00	-5.00042	0.70510	4.025
1450300	AL DOM	1.889E - 12	1.881E-12	-11.72555	0.99566	5.202
1451000	Ba DOM	1.255E-06	1.171E-06	-5.93149	0.93280	3.130
1451500	Ca DOM	1.198E-04	1.118E - 04	-3.95168	0.93280	2.930
1451600	CH DOM	0 456E 11	7 0000 11	10 10206	0 03300	3 330
1451600	Ca DOM	0.430E-11	7.000E-11	-10.10300	0.95200	3.330
1452110	Cr DOM	2.892E-11	2.880E-11	-10.54067	0.99566	15.222
1452310	Cu DOM	7.184E-10	6.701E-10	-9.17384	0.93280	4.930
1452810	Fe DOM	5.859E-19	5.833E-19	-18,23409	0.99566	7.702
1454600	IC DOM	1 0000 01	0 5445 05	1 00000	0.02200	1 020
1454600	Mg DOM	1.023E-04	9.544E-05	-4.02028	0.93280	1.930
1455400	Ni DOM	5.886E-10	5.491E-10	-9.26037	0.93280	3.330
1456000	Pb DOM	1.384E-11	1.291E-11	-10.88918	0.93280	5.230
1459500	ZD DOM	2 471E - 09	2 305E-09	-8 63738	0 93280	3 530
2200020	OIL OIL	2.9740 07	2.5056 05	C. E00CE	0.00701	14 141
3300020	OH-	2.8/4E-0/	2.5/8E-0/	-6.58865	0.89701	-14.141
4603300	MgOH +	1.184E-09	1.062E-09	-8.97390	0.89701	-11.957
4601400	MgCO3 AO	7.590E-09	7.610E-09	-8.11863	1.00260	2.941
4601401	MaHCO3 +	6 634E-08	5 950E-08	-7 22545	0.89701	11 482
1001101	Geoli I	0.0010 00	1.0000 11	10 70 01	0.00701	10 750
1503300	CaOH +	2.189E-11	1.964E-11	-10.70691	0.89701	-12.758
1501400	CaHCO3 +	6.010E-09	5.391E-09	-8.26834	0.89701	11.371
1501401	CaCO3 AQ	1.284E-09	1.287E-09	-8.89038	1.00260	3.100
5001400	NaCO3 -	9 330E-10	8 369E-10	-9 07730	0 89701	1 188
5001401	Nauco2 Do	1 0000 10	1 0205 00	7 72000	1 00260	10 070
5001401	Nancos AQ	1.0236-00	1.020E-00	-7.75000	1.00200	10.079
303300	AIOH +2	1.132E-13	7.326E-14	-13.13512	0.64/43	-4.971
303301	Al(OH)2 +	3.733E-11	3.349E-11	-10.47514	0.89701	-10.053
303302	A1 (OH) 4 -	1.748E - 09	1.568E-09	-8,80458	0.89701	-23.582
303303	A1 (04) 2 A0	1 6745-00	1 6795-00	_0 77515	1 00260	-16 001
303303	AI (UH)S AQ	1.0746-09	1.0706-09	-0.77515	1.00200	-10.001
2803300	FeOH +	1.152E-27	1.033E-27	-26.98589	0.89/01	-9.641
2803301	FeOH3 -1	3.288E-34	2.950E-34	-33.53021	0.89701	-31.386
2803302	FeOH2 AO	2.106E-31	2.111E-31	-30.67542	1.00260	-20.979
2813300	FOOH +2	7 355F-20	4 762F-20	-19 32223	0 64743	-2 150
2010000	F OHO	7.5555 20	9.0020 20	15.05260	0.00701	2.100
2813301	FeOH2 +	9.852E-16	8.83/E-16	-15.05368	0.89701	-5.623
2813302	FeOH3 AQ	4.123E-16	4.133E-16	-15.38369	1.00260	-13.601
2813303	FeOH4 -	1.834E-16	1.646E-16	-15.78369	0.89701	-21.553
2813304	Fe2(0H)2+4	A A16E-37	7 759F-38	-37 11021	0 17570	-2 388
2013304	rez (OII) 2+4	4.4106-57	1.7596-50	10.05501	0.17570	-2.500
2813305	Fe3 (OH) 4+5	2.112E-49	1.395E-50	-49.85531	0.06606	-5.324
8003300	SrOH +	6.756E-13	6.060E-13	-12.21751	0.89701	-13.338
1003300	BaOH +	2.469E-14	2.215E-14	-13.65472	0.89701	-13.526
2311400	CUCO3 AO	3 2738-13	3 2828-13	-12 48389	1 00260	6 729
2011400	CUCCO NO	0.0000 10	1.2020 10	12.40505	1.00200	10.010
2311401	Cu (CO3) 2-2	2.063E-16	1.335E-16	-15.8/43/	0.64/43	10.019
2313300	CuOH +	8.390E-14	7.526E-14	-13.12342	0.89701	-7.953
2313301	Cu(OH)2 AO	6.244E-12	6.260E-12	-11.20343	1.00260	-13.681
2313302	Cu (OH) 3 -	1.678E-17	1.505E-17	-16 82244	0.89701	-26 852
2212202		1 0/00 10	1 1020 00	21 02244	0 64742	20.002
2313303	Cu(On)4 -2	1.0426-22	1.1936-22	-21.92344	0.04/43	-39.411
2313304	Cu2 (OH) 2+2	2.152E-21	1.393E-21	-20.85591	0.64743	-10.420
2311402	CuHCO3 +	1.711E-14	1.535E-14	-13.81390	0.89701	13.047
9503300	ZnOH +	5.115E-13	4.588E-13	-12.33838	0.89701	-9 104
9503301	7n(0H)2 no	3 2505 12	3 2665 12	-12 10507	1 00260	-16 000
JJJJJJJJJJ	ALL (OIL) 2 HU	J.2JOE-13	J.200E-13	-12.40391	1.00200	-10.900
9503302	Zn(OH)3 -	4.584E-17	4.112E-17	-16.38598	0.89701	-28.352
9503303	Zn(OH)4 -2	4.007E-22	2.594E-22	-21.58599	0.64743	-41.010

9501400	ZnHCO3 +	3.713E-13	3.331E-13	-12.47744	0.89701	12.447
9501401	ZnCO3 AQ	1.051E-12	1.053E-12	-11.97744	1.00260	5.299
9501402	Zn(CO3)2-2	1.124E-14	7.279E-15	-14.13791	0.64743	9.819
1601400	Cd(CO3)3-4	2.826E-25	4.965E-26	-25.30407	0.17570	6.975
1603300	CdOH +	2.125E-15	1.906E-15	-14.71979	0.89701	-10.220
1603301	Cd(OH)2 AQ	6.255E-18	6.271E-18	-17.20265	1.00260	-20.351
1603302	Cd(OH)3 -	3.123E-23	2.801E-23	-22.55266	0.89701	-33.253
1603303	Cd(OH)4 -2	1.535E-29	9.939E-30	-29.00266	0.64743	-47.161
1603304	Cd2OH +3	2.365E-26	8.892E-27	-26.05098	0.37599	-9.121
1601400	CdHCO3 +	2.014E-14	1.807E-14	-13.74311	0.89701	12.447
1601401	CdCO3 AQ	7.157E-14	7.176E-14	-13,14411	1.00260	5.398
6001400	Pb(CO3)2-2	1.286E-17	8.323E-18	-17.07971	0.64743	10.829
6003300	PbOH +	1.579E-15	1.417E-15	-14.84877	0.89701	-7.663
6003301	Pb(OH)2 AQ	2.188E-17	2.194E-17	-16.65877	1.00260	-17.121
6003302	Pb(OH)3 -	1.118E-20	1.003E-20	-19.99878	0.89701	-28.013
6003303	Pb20H +3	1.539E-28	5.787E-29	-28.23752	0.37599	-5.935
6003304	Pb3 (OH) 4+2	1.300E-38	8.416E-39	-38.07488	0.64743	-24.070
6001401	PbCO3 AO	1.022E-14	1.025E-14	-13.98924	1.00260	7.239
6003305	Pb(OH)4 -2	1.416E-24	9.167E-25	-24.03779	0.64743	-39.510
6001402	PbHCO3 +	2.618E-16	2.348E-16	-15.62924	0.89701	13.247
5403300	NIOH +	2.511E-14	2.252E-14	-13.64738	0.89701	-9.990
5403301	Ni(OH)2 AQ	9.748E-16	9.773E-16	-15.00996	1.00260	-19.001
5403302	Ni(OH)3 -	4.337E-19	3.891E-19	-18.40996	0.89701	-29.953
5401400	NiHCO3 +	1.647E-13	1.478E-13	-12.83042	0.89701	12.517
5401401	NiCO3 AQ	1.474E-11	1.478E-11	-10.83042	1.00260	6.869
5401402	Ni(CO3)2-2	1.282E-14	8.300E-15	-14.08090	0.64743	10.299
3301400	нсоз –	2.190E-04	1.964E-04	-3.70680	0.89701	10.431
3301401	H2CO3 AQ	1.051E-05	1.053E-05	-4.97738	1.00260	16.712
2113300	Cr+3	8.362E-15	3.144E-15	-14.50252	0.37599	10.333
2113301	Cr(OH) + 2	9.967E-12	6.453E-12	-11.19024	0.64743	5.809
8123301	=S02-	8.255E-04	8.255E-04	-3.08326	1.00000	-8.930
8123302	=SO2H2+	9.655E-04	9.655E-04	-3.01525	1.00000	7.290
8113301	=S01-	2.004E-05	2.004E-05	-4.69813	1.00000	-8.930
8113302	=SO1H2+	2.344E-05	2.344E-05	-4.63012	1.00000	7.290
8129500	=SO2Zn+	1.312E-08	1.312E-08	-7.88222	1.00000	-1.990
8119500	=SO1Zn+	2.903E-07	2.903E-07	-6.53708	1.00000	0.970
8121600	=SO2Cd+	8.752E-11	8.752E-11	-10.05789	1.00000	-2.900
8111600	=SO1Cd+	4.542E-09	4.542E-09	-8.34276	1.00000	0.430
8112310	=SO1Cu+	2.550E-07	2.550E-07	-6.59354	1.00000	2.850
8122310	=SO2Cu+	5.906E-08	5.906E-08	-7.22867	1.00000	0.600
8115400	=SO1Ni+	1.659E-08	1.659E-08	-7.78007	1.00000	0.150
8125400	=SO2Ni+	1.530E-09	1.530E-09	-8.81520	1.00000	-2.500
8116000	=SO1Pb+	1.783E-07	1.783E-07	-6.74888	1.00000	4.710
8126000	=SO2Pb+	2.857E-10	2.857E-10	-9.54402	1.00000	0.300
8121500	=SO2Ca+	3.495E-07	3.495E-07	-6.45651	1.00000	-5.850
8111500	=SO1HCa++	4.706E-06	4.706E-06	-5.32737	1.00000	4.970
8111000	=SO1HBa++	9.612E-08	9.612E-08	-7.01718	1.00000	5.460
Type II	I - SPECIES W	ITH FIXED ACT	IVITY			
ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH	
2	H20	-2.306E-05	-4.637	0.000	0.000	
330	H+1	-3.547E-04	-3.450	7.600	0.000	
3301403	CO2 (g)	2.163E-04	-3.665	21.690	-0.530	
3300021	02 (g)	1.139E-04	-3.944	-84.354	133.830	
2802810	Fe+2/Fe+3	-5.372E-07	-6.270	13.175	-10.000	
Type IV	- FINITE SOL	IDS (present	at equilibriu	am)		
ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH	
3028100	HEMATITE	2.686E-07	-6.571	3.567	30.845	
2003002	DIASPORE	4.815E-06	-5.317	-7.225	24.630	
3021102	CR203	1.268E-08	-7.897	3.220	12.125	

		Pi	ART 4 (of (OUTPUT FI	LE	
	PERCEN	TAGE DIST	RIBUTI	ON (OF COMPON	NENTS AMONG	;
	TYPE I ar	nd TYPE II	(disso	olve	ed and ad	dsorbed) sp	ecies
ADS1TYP1							
	74.5	PERCENT	BOUND	IN	SPECIES	# 811	ADS1TYP1
	10.4	PERCENT	BOUND	IN	SPECIES	#8113301	=S01-
	12.2	PERCENT	BOUND	TN	SPECIES	#8113302	=S01H2+
	2 4	PERCENT	BOUND	TN	SPECIES	#8111500	=SO1HCa++
ADG1TVD2	2.1	LEROBHI	DOUND		0110110	10111000	Dottiou
ADDITIEZ	76 7	DEDCENT	POLIND	TN	ODECTES	# 012	ADC1TVD2
	10.7	PERCENT	DOUND	TN	SPECIES	# 012	ADDITITZ
	10.7	PERCENT	BOUND	IN	SPECIES	#0123301	-302-
	12.6	PERCENT	ROOND	IN	SPECIES	#8123302	=SOZHZ+
Ba+2							
	2.3	PERCENT	BOUND	IN	SPECIES	# 100	Ba+2
	90.7	PERCENT	BOUND	IN	SPECIES	#1451000	Ba DOM
	6.9	PERCENT	BOUND	IN	SPECIES	#8111000	=SO1HBa++
Ca+2							
	3.8	PERCENT	BOUND	IN	SPECIES	# 150	Ca+2
	92.3	PERCENT	BOUND	IN	SPECIES	#1451500	Ca DOM
	3.6	PERCENT	BOUND	IN	SPECIES	#8111500	=SO1HCa++
Cd+2							
	1.8	PERCENT	BOUND	IN	SPECIES	#1451600	Cd DOM
	1.9	PERCENT	BOUND	TN	SPECTES	#8121600	=SO2Cd+
	96.3	PERCENT	BOUND	TN	SPECIES	#8111600	=S01Cd+
ADG1 DGTO	20.5	I DICODIAL	DOOND	7 14	DITICITO	#0111000	borca
VDOTIDIO	626 5	DEDCENT	POUND	TN	ODECTES	#0123302	-90242+
	15 2	PERCENT	BOUND	TN	SPECIES	#0123302	-502112+
	15.2	PERCENT	BOUND	IN	SPECIES	#8113302	=501H2+
-	6.1	PERCENT	BOOND	IN	SPECIES	#8111500	=SOINCa++
Cu+2	01 0	555 451 M	E OTHER			10110010	0010
	81.0	PERCENT	ROOND	IN	SPECIES	#8112310	=SOICu+
	18.8	PERCENT	BOUND	IN	SPECIES	#8122310	=SO2Cu+
DOM							
	92.2	PERCENT	BOUND	IN	SPECIES	# 145	DOM
	4.0	PERCENT	BOUND	IN	SPECIES	#1451500	Ca DOM
	3.4	PERCENT	BOUND	IN	SPECIES	#1454600	Mg DOM
K+1							
	100.0	PERCENT	BOUND	IN	SPECIES	# 410	K+1
Mg+2							
	28.9	PERCENT	BOUND	IN	SPECIES	# 460	Mg+2
	71.1	PERCENT	BOUND	IN	SPECIES	#1454600	Mg DOM
Na+1							
	100.0	PERCENT	BOUND	IN	SPECIES	# 500	Na+1
Ni+2							
	3.1	PERCENT	BOUND	IN	SPECIES	#1455400	Ni DOM
	88 6	PERCENT	BOUND	TN	SPECIES	#8115400	=SO1Ni+
	8 2	PERCENT	BOUND	TN	SPECIES	#8125400	=SO2Ni+
Ph+2	0.2	I DITODITI	DOOLD	714	0110110	10120100	DOLITI
EDTZ	00 0	DEDCENT	DOUND	TN	ODECTES	#0116000	-CO1Db+
Cm12	99.0	PERCENT	BOUND	TIN	SLECTES	#0110000	-SOIPD+
SI+Z	100 0	DDDODNE	DOUND	TAT	ODDOTTO		0
5 . 0	100.0	PERCENT	BOUND	IN	SPECIES	# 800	Sr+2
Zn+2							
	4.3	PERCENT	BOUND	IN	SPECIES	#8129500	=SO2Zn+
	94.9	PERCENT	BOUND	IN	SPECIES	#8119500	=SO1Zn+
Cr(OH)2+							
	27.0	PERCENT	BOUND	IN	SPECIES	# 211	Cr(OH)2+
	71.3	PERCENT	BOUND	IN	SPECIES	#2113302	Cr(OH) 3 AQ
	1.1	PERCENT	BOUND	IN	SPECIES	#1452110	Cr DOM
A1+3							
	1.1	PERCENT	BOUND	IN	SPECIES	# 303301	Al(OH)2 +
	50.5	PERCENT	BOUND	IN	SPECIES	# 303302	Al (OH) 4 -
	48.4	PERCENT	BOUND	TN	SPECIES	# 303303	A1 (OH) 3 AO
CO3-2			200110	1			(/ ×
	95 2	PERCENT	BOUND	TN	SPECTES	#3301400	HCO3 -
	1 6	DEDCENT	BOUND	TN	SPECTES	#3301/01	H2CO3 A0
	4.0	EBRCENT	DOOND	TIA	SLECIES	#3301401	MZCOD AV

		99.4	PERCENT	BOUND	IN	SPECIES	# 280	Fe+2	
E-1									
Fe+3									
		62.3	PERCENT	BOUND	IN	SPECIES	#2813301	FeOH2 +	
		26.1	PERCENT	BOUND	TN	SPECIES	#2813302	FeOH3 AO	
		11 6	PERCENT	BOUND	TN	SPECIES	#2813303	FeOH4 -	
H+1		11.0	L DI(ODIAL	DOOND	T 14	DIHCIHO	#2010000	LCOILI	
11 1 1		3 0	DEDCENT	POIND	TN	CDECTES	#1453300	H DOM	
		5.0	DEDCENT	DOUND	TN	SPECIES	#1455500	H DOM	
		55.6	PERCENT	BOUND	TIN	SPECIES	#3301400	HCOS -	
		5.3	PERCENT	BOUND	IN	SPECIES	#3301401	HZCO3 AQ	
		245.2	PERCENT	BOUND	IN	SPECIES	#8123302	=SO2H2+	
		6.0	PERCENT	BOUND	IN	SPECIES	#8113302	=SO1H2+	
H20									
		25.6	PERCENT	BOUND	IN	SPECIES	#3300020	OH-	
		1.2	PERCENT	BOUND	IN	SPECIES	#8129500	=SO2Zn+	
		25.9	PERCENT	BOUND	IN	SPECIES	#8119500	=SO1Zn+	
		22.7	PERCENT	BOUND	IN	SPECIES	#8112310	=SO1Cu+	
		5.3	PERCENT	BOUND	IN	SPECIES	#8122310	=SO2Cu+	
		1.5	PERCENT	BOUND	IN	SPECIES	#8115400	=SO1Ni+	
		15.9	PERCENT	BOUND	TN	SPECIES	#8116000	=SO1Pb+	
		2012	- BIIOBIII	DoonD		0110110	10110000	DOTED.	
			P	ART 5	of C	UTPUT F	TIF		
		F		ATTED M	ACC	DIGTOI			
		E	QUILIDR	ALED M	CCH	DISIKIB	OTION		
TOV	NTO MET	D	TOCOTAT			CODD		DDDCTDT	mamp
IDX	NAME	D	ISSOLVE			SORB.	ED	PRECIPI	TATED
		MOL	/KG PI	ERCENT		MOL/KG	PERCENT	MOL/KG	PERCENT
							n national statement		
100	Ba+2	1.287	E-06	93.1	9.	615E-08	6.9	0.000E-01	0.0
150	Ca+2	1.2471	E - 04	96.1	5.	055E-06	3.9	0.000E-01	0.0
160	Cd+2	8.6021	E-11	1.8	4.	629E-09	98.2	0.000E-01	0.0
231	Cu+2	7.2541	E-10	0.2	3.	140E-07	99.8	0.000E-01	0.0
145	DOM	3.000	E-03	100.0	0.	000E-01	0.0	0.000E-01	0.0
410	K+1	6.6471	E-05	100.0	0.	000E-01	0.0	0.000E-01	0.0
460	Ma+2	1.440	E-04	100.0	0.	000E-01	0.0	0.000E-01	0.0
500	Na+1	2.0881	E-04	100.0	0	000E-01	0.0	0.000E - 01	0.0
540	Ni+2	6 1311	E = 10	3 3	1	812E-08	96.7	0 000E-01	0.0
600	Ph+2	1 3851	E_11	0.0	1	7865-07	100.0	0.000E-01	0.0
800	Sr+2	5 7071	E _ 07	100.0	1.	000E-01	100.0	0.000E-01	0.0
050	D112	2.1001	E-07 .	0.0	2.	000E-01	0.0	0.000E-01	0.0
950	211+2	2.490	2-09	0.8	5.	035E-07	99.2	0.000E-01	0.0
211	Cr(OH)2+	2.5431	2-09	9.1	0.	UUUE-UI	0.0	2.536E-08	90.9
30	AL+3	3.4621	s-09	0.1	0.	000E-01	0.0	4.815E-06	99.9
140	CO3-2	2.301	E-04 .	100.0	0.	000E-01	0.0	0.000E-01	0.0
280	Fe+2	1.9681	E-25 1	100.0	0.	000E-01	0.0	0.000E-01	0.0
1	E-1	0.0001	E-01	0.0	0.	000E-01	0.0	0.000E-01	0.0
281	Fe+3	1.5821	E - 15	0.0	0.	000E-01	0.0	5.372E-07	100.0
330	H+1	2.516	E - 04	63.9	1.	422E-04	36.1	0.000E-01	0.0
2	H20	3.0251	E - 07	27.0	8.	188E-07	73.0	0.000E-01	0.0
	Charge Bala Sum of CA PERCENT I NON-CARBONA EQUILIBRIUM EQUILIBRIUM EQUILIBRIUM	ance: SPEC ATIONS = 1 DIFFERENCE ATE ALKALIN 1 IONIC STH 1 pH 1 pe	IATED 1.369E-(= 7.3 NITY RENGTH)3 Sum 361E+01 = (m) = = =	of (2. 1. 7.	ANIONS ANIONS 595E-07 127E-02 600 489	9.007E- - CATIONS	03)/(ANIONS + 782 67 my	CATIONS)
	PAOTPIDKION	pe		-	тз.	409 01		/02.0/ MV	
****	*** DIFFUSE	LAYER ADSC	DRPTION	MODEL	* * *	****			
***	* Parameters	For Adson	cbent Nu	mber 1	**	**			
El	ectrostatic	Variables	psi0	= 0.02	762	0 s:	ig0 = 0.00	07201	
			psib	= 0.00	000	0 s:	igb = 0.00	00000	
			psid	= 0.00	000	0 s:	igd = 0.00	00000	
Ad	sorbent Cond	entration	(q/1):	3.44	2				
Sp	ecific Surfa	ce Area (sa. mete	ers/a).	6	00.00			
E			1		0				

Fe+2

		PART 6	of OUT	PUT F	ILE					
Saturation	n indices and	stoichiometry	of all	mine	ral	5				
ID #	NAME	Sat. Index	St	coichi	omet	try in [bracl	ket:	s]	
2003000	ALOH3 (A)	-3.542 [1.000)] 30) [3.000]	2	[-3.000]	330
5015000	ARAGONITE	-3.706 [1.000)] 150) [1.000]	140			
5046000	ARTINITE	-10.441 [-2.000)] 330) [2.000]	460	[1.000]	140
		[5.000)] 2						
2003001	BOEHMITE	-1.755 [-3.000)] 330) [1.000]	30	[2.000]	2
2046000	BRUCITE	-6.531 [1.000)] 460] (2.000]	2]	-2.000]	330
5015001	CALCITE	-3.549 [1.000)] 150) [1.000]	140			
2003002	DIASPORE	0.000 [-3.000)] 330) [1.000]	30]	2.000]	2
5015002	DOLOMITE	-6.171 [1.000)] 150] (1.000]	460]	2.000]	140
2028100	FERRIHYDRITE	-6.675 [-3.000] 330) [1.000]	281	I	3.000]	2
2028101	FE3 (OH) 8	-33.487 [-8.000)] 330) [2.000]	281]	1.000]	280
		[8.000)] 2						
2003003	GIBBSITE (C)	-1.871 [-3.000)] 330] (1.000]	30	I	3.000]	2
3003000	A1203	-8.530 [2.000)] 30] (3.000]	2	[-6.000]	330
2028102	GOETHITE	-2.491 [-3.000)] 330] (1.000]	281]	2.000]	2
3028100	HEMATITE	0.000 [-6.000)] 330] (2.000]	281	I	3.000]	2
5015003	HUNTITE	-15.573 [3.000	1 460) [1.000]	150	[4.000]	140
5046001	HYDRMAGNESIT	-25.591 [5.000	1 460] (4.0001	140	[-2.000]	330
		[6.000)] 2						
3028101	MAGHEMITE	-9.953 [-6.000	330] (2.000]	281	[3.000]	2
5046002	MAGNESITE	-3.119 [1.000	460] (1.000]	140			
3028000	MAGNETITE	-17.723 [-8.000	330) (2.000]	281	[1.000]	280
		[4.000)] 2						
3050000	NATRON	-12.410 [2.000) 500) [1.000]	140	E	10.000]	2
5046003	NESQUEHONITE	-5.522 [1.000) 460] (1.000]	140	I	3.000]	2
5028000	SIDERITE	-20.914 [1.000	280) (1.000]	140			
5080000	STRONTIANITE	-3.683 [1.000) 800] (1.000]	140			
5050001	THERMONATR	-14.111 [2.000	0] 500] (1.000]	140	[1.000]	2
5010000	WITHERITE	-5.581 [1.000) 100) (1.000]	140			
5023100	CUCO3	-9.584 [1.000)] 231	. [1.000]	140			
2023100	CU (OH) 2	-6.381 [-2.000	330) (1.000]	231	Γ	2.000]	2
2023101	TENORITE	-5.361 [-2.000)] 330] (1.000]	231	[1.000]	2
3023100	CUPRICFERIT	-7.523 [-8.000	330) [1.000]	231]	2.000]	281
]	4.000	2 2						
95000	ZN METAL	-64.046 [1.000)] 950] (2.000]	1			
5095000	SMITHSONITE	-7.340 [1.000) 950) [1.000]	140			
5095001	ZNCO3, 1H2O	-7.017 [1.000	950] (1.000]	140]	1.000]	2
2095000	ZN (OH) 2 (A)	-8.037 [-2.000)] 330] (1.000]	950]	2.000]	2
2095001	ZN(OH)2 (C)	-7.787 [-2.000)] 330] (1.000]	950]	2.000]	2
2095002	ZN (OH) 2 (B)	-7.337 [-2.000	330) [1.000]	950	Γ	2.000]	2
2095003	ZN (OH) 2 (G)	-7.297 [-2.000	330] (1.000]	950	[2.000]	2
2095004	ZN(OH)2 (E)	-7.087 [-2.000	330) (1.000]	950	I	2.000]	2
2095005	ZNO (ACTIVE)	-6.897 [-2.000)] 330) [1.000]	950	J	1.000]	2
ID #	NAME	Sat. Index	St	oichi	omet	try in [bracl	ket:	s]	
2095006	ZINCITE	-7.039 [-2.000)] 330] (1.000]	950]	1.000]	2
16000	CD METAL	-52.777 [1.000)] 160] (2.000]	1			
16001	GAMMA CD	-52.879 [1.000)] 160] (2.000]	1			
5016000	OTAVITE	-4.811 [1.000)] 160) [1.000]	140			
2016000	CD(OH)2 (A)	-10.879 [-2.000)] 330] (1.000]	160	I	2.000]	2
2016001	CD(OH)2 (C)	-10.503 [-2.000	330] (1.000]	160	J	2.000]	2
2016002	MONTEPONITE	-12.326 [-2.000)] 330] (1.000]	160	J	1.000]	2
60000	PB METAL	-45.980	1.000	600] (2.000]	1			
5060000	CERRUSITE	-8.030	1.000	600] (1.000]	140			
2060000	MASSICOT	-12.688 [-2.000	330] (1.000]	600	[1.000]	2
2060001	LITHARGE	-12.493	-2.000	330) [1.000]	600]	1.000]	2
2060002	PBO, .3H20	-12.519 [-2.000	330] (1.000]	600]	1.330]	2
5060001	PB2OCO3	-20.432	-2.000	330] (2.000]	600]	1.000]	2
		[1.000] 140				-		
5060002	PB302C03	-31.704 [-4.000)] 330) [3.000]	600	Ι	1.000]	140
		ſ	2.000	2 2	-			-		

2060003	PLATTNERITE	-7.672	[-4.000]	330	[-2.000]	1	[1.000]	600
3060000	PB2O3	-17.941	[-6.000]	330	[-2.000]	1	[2.000]	600
3060001	MINIUM	-31.597	[-8.000]	330	[-2.000]	1	[3.000]	600
2060004	PB(OH)2 (C)	-7.889	ſ	-2.0001	330	[1.000]	600	[2.000]	2
5060003	HYDCERRUSITE	-24.537	[-2.000]	330 2	[3.000]	600	[2.000]	140
2060005	PB20 (OH) 2	-25.278	Ī	-4.000]	330	[2.000]	600	[3.000]	2
5054000	NICO3	-11.002	[1.000]	540]	1.000]	140			
2054000	NI (OH) 2	-6.375]	-2.000]	330	[1.000]	540	[2.000]	2
2054001	BUNSENITE	-8.802]	-2.000]	330	I	1.000]	540	[1.000]	2
5023101	MALACHITE	-11.780]	2.000]	231	[2.000]	2	[1.000]	140
5023102	ATIPTTE	-19 371	L	3 0001	231	٢	2 0001	2	٢	2 0001	140
5025102	ADOILTE	10.011	ſ	-2.0001	330	L	2.000]	-	L	2.000]	2.0
2015000	LIME	-23.759	ſ	-2.0001	330	ſ	1.0001	150	ſ	1.000]	2
2015001	PORTLANDITE	-13.415	Ĩ	-2.0001	330	ſ	1.0001	150	ſ	2.0001	2
2028000	WUSTITE	-20.420	ĩ	-2.0001	330	ſ	0.947]	280	Ĩ	1.000]	2
2046001	PERICLASE	-11.396	ſ	-2.000]	330]	1.000]	460	[1.000]	2
3028001	HERCYNITE	-23.529	Ĩ	-8.000]	330	[1.000]	280	C	2.000]	30
			I	4.000]	2						
3046000	SPINEL	-12.526	[-8.000]	330	[1.000]	460	[2.000]	30
			I	4.000]	2						
3046001	MAG-FERRITE	-10.654	[-8.000]	330	[1.000]	460	[2.000]	281
]	4.000]	2						
3028102	LEPIDOCROCIT	-3.155	[-3.000]	330	[1.000]	281	[2.000]	2
3021100	FECR204	-12.371	[2.000]	211	J	1.000]	280	[-4.000]	330
3021101	MGCR204	-5.239	[2.000]	211]	1.000]	460	[-4.000]	330
3021102	CR203	0.000]	2.000]	211]	-2.000]	330	[-1.000]	2
2021102	CR (OH) 3 (A)	-0.860	[1.000]	211	[1.000]	2	Ε	-1.000]	330
2021101	CR (OH) 3 (C)	-3.412]	1.000]	211]	1.000]	2	[-1.000]	330

4 - Modelling with DOM = 0.004 mol/l

PART 1 of OUTPUT FILE										
Revuè river water-Site 14 - DOM = 0.004 mol/1										
Entered	PCO_2 , PO_2 , fixed	PH, solids	allowed to	o precipi	tate, F	'e redox	pair,			
adsorpti	adsorption and dissolved organic matter									
Tempera Units o Ionic s Carbona Do not Precipi the p The max The met Interme Adsorpt Number	ture (Celsius): of concentration trength to be c te concentratio automatically t tation is allow orint option for cimum number of hod used to com diate output fi ion model: Diff of adsorbing su	19.30 : MG/L omputed. n represents erminate if ed for all s solids is s iterations : pute activit le use Layer rfaces: 1	s carbonate charge imb solids in t set to: 1 is: 200 cy coeffici	e alkalin: balance ex the thermo ents is:	ity. xceeds odynami Davies	30% c databa equatio	use and			
INPUT DA	TA BEFORE TYPE	MODIFICATION	15							
ID	NAME	ACTIVITY GU	JESS LOG	GUESS	ANAL T	OTAL				
330	H+1	2.5121	E-08	-7.600	0.000	E-01				
30	Al+3	4.7861	E-06	-5.320	1.300	E-01				
100	Ba+2	1.3801	E-06	-5.860	1.900	E-01				
150	Ca+2	1.2881	S-04	-3.890	5.200	E+00				
211	Cr(OH)2+	2 8181	2-09	-7.550	2 400	E-04 E-03				
231	Cu+2	3.1621	E = 07	-6.500	2.000	E-02				
280	Fe+2	5.3701	E-07	-6.270	3.000	E-02				
410	K+1	6.607E-05 -4.180 2.599E+00								
460	Mg+2	1.445E-04 -3.840 3.500E+00								
500	Na+1	2.0891	E-04	-3.680	4.800	E+00				
540	Ni+2	1.8621	E-08	-7.730	1.100	E-03				
600	Pb+2	1.7781	E-07	-6.750	3.700	E-02				
950	51+2 7n+2	3 0901	2-07	-6.510	2 000	E-02 E-02				
1	E-1	1.000	E-16	-16.000	0.000	E-01				
140	C03-2	2.1881	E - 04	-3.660	1.310	E+01				
281	Fe+3	1.7781	5-21	-20.750	0.000	E-01				
813	ADS1PSIO	1.000	E+00	0.000	0.000	E-01				
811	ADS1TYP1	1.9051	E-04	-3.720	1.922	E-04				
812	ADS1TYP2	7.762	E-03	-2.110	7.690	E-03				
145	DOM	3.9811	5-03	-2.400	4.000	E-03 E-01				
2	1120	1.0001	100	0.000	0.000	E-OI				
Cha S P	rge Balance: UN um of CATIONS= ERCENT DIFFEREN	SPECIATED 8.438E-04 S CE = 8.648B	Sum of ANIC E+01 (ANIC	DNS = 1.3 DNS - CAT	164E-02 IONS)/(ANIONS -	- CATIONS)			
		PART	3 of OUTPU	JT FILE						
Type I	- COMPONENTS AS	SPECIES IN	SOLUTION			021015				
ID	NAME	CALC MOL	ACTIVITY	LOG ACT		GAMMA	NEW LOGK			
30	D1+3	2.042E-00 8 070E-16	2.512E-08	-15 57	513 0	32961	0.482			
100	Ba+2	2.268E-08	1.385E-08	-7.85	B54 0	.61063	0.214			
150	Ca+2	3.412E-06	2.083E-06	-5.68	122 0	.61063	0.214			
160	Cd+2	1.407E-12	8.592E-13	-12.06	592 0	.61063	0.214			
211	Cr(OH)2+	6.971E-10	6.162E-10	-9.21	025 0	.88399	0.054			
231	Cu+2	3.031E-13	1.851E-13	-12.73	259 0	.61063	0.214			
280	Fe+2	2.074E-25	1.267E-25	-24.89	733 0	.61063	0.214			
410	K+1	6.647E-05	5.876E-05	-4.23	093 0	.88399	0.054			
460	Mg+Z	3.128E-05	1.910E-05	-4.71		. 61063	0.214			
500	NATI	2.0001-04	1.0406-04	-3.13.	300 0	.00399	0.054			

540	N1+2	9.732E-12	5.943E-12	-11.22601	0.61063	0.214
600	Pb+2	2.925E-15	1.786E-15	-14.74809	0.61063	0.214
800	Cr+2	5 7075-07	3 1955-07	-6 15781	0 61063	0 214
000	51+2	J. 707E-07	J.405E-07	-0.45704	0.01005	0.214
950	Zn+2	2.608E-11	1.592E-11	-10.79795	0.61063	0.214
812	ADS1TYP2	5.897E-03	5.897E-03	-2.22937	1.00000	0.000
140	CO3-2	5 293E-07	3 232E-07	-6 49048	0 61063	0 214
201	E-+2	7 0127 05	0.0000 05	0.10010	0.01000	0.400
281	re+3	7.913E-25	2.608E-25	-24.58367	0.32961	0.482
145	DOM	3.744E-03	1.424E-03	-2.84652	0.38030	0.420
811	ADS1TYP1	1.443E-04	1.443E - 04	-3.84072	1.00000	0.000
	OTHER OPPOTES	TN COLUMN	N OD ADGODD	DD		
Type II	- OTHER SPECIES	IN SOLUTIO	IN OR ADSORB	ED		
ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
8121000	=SO2Ba+	2.355E-11	2.355E-11	-10.62806	1,00000	-7.200
2112202	Cr (04) 2 70	1 0125 00	1 0105 00	0 74025	1 00240	7 122
2113302	CI (OR) 5 AQ	1.0126-09	1.0196-09	-0.74025	1.00340	-7.132
2113303	Cr (OH) 4-	7.822E-13	6.914E-13	-12.16026	0.88399	-18.096
2113304	Cr02-	1.985E-12	1.755E-12	-11.75585	0.88399	-17.692
1453300	H DOM	1.905E - 05	1 278E-05	-4.89356	0.67063	4 044
1450300	AL DOM	2 007E 12	2.0025 12	11 52060	0.00500	5 202
1450500	AI DOM	2.9076-12	2.8936-12	-11.55669	0.99508	5.202
1451000	Ba DOM	1.295E-06	1.196E-06	-5.92211	0.92411	3.134
1451500	Ca DOM	1.229E-04	1.136E-04	-3.94479	0.92411	2.934
1451600	Cd DOM	1.273E - 10	1.176E - 10	-9 92948	0 92411	3 334
1452110	Cra DOM	A 4505 11	1.1700 10	10 25201	0.00500	15 000
1452110	CI DOM	4.450E-11	4.428E-11	-10.35381	0.99508	13.222
1452310	Cu DOM	1.092E-09	1.009E-09	-8.99616	0.92411	4.934
1452810	Fe DOM	9.014E-19	8.970E-19	-18.04723	0.99508	7.702
1454600	Ma DOM	1 126E - 04	1 041E - 04	-3 98257	0 92411	1 934
14554000	Ni DOM	0.0045 10	0 1265 10	0.00057	0.02411	2.224
1455400	NI DOM	8.804E-10	8.130E-10	-9.08957	0.92411	3.334
1456000	Pb DOM	2.102E-11	1.942E-11	-10.71165	0.92411	5.234
1459500	Zn DOM	3.739E-09	3.455E-09	-8.46151	0.92411	3.534
3300020	OH-	2 917E-07	2 578E-07	-6 58865	0 88399	-14 135
1602200	Maoli	0 5010 10	7 5225 10	0.10005	0.00000	11 050
4603300	MGOH +	8.521E-10	7.333E-10	-9.12305	0.88399	-11.950
4601400	MgCO3 AQ	5.379E-09	5.398E-09	-8.26777	1.00348	2.940
4601401	MgHCO3 +	4.775E-08	4.221E-08	-7.37459	0.88399	11.488
1503300	CaOH +	1 468E-11	1 298E-11	-10 88687	0 88399	-12 752
1 5 0 1 4 0 0	CallCO2	1 0205 00	2 500 11	0.44020	0.00000	11 277
1501400	Carcos +	4.030E-09	3.362E-09	-8.44830	0.88399	11.377
1501401	CaCO3 AQ	8.475E-10	8.505E-10	-9.07034	1.00348	3.100
5001400	NaCO3 -	9.330E-10	8.248E-10	-9.08365	0.88399	1.194
5001401	NaHCO3 AO	1795E - 08	1.802E - 08	-7 74435	1 00348	10 078
303300	7104 +2	1 2005-13	7 3265-14	-12 12512	0 61063	1 916
303300	AION +2	1.2006-13	7.5206-14	-13.13512	0.01003	-4.940
303301	AI (OH) 2 +	3.788E-11	3.349E-11	-10.47514	0.88399	-10.046
303302	Al(OH)4 -	1.774E-09	1.568E-09	-8.80458	0.88399	-23.576
303303	Al(OH)3 AO	1.672E-09	1.678E-09	-8.77515	1.00348	-16.002
2803300	FOOH +	1 169F-27	1 0338-27	-26 98589	0 88399	-9 635
2000000	D ONO 1	1.1000 27	1.0551 21	20.50505	0.00000	9.033
2803301	FeOH3 -1	3.33/E-34	2.950E-34	-33.53021	0.88399	-31.379
2803302	FeOH2 AQ	2.104E-31	2.111E-31	-30.67542	1.00348	-20.980
2813300	FeOH +2	7.798E-20	4.762E-20	-19.32223	0.61063	-2.124
2813301	FeOH2 +	9 997E-16	8 837E-16	-15 05368	0 88399	-5 616
2013301	Feolia Po	1 1100 10	4 1225 10	15.00000	1.00340	12.010
2813302	FEOH3 AQ	4.1198-16	4.133E-16	-15.38369	1.00348	-13.602
2813303	FeOH4 -	1.861E-16	1.646E-16	-15.78369	0.88399	-21.546
2813304	Fe2(OH)2+4	5.580E-37	7.759E-38	-37.11021	0.13903	-2.286
2813305	Fe3 (OH) 4+5	3 0458-49	1 395F-50	-49 85531	0 04583	-5 165
2010000		5.045E 45	I.JJJJI JU	10.01000	0.04000	10.100
8003300	STOH +	6.466E-13	5.716E-13	-12.24292	0.88399	-13.332
1003300	BaOH +	1.665E-14	1.472E-14	-13.83219	0.88399	-13.520
2311400	CuCO3 AO	3.202E-13	3.213E-13	-12.49307	1.00348	6.728
2311401	$C_{11}(CO3)^2 = 2$	2 141E - 16	1 308F-16	-15 88355	0 61063	10 044
20112200	Cu (COS) 2 2	2.1410 10	1.3000 10	10.00000	0.01000	10.044
2313300	CUOH +	8.336E-14	7.369E-14	-13.13260	0.88399	-1.946
2313301	Cu(OH)2 AQ	6.108E-12	6.129E-12	-11.21261	1.00348	-13.682
2313302	Cu(OH)3 -	1.667E-17	1.474E-17	-16.83161	0.88399	-26.845
2313303	$C_{11}(OH) 4 -2$	1 9128-22	1 168F-22	-21 93262	0 61063	-39 386
2212204	C12 (011) 2 1 2	2 1005 01	1 2260 01	21.95202	0.01000	10 005
2313304	Cu2 (UR) 2+2	2.1008-21	1.3308-21	-20.8/426	0.01063	-10.395
2311402	CuHCO3 +	1.700E-14	1.503E-14	-13.82307	0.88399	13.054
9503300	ZnOH +	5.060E-13	4.473E-13	-12.34937	0.88399	-9.098
9503301	Zn(OH)2 AO	3.173E-13	3.185E-13	-12,49696	1 00348	-16 901
9503302	7n (OH) 3 -	1 5255 17	1 000E 17	-16 20607	0 00000	-20 245
0500002		4.5556-17	4.0096-17	-10.2303/	0.00399	-20.345
2202203	2n(OH)4 - 2	4.142E-22	2.529E-22	-21.59697	0.61063	-40.985

9501400	ZnHCO3 +	3.674E-13	3.248E-13	-12.48842	0.88399	12.454
9501401	ZnCO3 AQ	1.023E-12	1.027E-12	-11.98842	1.00348	5.298
9501402	Zn(CO3)2-2	1.162E-14	7.097E-15	-14.14890	0.61063	9.844
1601400	Cd(CO3)3-4	3.464E-25	4.816E-26	-25.31735	0.13903	7.077
1603300	CdOH +	2.092E-15	1.849E-15	-14.73307	0.88399	-10.214
1603301	Cd(OH)2 AQ	6.061E-18	6.082E-18	-17.21593	1.00348	-20.352
1603302	Cd(OH)3 -	3.073E-23	2.717E-23	-22.56594	0.88399	-33.246
1603303	Cd(OH)4 -2	1.579E-29	9.640E-30	-29.01594	0.61063	-47.136
1603304	Cd20H +3	2.538E-26	8.365E-27	-26.07754	0.32961	-9.064
1601400	CdHCO3 +	1.982E-14	1.752E-14	-13.75640	0.88399	12.454
1601401	CdCO3 AQ	6.936E-14	6.960E-14	-13.15739	1.00348	5.397
6001400	Pb(CO3)2-2	1.334E-17	8.146E-18	-17.08904	0.61063	10.854
6003300	PbOH +	1.568E-15	1.386E-15	-14.85809	0.88399	-7.656
6003301	Pb(OH)2 AQ	2.140E-17	2.147E-17	-16.66810	1.00348	-17.122
6003302	Pb(OH)3 -	1.110E-20	9.815E-21	-20.00811	0.88399	-28.006
6003303	Pb2OH +3	1.682E-28	5.544E-29	-28.25618	0.32961	-5.878
6003304	Pb3 (OH) 4+2	1.292E-38	7.891E-39	-38.10286	0.61063	-24.044
6001401	PbCO3 AQ	9.998E-15	1.003E-14	-13.99857	1.00348	7.238
6003305	Pb(OH)4 -2	1.469E-24	8.972E-25	-24.04711	0.61063	-39.485
6001402	PbHCO3 +	2.600E-16	2.298E-16	-15.63857	0.88399	13.254
5403300	NiOH +	2.455E-14	2.170E-14	-13.66344	0.88399	-9.984
5403301	Ni(OH)2 AQ	9.386E-16	9.418E-16	-15.02602	1.00348	-19.002
5403302	Ni(OH)3 -	4.242E-19	3.749E-19	-18.42603	0.88399	-29.946
5401400	NiHCO3 +	1.611E-13	1.424E-13	-12.84649	0.88399	12.524
5401401	NiCO3 AQ	1.419E-11	1.424E-11	-10.84648	1.00348	6.868
5401402	Ni(CO3)2-2	1.310E-14	7.999E-15	-14.09696	0.61063	10.324
3301400	HCO3 -	2.222E-04	1.964E-04	-3.70680	0.88399	10.437
3301401	H2CO3 AQ	1.050E-05	1.053E-05	-4.97738	1.00348	16.712
2113300	Cr+3	9.538E-15	3.144E-15	-14.50252	0.32961	10.390
2113301	Cr(OH)+2	1.057E-11	6.453E-12	-11.19024	0.61063	5.834
8123301	=S02-	8.142E-04	8.142E-04	-3.08929	1.00000	-8.930
8123302	=SO2H2+	9.785E-04	9.785E-04	-3.00944	1.00000	7.290
8113301	=S01-	1.992E-05	1.992E-05	-4.70065	1.00000	-8.930
8113302	=SO1H2+	2.394E-05	2.394E-05	-4.62080	1.00000	7.290
8129500	=SO2Zn+	1.296E-08	1.296E-08	-7.88739	1.00000	-1.990
8119500	=SO1Zn+	2.892E-07	2.892E-07	-6.53875	1.00000	0.970
8121600	=SO2Cd+	8.603E-11	8.603E-11	-10.06537	1.00000	-2.900
8111600	=SO1Cd+	4.501E-09	4.501E-09	-8.34672	1.00000	0.430
8112310	=SO1Cu+	2.550E-07	2.550E-07	-6.59340	1.00000	2.850
8122310	=SO2Cu+	5.861E-08	5.861E-08	-7.23204	1.00000	0.600
8115400	=SO1Ni+	1.634E-08	1.634E-08	-7.78681	1.00000	0.150
8125400	=SO2Ni+	1.495E-09	1.495E-09	-8.82546	1.00000	-2.500
8116000	=SO1Pb+	1.783E-07	1.783E-07	-6.74890	1.00000	4.710
8126000	=SO2Pb+	2.834E-10	2.834E-10	-9.54754	1.00000	0.300
8121500	=SO2Ca+	2.341E-07	2.341E-07	-6.63067	1.00000	-5.850
8111500	=SO1HCa++	3.220E-06	3.220E-06	-5.49210	1.00000	4.970
8111000	=SO1HBa++	6.616E-08	6.616E-08	-7.17942	1.00000	5.460
Type III	- SPECIES V	VITH FIXED ACTI	VITY		-	
ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH	
2	H2O	-2.628E-05	-4.580	0.000	0.000	
330	H+1	-3.838E-04	-3.416	7.600	0.000	
3301403	CO2 (g)	2.130E-04	-3.672	21.690	-0.530	
3300021	02 (g)	1.139E-04	-3.944	-84.354	133.830	
2802810	Fe+2/Fe+3	-5.372E-07	-6.270	13.175	-10.000	
Type IV	- FINITE SC	DLIDS (present	at equilibriu	um)		
ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH	
3028100	HEMATITE	2.686E-07	-6.571	3.567	30.845	
2003002	DIASPORE	4.815E-06	-5.317	-7.225	24.630	
3021102	CR203	1.267E-08	-7.897	3.220	12,125	

		PI	ART 4 (of (JUTPUT F.	ILE	
	PERCEN	NTAGE DIST	RIBUTIC	ON (OF COMPON	NENTS AMONG	
	TYPE T at	DA TYPE IT	(disso	JV	ed and a	dsorhed) sn	ecies
ADO10VD1	TITE T C	IC TIT II	101001	JT V	cu unu u	aborned) op	CCTCD
ADSITIPI							
	75.1	PERCENT	BOUND	IN	SPECIES	# 811	ADS1TYP1
	10.4	PERCENT	BOUND	IN	SPECIES	#8113301	=S01-
	12.5	PERCENT	BOUND	IN	SPECIES	#8113302	=S01H2+
	1.7	PERCENT	BOUND	TN	SPECIES	#8111500	=SO1HCa++
ADC1TVD2		L DITOLITI	DOOLD		01 00100	10111000	0011100
ADSITIEZ	76 7	DDDCDM	DOUND	T 11	apparta		T DO1 TUDO
	16.1	PERCENT	BOOND	TN	SPECIES	# 815	ADSITYPZ
	10.6	PERCENT	BOUND	IN	SPECIES	#8123301	=S02-
	12.7	PERCENT	BOUND	IN	SPECIES	#8123302	=SO2H2+
Ba+2							
	1 6	PERCENT	BOUND	TN	SPECTES	# 100	Ba+2
	02 6	DEDCENT	DOUND	TN	OPECIEC	# 1451000	Do DOM
	93.0	PERCENT	BOUND	TIN	SPECIES	#1451000	Ba DOM
	4.8	PERCENT	BOUND	IN	SPECIES	#8111000	=SO1HBa++
Ca+2							
	2.6	PERCENT	BOUND	IN	SPECIES	# 150	Ca+2
	94.7	PERCENT	BOUND	TN	SPECTES	#1451500	Ca DOM
	2 5	DEBCENT	BOUND	TN	SPECTES	#8111500	
G-1+0	2.5	LUKCENT	DOOND	TIA	DEFCTED	#0111300	-Boinca i
Ca+2							
	2.7	PERCENT	BOUND	IN	SPECIES	#1451600	Cd DOM
	1.8	PERCENT	BOUND	IN	SPECIES	#8121600	=SO2Cd+
	95.4	PERCENT	BOUND	IN	SPECIES	#8111600	=S01Cd+
ADS1PSTO							
110011010	556 0	DEDCENT	POUND	TN	CDECTES	#0122202	- 502424
	550.0	FERCENT	BOUND	TIN	SPECIES	#0123302	-502H2+
	13.6	PERCENT	ROUND	TN	SPECIES	#8113302	=SOIH2+
	3.7	PERCENT	BOUND	IN	SPECIES	#8111500	=SO1HCa++
Cu+2							
	81.0	PERCENT	BOUND	IN	SPECIES	#8112310	=SO1Cu+
	18.6	PERCENT	BOUND	TN	SPECIES	#8122310	=\$02C11+
DOM	2010	L DITODITA	Doorid		0110110	10122010	00204
DOM	0.2 C	DEDORNE	DOUND	T 37	ODDOTDO	11 1 4 5	DOM
	93.6	PERCENT	BOUND	TN	SPECIES	# 145	DOM
	3.1	PERCENT	BOUND	IN	SPECIES	#1451500	Ca DOM
	2.8	PERCENT	BOUND	IN	SPECIES	#1454600	Mg DOM
K+1							
	100.0	PERCENT	BOUND	TN	SPECIES	# 410	K+1
Ma+2	10010		200112		ornorno	11 120	
ngrz	01 7	DEDOEN	DOUND	-	apparta		Martin
	21.7	PERCENT	ROOND	IN	SPECIES	# 460	Mg+2
	78.2	PERCENT	BOUND	IN	SPECIES	#1454600	Mg DOM
Na+1							
	100.0	PERCENT	BOUND	IN	SPECIES	# 500	Na+1
Ni+2							
	1 7	PERCENT	BOUND	TN	SPECTES	#1455400	NI DOM
	07 0	DEDCENT	DOUND	TN	CDECIEC	#1155400	
	81.2	PERCENT	BOUND	TIN	SPECIES	#8115400	=SOIN1+
	8.0	PERCENT	BOUND	IN	SPECIES	#8125400	=SO2Ni+
Pb+2							
	99.8	PERCENT	BOUND	IN	SPECIES	#8116000	=SO1Pb+
Sr+2							
01.1	100 0	DEDCENT	DOUND	TN	ODECTEC	# 000	Sm12
F O	100.0	FERCENT	DOOND	TIN	SPECIES	# 000	5172
Zn+Z							
	1.2	PERCENT	BOUND	IN	SPECIES	#1459500	Zn DOM
	4.2	PERCENT	BOUND	IN	SPECIES	#8129500	=SO2Zn+
	94.5	PERCENT	BOUND	IN	SPECIES	#8119500	=SO1Zn+
Cr(0H)2+							
01 (011/2)	27 2	DEDORM	DOLIND	TN	ODECTEC	# 011	C= (011) 2 :
	21.2	PERCENT	BOUND	TIN	SPECIES	# 211	CI (OR) 2+
	10.6	PERCENT	BOUND	IN	SPECIES	#2113302	Cr(OH)3 AQ
	1.7	PERCENT	BOUND	IN	SPECIES	#1452110	Cr DOM
A1+3							
	1.1	PERCENT	BOUND	IN	SPECTES	# 303301	Al(OH)2 +
	50 9	DEDCENT	BOUND	TN	SPECTEC	# 303303	A1 (OH) 4 -
	10.9	DEDCENT	DOUND	L IN	OPECIES	π 303302	
	48.0	PERCENT	ROOND	TN	SPECIES	# 303303	AL (OH) 3 AQ
C03-2							
	95.2	PERCENT	BOUND	IN	SPECIES	#3301400	HCO3 -

D - 10		4.5	PERCEN	T BOUND	IN	SPECIES	#3301401	H2CO3 AQ		
re+2		99.4	PERCEN	T BOUND	IN	SPECIES	# 280	Fe+2		
E-1										
Fe+3										
		62.5	PERCEN	T BOUND	IN	SPECIES	#2813301	FeOH2 +		
		11.6	PERCEN	T BOUND	TN	SPECIES	#2813303	FeoH4 -		
H+1		11.0	I LIKOLIK	1 DOORD	T14	DIDOIDD	12010000	1 COII4		
		4.4	PERCEN	T BOUND	IN	SPECIES	#1453300	H DOM		
		51.8	PERCEN	T BOUND	IN	SPECIES	#3301400	нсоз –		
		4.9	PERCEN	T BOUND	IN	SPECIES	#3301401	H2CO3 AQ		
	2	5 6	PERCEN	T BOUND	IN	SPECIES	#8113302	= SO2H2+		
H20		0.0	1 BROBR	Doond	±11	01 HOTHO	10110002	DOTIL !		
		26.0	PERCEN	T BOUND	IN	SPECIES	#3300020	OH-		
		1.2	PERCEN	T BOUND	IN	SPECIES	#8129500	=SO2Zn+		
		25.7	PERCEN	T BOUND	IN	SPECIES	#8119500	=SO1Zn+		
		5.2	PERCEN	T BOUND	TN	SPECIES	#8122310	= SO1Cu+		
		1.5	PERCEN	T BOUND	IN	SPECIES	#8115400	=SO1Ni+		
		15.9	PERCEN	T BOUND	IN	SPECIES	#8116000	=SO1Pb+		
			FOULT	PART 5 C	of (DUTPUT FI	UTION			
			DQUIDIE		100	DIDIRID	01101			
IDX	NAME		DISSOLV	ED		SORBE	ED	PRECIPI	TATED	
			MOL/KG	PERCENT		MOL/KG	PERCENT	MOL/KG	PERCENT	
100	Ba+2	1	317E-06	95.2	6	618E-08	4 8	0.000 E - 01	0 0	
150	Ca+2	1	L.263E-04	97.3	3	.454E-06	2.7	0.000E-01	0.0	
160	Cd+2	1	L.288E-10	2.7	4	.587E-09	97.3	0.000E-01	0.0	
231	Cu+2	1	L.099E-09	0.3	3.	.136E-07	99.7	0.000E-01	0.0	
145	DOM	4	1.000E-03	100.0	0.	.000E-01	0.0	0.000E-01	0.0	
410	K+1 Mat2	t	0.64/E-05	100.0	0.	.000E-01	0.0	0.000E-01	0.0	
500	Na+1	2	2.088E-04	100.0	0	000E-01	0.0	0.000E-01	0.0	
540	Ni+2	9	0.046E-10	4.8	1.	.783E-08	95.2	0.000E-01	0.0	
600	Pb+2	2	2.103E-11	0.0	1.	.786E-07	100.0	0.000E-01	0.0	
800	Sr+2		5.707E-07	100.0	0.	.000E-01	0.0	0.000E-01	0.0	
950	Zn+2	3	3.767E-09	1.2	3.	.022E-07	98.8	0.000E-01	0.0	
30	Cr(OH)2+	4	2.56/E-09	9.2	0.	000E-01	0.0	2.534E-08	90.8	
140	CO3-2	2	2.333E-04	100.0	0.	.000E-01	0.0	4.813E-00	99.9	
280	Fe+2	2	2.086E-25	100.0	0.	.000E-01	0.0	0.000E-01	0.0	
1	E-1	0	0.000E-01	0.0	0.	.000E-01	0.0	0.000E-01	0.0	
281	Fe+3	1	.599E-15	0.0	0.	.000E-01	0.0	5.372E-07	100.0	
330	H+1	2	2.620E-04	61.0	1.	.673E-04	39.0	0.000E-01	0.0	
2	H20	.,	3.065E-07	21.3	8.	.168E-07	12.1	0.000E-01	0.0	
	Charge Bala	nce:	SPECIATED							
	Sum of CA	TIONS	S = 1.356E	-03 Sum	of	ANIONS	1.176E-	02		
	PERCENT D	TE AT	RENCE = 7	.933E+01	. ((ANIONS -	- CATIONS)/(ANIONS +	CATIONS)	
	FOUTLTBRTUM	TONI	C STRENGTH	(m) =	2.	510E-02				
	EQUILIBRIUM	pH	.o ornenorn	(/ =	7.	600				
	EQUILIBRIUM	pe		=	13.	489 or	Eh =	782.67 mv		
****	****** DIDDIICD INVED ADCODDUTON MODEL ++++++									
***	**** Parameters For Adsorbent Number 1 ****									
Ele	ectrostatic	Varia	bles: psi	0 = 0.02	727	7 si	g0 = 0.00	08222		
			psil	0.00 = 0.00	000)0 si	gb = 0.00	00000		
			psic	d = 0.00	000)0 si	gd = 0.00	00000		
Ads	sorbent Conc	entra	ition (g/l)	3.44	2	500 00				
-PC	ourra	mi	ind. me		C					

	PART 6	of OU	UTPU	JT FI	LE					
Saturation indices and	stoichiometry	of al	ll m	niner	als					
ID # NAME	Sat. Index		Stoi	chic	omet	ry in [brack	cet:	5]	
2003000 ALOH3(A)	-3.542 [1.00	00]	30	[3.000]	2]	-3.000]	330
5015000 ARAGONITE	-3.886 [1.00	00]	150	[1.000]	140			
5046000 ARTINITE	-10.739 [-2.00	00]	330	[2.000]	460]	1.000]	140
	[5.00	[00	2						
2003001 BOEHMITE	-1.755 [-3.00	00]	330	[1.000]	30	[2.000]	2
2046000 BRUCITE	-6.680 [1.00	00]	460]	2.000]	2	[-2.000]	330
5015001 CALCITE	-3.729 [1.00	00]	150	[1.000]	140			
2003002 DIASPORE	0.000 [-3.00	00]	330]	1.000]	30	[2.000]	2
5015002 DOLOMITE	-6.500 [1.00	00]	150	[1.000]	460	[2.000]	140
2028100 FERRIHYDRITE	-6.675 [-3.00	00]	330	I	1.000]	281	[3.000]	2
2028101 FE3(OH)8	-33.487 [-8.00	00]	330	[2.000]	281	[1.000]	280
	E	8.00	00]	2						
2003003 GIBBSITE (C)	-1.871 [-3.00	00]	330	[1.000]	30	[3.000]	2
3003000 A1203	-8.530 [2.00	00]	30	[3.000]	2	[-6.000]	330
2028102 GOETHITE	-2.491 [-3.00	00]	330	[1.000]	281	[2.000]	2
3028100 HEMATITE	0.000 [-6.00	00]	330	I	2.000]	281	[3.000]	2
5015003 HUNTITE	-16.200 [3.00	00]	460	[1.000]	150	[4.000]	140
5046001 HYDRMAGNESIT	-26.337 [5.00	00]	460	I	4.000]	140]	-2.000]	330
	[6.00	00]	2						
3028101 MAGHEMITE	-9.953 [-6.00	00]	330	[2.000]	281	[3.000]	2
5046002 MAGNESITE	-3.269 [1.00	00]	460	I	1.000]	140			
3028000 MAGNETITE	-17.723 [-8.00	00]	330]	2.000]	281	[1.000]	280
	[4.00	00]	2						
3050000 NATRON	-12.422 [2.00	00]	500	[1.000]	140	[10.000]	2
5046003 NESQUEHONITE	-5.671 [1.00	00]	460]	1.000]	140	[3.000]	2
5028000 SIDERITE	-20.914 [1.00	00]	280	[1.000]	140			
5080000 STRONTIANITE	-3.708 [1.00	00]	800	J	1.000]	140			
5050001 THERMONATR	-14.123 [2.00	00]	500	[1.000]	140	[1.000]	2
5010000 WITHERITE	-5.759 [1.00	00]	100	[1.000]	140			
5023100 CUCO3	-9.593 [1.00	00]	231	[1.000]	140			
2023100 CU(OH)2	-6.390 [-2.00	00]	330	[1.000]	231	[2.000]	2
2023101 TENORITE	-5.370 [-2.00	00]	330	[1.000]	231	I	1.000]	2
3023100 CUPRICFERIT	-7.533 [-8.00	00]	330	C	1.000]	231	[2.000]	281
	[4.00	00]	2						
95000 ZN METAL	-64.057 [1.00	00]	950	[2.000]	1			
5095000 SMITHSONITE	-7.351 [1.00	00]	950	[1.000]	140			
5095001 ZNCO3, 1H2O	-7.028 [1.00	00]	950	[1.000]	140	[1.000]	2
2095000 ZN(OH)2 (A)	-8.048 [-2.00	00]	330	[1.000]	950	[2.000]	2
2095001 ZN(OH)2 (C)	-7.798 [-2.00	00]	330]	1.000]	950	[2.000]	2
2095002 ZN (OH) 2 (B)	-7.348 [-2.00	00]	330	[1.000]	950	[2.000]	2
2095003 ZN(OH)2 (G)	-7.308 [-2.00	00]	330	[1.000]	950	[2.000]	2
2095004 ZN(OH)2 (E)	-7.098 [-2.00	00]	330	[1.000]	950	[2.000]	2
2095005 ZNO(ACTIVE)	-6.908 [-2.00	00]	330]	1.000]	950	[1.000]	2
ID # NAME	Sat. Index	5	Stoi	chic	omet	ry in [brac}	ket:	5]	
2095006 ZINCITE	-7.050 [-2.00	00]	330	C	1.000]	950	[1.000]	2
16000 CD METAL	-52.790 [1.00	00]	160	J	2.000]	1			
16001 GAMMA CD	-52.892 [1.00	00]	160	[2.000]	1			
5016000 OTAVITE	-4.825 [1.00	00]	160	[1.000]	140			
2016000 CD(OH)2 (A)	-10.893 [-2.00	00]	330	[1.000]	160	[2.000]	2
2016001 CD(OH)2 (C)	-10.516 [-2.00	00]	330	[1.000]	160	[2.000]	2
2016002 MONTEPONITE	-12.340 [-2.00	00]	330	[1.000]	160	[1.000]	2
60000 PB METAL	-45.989 [1.00	00]	600]	2.000]	1			
5060000 CERRUSITE	-8.039 [1.00	00]	600	[1.000]	140			
2060000 MASSICOT	-12.698 [-2.00	00]	330	[1.000]	600	[1.000]	2
2060001 LITHARGE	-12.502 [-2.00	00]	330	[1.000]	600	[1.000]	2
2060002 PBO, .3H2O	-12.528 [-2.00	00]	330	[1.000]	600	[1.330]	2
5060001 PB20CO3	-20.450 [-2.00	00]	330	C	2.000]	600	[1.000]	2
	[1.00	00]	140						
5060002 PB302C03	-31.732 [-4.00	00]	330	[3.000]	600	[1.000]	140
	[2.00	00]	2						

2060003	PLATTNERITE	-7.681	[-4.000]	330	[-2.000]	1	[1.000]	600
3060000	PB203	-17.959	[-6.000]	330]	-2.000]	1	[2.000]	600
3060001	MINIUM	-31.625	[-8.000]	330	[-2.000]	1	[3.000]	600
2060004	PB (0H) 2 (C)	-7 898	L	4.000	230	ſ	1 0001	600	Г	2 0001	2
5060003	HYDCERRUSITE	-24.565	ĺ	-2.000]	330	[3.000]	600	E	2.000]	140
			[2.000]	2				-		
2060005	PB20 (OH) 2	-25.296	[-4.000]	330	[2.000]	600	[3.000]	2
5054000	NICO3	-11.018	[1.000]	540	[1.000]	140			
2054000	NI (OH) 2	-6.391]	-2.000]	330	[1.000]	540	[2.000]	2
2054001	BUNSENITE	-8.818	E	-2.000]	330	[1.000]	540	Ε	1.000]	2
5023101	MALACHITE	-11.799	[2.000]	231	[2.000]	2	I	1.000]	140
]	-2.000]	330						
5023102	AZURITE	-19.398]	3.000]	231	[2.000]	2	I	2.000]	140
			[-2.000]	330						
2015000	LIME	-23.939]	-2.000]	330]	1.000]	150]	1.000]	2
2015001	PORTLANDITE	-13.595]	-2.000]	330	[1.000]	150	I	2.000]	2
2028000	WUSTITE	-20.420	1	-2.000]	330	Γ	0.947]	280	[1.000]	2
2046001	PERICLASE	-11.545	[-2.000]	330	[1.000]	460	[1.000]	2
3028001	HERCYNITE	-23.529	I	-8.000]	330	[1.000]	280]	2.000]	30
]	4.000]	2						
3046000	SPINEL	-12.675]	-8.000]	330	Ι	1.000]	460	[2.000]	30
			[4.000]	2						
3046001	MAG-FERRITE	-10.803]	-8.000]	330	[1.000]	460	I	2.000]	281
]	4.000]	2						
3028102	LEPIDOCROCIT	-3.155	[-3.000]	330	[1.000]	281	[2.000]	2
3021100	FECR204	-12.371]	2.000]	211	[1.000]	280	[-4.000]	330
3021101	MGCR204	-5.389]	2.000]	211	J	1.000]	460]	-4.000]	330
3021102	CR203	0.000]	2.000]	211	I	-2.000]	330	Ţ	-1.000]	2
2021102	CR (OH) 3 (A)	-0.860]	1.000]	211	[1.000]	2	[-1.000]	330
2021101	CR (OH) 3 (C)	-3.412]	1.000]	211	٦	1.0001	2	ſ	-1.0001	330

5 - Modelling with DOM = 0.005 mol/l

		PART	1 of OUTPU	JT FILE			
Revuè ri	ver water-Site	14 - DOM = 0	0.005 mol/1				
Entered	PCO_2 , PO_2 , fix	ed pH, soli	lds allowed	d to pre-	cipitate,	Fe rec	lox pair,
adsorpti	ion and dissolve	ed organic ma	atter				
Tempera Units of Ionic s Carbona Do not Precipi the p The max The met Interme Adsorpt Number	ature (Celsius) of concentration strength to be of automatically to tation is allow orint option for simum number of thod used to corrediate output for cion model: Diff of adsorbing su	: 19.30 h: MG/L computed. on represent: terminate if wed for all s r solids is iterations inpute activit ile fuse Layer urfaces: 1 MODIFICATION	s carbonate charge imb solids in t set to: 1 is: 200 ty coeffici	e alkalini balance ex the thermo lents is:	ity. ceeds 30% odynamic d Davies eq	latabase puation	and
ID	NAME	ACTIVITY G	JESS LOC	GUESS	ANAL TOTA	T	
330	H+1	2.5121	E-08	-7.600	0.000E-0	1	
30	A1+3	4.7861	E-06	-5.320	1.300E-0	1	
100	Ba+2	1.3801	E-06	-5.860	1.900E-0	1	
150	Ca+2	1.2881	E-04	-3.890	5.200E+0	0	
160	Ca+2	4.6//	E-09	-8.330	5.300E-0	4	
231	Cr(OH) 2+	3 1621	E = 0.7	-7.550	2.400E-0	2	
280	Fe+2	5.370	E = 07	-6.270	3.000E-0	2	
410	K+1	6.6071	E-05	-4.180	2.599E+0	0	
460	Mg+2	1.4451	E-04	-3.840	3.500E+0	0	
500	Na+1	2.0891	E - 04	-3.680	4.800E+0	0	
540	Ni+2	1.8621	E-08	-7.730	1.100E-0	3	
600	Pb+2	1.7781	E-07	-6.750	3.700E-0	2	
800	Sr+2	5.7541	E-07	-6.240	5.000E-0	2	
950	Zn+Z F-1	3.090	5-07 7-16	-6.510	2.000E-0	2	
140	CO3-2	2.1881	E-04	-3.660	1.310E+0	1	
281	Fe+3	1.7781	E-21	-20.750	0.000E-0	1	
813	ADS1PSIO	1.0001	E+00	0.000	0.000E-0	1	
811	ADS1TYP1	1.9051	E-04	-3.720	1.922E-0	4	
812	ADS1TYP2	7.7621	E-03	-2.110	7.690E-0	3	
145	DOM	5.0121	E-03	-2.300	5.000E-0	3	
2	H20	1.0001	8+00	0.000	0.000E-0	1	
Cha S F	arge Balance: UN Sum of CATIONS= PERCENT DIFFEREN	NSPECIATED 8.438E-04 1 NCE = 8.8961	Sum of ANIC	DNS = 1.4 DNS - CATI	144e-02 IONS)/(ANI	ONS + C	CATIONS)
Tume T	- COMDONENING TO	PART	3 OI OUTPU	DI FILE -			
Type T	- COMPONENTS AS	CALC MOL	ACTIVITY	LOC ACT		AT M	NEW LOCK
330	H+1	2.877E - 08	2.512E-08	-7.600	00 0.87	306	0.059
30	A1+3	9.025E-16	2.660E-16	-15.575	513 0.29	473	0.531
100	Ba+2	1.750E-08	1.017E-08	-7.992	288 0.58	101	0.236
150	Ca+2	2.624E-06	1.524E-06	-5.816	591 0.58	101	0.236
160	Cd+2	1.442E-12	8.379E-13	-12.076	580 0.58	101	0.236
211	Cr(OH)2+	7.058E-10	6.162E-10	-9.210	0.87	306	0.059
231	Cu+2	3.136E-13	1.822E-13	-12.739	0.58	101	0.236
280	re+2	2.180E-25	1.26/E-25	-24.897	0.58	101	0.236
410	Ma+2	2 5058-05	1 455F-05	-4.236		101	0.059
500	Na+1	2.088E-04	1.823E-03	-3 730	927 0.87	306	0.250
000	- 1	1.000L 01		5.15.			0.000

540	Ni+2	9.907E-12	5.756E-12	-11.23989	0.58101	0.236
600	Pb+2	3.027E-15	1.759E-15	-14.75477	0.58101	0.236
800	Sr+2	5.707E-07	3.316E-07	-6.47943	0.58101	0.236
950	Zn+2	2.688E-11	1.561E-11	-10.80646	0.58101	0.236
812	ADS1TYP2	5.896E-03	5.896E-03	-2.22947	1.00000	0.000
140	CO3-2	5.563E-07	3.232E-07	-6.49048	0.58101	0.236
281	Fe+3	8.849E-25	2.608E-25	-24.58367	0.29473	0.531
145	DOM	4.728E-03	1.631E-03	-2.78752	0.34499	0.462
811	ADS1TYP1	1.449E-04	1.449E-04	-3.83895	1.00000	0.000
Type II	- OTHER SPECIES	TN SOLUTIO	N OR ADSORB	ED		
TD	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOCK
8121000	=SO2Ba+	1.767E-11	1.767E - 11	-10,75273	1.00000	-7.200
2113302	Cr(OH)3 AO	1.811E-09	1.819E-09	-8.74025	1.00438	-7.132
2113303	Cr(OH)4-	7.919E-13	6.914E-13	-12,16026	0.87306	-18.091
2113304	Cr02-	2.010E-12	1.755E-12	-11.75585	0.87306	-17.687
1453300	H DOM	2.726E-05	1.756E-05	-4.75554	0.64416	4.061
1450300	Al DOM	3.997E-12	3.975E-12	-11.40067	0.99458	5.202
1451000	Ba DOM	1.316E-06	1.207E-06	-5.91842	0.91679	3.138
1451500	Ca DOM	1.245E-04	1.142E-04	-3.94245	0.91679	2.938
1451600	Cd DOM	1.719E-10	1.576E-10	-9.80234	0.91679	3.338
1452110	Cr DOM	6.118E-11	6.084E-11	-10.21578	0.99458	15.222
1452310	Cu DOM	1.488E-09	1.365E-09	-8.86499	0.91679	4.938
1452810	Fe DOM	1.239E-18	1.233E-18	-17.90921	0.99458	7.702
1454600	Mg DOM	1.189E-04	1.090E-04	-3.96260	0.91679	1.938
1455400	Ni DOM	1.181E-09	1.083E-09	-8.96543	0.91679	3.338
1456000	Pb DOM	2.867E-11	2.628E-11	-10.58031	0.91679	5.238
1459500	Zn DOM	5.078E-09	4.656E-09	-8.33200	0.91679	3.538
3300020	OH-	2.953E-07	2.578E-07	-6.58865	0.87306	-14.130
4603300	MgOH +	6.574E-10	5.740E-10	-9.24111	0.87306	-11.945
4601400	MgCO3 AQ	4.095E-09	4.113E-09	-8.38583	1.00438	2.940
4601401	MgHCO3 +	3.684E-08	3.216E-08	-7.49265	0.87306	11.494
1503300	CaOH +	1.087E-11	9.494E-12	-11.02256	0.87306	-12.747
1501400	CaHCO3 +	2.985E-09	2.606E-09	-8.58399	0.87306	11.382
1501401	CaCO3 AQ	6.195E-10	6.223E-10	-9.20603	1.00438	3.099
5001400	NaCO3 -	9.330E-10	8.146E-10	-9.08905	0.87306	1.200
5001401	NaHCO3 AQ	1.772E-08	1.779E-08	-7.74975	1.00438	10.078
303300	AloH +2	1.261E-13	7.326E-14	-13.13512	0.58101	-4.924
303301	Al(OH)2 +	3.835E-11	3.349E-11	-10.47514	0.87306	-10.041
303302	Al(OH)4 -	1.796E-09	1.568E-09	-8.80458	0.87306	-23.570
303303	Al(OH)3 AQ	1.671E-09	1.678E-09	-8.77515	1.00438	-16.002
2803300	FeOH +	1.183E-27	1.033E-27	-26.98589	0.87306	-9.630
2803301	FeOH3 -1	3.379E-34	2.950E-34	-33.53021	0.87306	-31.374
2803302	FeOH2 AQ	2.102E-31	2.111E-31	-30.67542	1.00438	-20.980
2813300	FeOH +2	8.196E-20	4.762E-20	-19.32223	0.58101	-2.103
2813301	FeOH2 +	1.012E-15	8.837E-16	-15.05368	0.87306	-5.611
2813302	FeOH3 AQ	4.115E-16	4.133E-16	-15.38369	1.00438	-13.602
2813303	FeOH4 -	1.885E-16	1.646E-16	-15.78369	0.8/306	-21.541
2813304	Fe2 (OH) 2+4	6.808E-37	1.759E-38	-37.11021	0.11396	-2.200
2813305	Fe3 (OH) 4+5	4.155E-49	1.395E-50	-49.85531	0.03359	-5.030
1003300	SIOH +	6.229E-13	5.439E-13	-12.26451	0.87306	-13.326
2211400	BaUH +	1.237E-14	1.080E-14	-13.96653	0.87306	-13.515
2311400	CUCOS AQ	3.149E-13	1 207E 16	-12.49993	1.00430	10.000
2313300	Cu(COS)Z=Z	2.215E-10 9.209E-14	7 2525-14	-13.89041	0.38101	10.066
2313301	CUOH +	6.007E-12	6 033E-12	-11 21047	1 00439	-13 692
2313302	Cu(OH) = AU	1.661F - 17	1 451 r = 17	-16 83940	0 87306	-26 840
2313302	Cu(OH)A = 2	1 9795-22	1 1505-22	-21 03040	0.50101	-30 264
2313304	$C_{11}2(OH)2+2$	2 2288-21	1 2945-21	-20 88700	0.58101	-10 272
2311402	CuHCO3 +	1 6945-14	1 1705-11	-13 02002	0.97306	13 050
9503300	ZnOH +	5 0248-13	4 3875-13	-12 35788	0.87306	-9 0039
9503301	Zn (OH) 2 AO	3.109E-13	3.123E-13	-12 50547	1.00438	-16 901
9503302	Zn (OH) 3 -	4.503E-17	3.931E - 17	-16.40548	0.87306	-28.340
9503303	Zn(OH) 4 -2	4.269E-22	2.480E-22	-21,60548	0.58101	-40 963
		La tata			0.00101	

9501400	ZnHCO3 +	3.648E-13	3.185E-13	-12.49694	0.87306	12.459
9501401	ZnCO3 AQ	1.003E-12	1.007E-12	-11.99694	1.00438	5.298
9501402	Zn(CO3)2-2	1.198E-14	6.960E-15	-14.15741	0.58101	9.866
1601400	Cd(CO3)3-4	4.121E-25	4.696E-26	-25.32823	0.11396	7.163
1603300	CdOH +	2.065E-15	1.803E-15	-14.74395	0.87306	-10.208
1603301	Cd(OH)2 AQ	5.906E-18	5.932E-18	-17.22681	1.00438	-20.352
1603302	Cd(OH)3 -	3.035E-23	2.650E-23	-22.57682	0.87306	-33.241
1603303	Cd(OH)4 -2	1.618E-29	9.401E-30	-29.02682	0.58101	-47.114
1603304	Cd2OH +3	2.699E-26	7.956E-27	-26.09930	0.29473	-9.015
1601400	CdHCO3 +	1.957E-14	1.709E-14	-13.76728	0.87306	12.459
1601401	CdCO3 AQ	6.758E-14	6.788E-14	-13.16827	1.00438	5.397
6001400	Pb(CO3)2-2	1.381E-17	8.022E-18	-17.09572	0.58101	10.876
6003300	PbOH +	1.564E-15	1.365E-15	-14.86477	0.87306	-7.651
6003301	Pb(OH)2 AQ	2.105E-17	2.115E-17	-16.67478	1.00438	-17.122
6003302	Pb(OH)3 -	1.107E-20	9.665E-21	-20.01479	0.87306	-28.001
6003303	Pb20H +3	1.824E-28	5.376E-29	-28.26954	0.29473	-5.829
6003304	Pb3 (OH) 4+2	1.297E-38	7.535E-39	-38.12290	0.58101	-24.023
6001401	PbCO3 AQ	9.837E-15	9.880E-15	-14.00524	1.00438	7.238
6003305	Pb(OH)4 -2	1.521E-24	8.835E-25	-24.05379	0.58101	-39.463
6001402	PbHCO3 +	2.592E-16	2.263E-16	-15.64525	0.87306	13.259
5403300	NiOH +	2.408E-14	2.102E-14	-13.67733	0.87306	-9.978
5403301	Ni(OH)2 AQ	9.082E-16	9.122E-16	-15.03990	1.00438	-19.002
5403302	Ni(OH)3 -	4.159E-19	3.632E-19	-18.43991	0.87306	-29.941
5401400	NiHCO3 +	1.580E-13	1.379E-13	-12.86037	0.87306	12.529
5401401	NiCO3 AQ	1.373E-11	1.379E-11	-10.86037	1.00438	6.868
5401402	Ni(CO3)2-2	1.333E-14	7.747E-15	-14.11085	0.58101	10.346
3301400	HCO3 -	2.250E-04	1.964E-04	-3.70680	0.87306	10.443
3301401	H2CO3 AQ	1.049E-05	1.053E-05	-4.97738	1.00438	16.711
2113300	Cr+3	1.067E-14	3.144E-15	-14.50252	0.29473	10.438
2113301	Cr(OH)+2	1.111E-11	6.453E-12	-11.19024	0.58101	5.856
8123301	=S02-	8.048E-04	8.048E-04	-3.09429	1.00000	-8.930
8123302	=SO2H2+	9.893E-04	9.893E-04	-3.00466	1.00000	7.290
8113301	=S01-	1.978E-05	1.978E-05	-4.70376	1.00000	-8.930
8113302	=S01H2+	2.431E-05	2.431E-05	-4.61414	1.00000	7.290
8129500	=SO2Zn+	1.285E-08	1.285E-08	-7.89113	1.00000	-1.990
8119500	=SO1Zn+	2.880E-07	2.880E-07	-6.54060	1.00000	0.970
8121600	=SO2Cd+	8.483E-11	8.483E-11	-10.07146	1.00000	-2.900
8111600	=SO1Cd+	4.457E-09	4.457E-09	-8.35094	1.00000	0.430
8112310	=SO1Cu+	2.549E-07	2.549E-07	-6.59360	1.00000	2.850
8122310	=SO2Cu+	5.833E-08	5.833E-08	-7.23412	1.00000	0.600
8115400	=SO1Ni+	1.607E-08	1.607E-08	-7.79403	1.00000	0.150
8125400	=SO2Ni+	1.464E-09	1.464E-09	-8.83456	1.00000	-2.500
8116000	=SO1Pb+	1.783E-07	1.783E-07	-6.74891	1.00000	4.710
8126000	=SO2Pb+	2.822E-10	2.822E-10	-9.54943	1.00000	0.300
8121500	=SO2Ca+	1.732E-07	1.732E-07	-6.76157	1.00000	-5.850
8111500	=SO1HCa++	2.420E-06	2.420E-06	-5.61624	1.00000	4.970
8111000	=SO1HBa++	4.987E-08	4.987E-08	-7.30220	1.00000	5.460
Type II:	I - SPECIES W	ITH FIXED ACT	IVITY			
ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH	
2	H20	-2.907E-05	-4.537	0.000	0.000	
330	H+1	-4.099E-04	-3.387	7.600	0.000	
3301403	CO2 (g)	2.102E-04	-3.677	21.690	-0.530	
3300021	02 (g)	1.138E-04	-3.944	-84.354	133.830	
2802810	Fe+2/Fe+3	-5.372E-07	-6.270	13.175	-10.000	
-						
Type IV	- FINITE SOL	IDS (present	at equilibriu	.m)		
TD	NAME	CALC MOL	LOG MOL	NEW LOGK	DH	
3028100	HEMATITE	2.686E-07	-6.571	3.567	30.845	
2003002	DIASPORE	4.815E-06	-5.317	-7.225	24.630	
3021102	CR203	1.266E-08	-7.898	3.220	12.125	

		PZ	ART 4 (of (OUTPUT F	ILE	
	PERCEN	TAGE DIST	RIBUTI	ON (OF COMPON	VENTS AMONG	
	TYPE I ar	nd TYPE II	(disso	olve	ed and ad	dsorbed) sp	ecies
ADS1TYP1							
	75.4	PERCENT	BOUND	IN	SPECIES	# 811	ADS1TYP1
	10.3	PERCENT	BOUND	IN	SPECIES	#8113301	=S01-
	12.7	PERCENT	BOUND	IN	SPECIES	#8113302	=SO1H2+
	1.3	PERCENT	BOUND	IN	SPECIES	#8111500	=SO1HCa++
ADS1TYP2							
	76.7	PERCENT	BOUND	TN	SPECIES	# 812	ADS1TYP2
	10.5	PERCENT	BOUND	TN	SPECIES	#8123301	=502-
	12 9	DEDCENT	BOUND	TN	SPECIES	#8123302	=502H2+
Pa+2	12.5	LEIKOBIAT	DOOND	TIA	DIDCITD	#0123302	-502112
Datz	1 2	DEDCENT	POUND	TN	CDECTES	# 100	Bat2
	1.5	PERCENT	BOUND	TN	SPECIES	# 100	Datz Ba DOM
	30.1	PERCENT	BOUND	TN	SPECIES	#1451000	
0-10	3.0	PERCENT	BOOND	TIN	SPECIES	#0111000	-SUINDATT
Ca+2	0.0		DOUND		apparpa	1.50	G + 0
	2.0	PERCENT	BOUND	IN	SPECIES	# 150	Ca+2
	96.0	PERCENT	BOUND	IN	SPECIES	#1451500	Ca DOM
	1.9	PERCENT	BOUND	IN	SPECIES	#8111500	=SOIHCa++
Cd+2							
	3.6	PERCENT	BOUND	IN	SPECIES	#1451600	Cd DOM
	1.8	PERCENT	BOUND	IN	SPECIES	#8121600	=SO2Cd+
	94.5	PERCENT	BOUND	IN	SPECIES	#8111600	=SO1Cd+
ADS1PSIO							
	507.5	PERCENT	BOUND	IN	SPECIES	#8123302	=SO2H2+
	12.5	PERCENT	BOUND	IN	SPECIES	#8113302	=SO1H2+
	2.5	PERCENT	BOUND	IN	SPECIES	#8111500	=SO1HCa++
Cu+2							
	81.0	PERCENT	BOUND	IN	SPECIES	#8112310	=SO1Cu+
	18.5	PERCENT	BOUND	IN	SPECIES	#8122310	=SO2Cu+
DOM							
	94.6	PERCENT	BOUND	IN	SPECIES	# 145	DOM
	2.5	PERCENT	BOUND	IN	SPECIES	#1451500	Ca DOM
	2.4	PERCENT	BOUND	TN	SPECIES	#1454600	Mg DOM
K+1	211	L BLIODILL	Dooring				
	100.0	PERCENT	BOUND	TN	SPECIES	# 410	K+1
Ma+2	100.0	L DIVUDIU	DoonD		0100100	11 120	
119.2	17 4	DEBCENT	BOUND	TN	SPECTES	# 460	Ma+2
	82 6	PERCENT	BOUND	TN	SPECIES	#1454600	Mg DOM
Na+1	02.0	L DICODITI	DOOLD	T 14	DILICILD	11101000	ing bon
Nati	100 0	DEDCENT	POUND	TN	SDECTES	# 500	Na+1
Ni+2	100.0	FERCENT	BOOND	TIN	DEPCIED	# 500	Natz
NTTT	6.2	DEDCENT	DOUND	TN	ODECTES	#1455400	NI DOM
	0.3	PERCENT	BOUND	TN	SPECIES	#1455400	NI DOM
	85.8	PERCENT	BOUND	IN	SPECIES	#8115400	
21 . 0	1.8	PERCENT	BOUND	IN	SPECIES	#8125400	= 502N1 +
PD+2	~~~~		-			1011 0000	00101
	99.8	PERCENT	BOUND	IN	SPECIES	#8116000	=SO1Pb+
Sr+2							
	100.0	PERCENT	BOUND	IN	SPECIES	# 800	Sr+2
Zn+2							
	1.7	PERCENT	BOUND	IN	SPECIES	#1459500	Zn DOM
	4.2	PERCENT	BOUND	IN	SPECIES	#8129500	=SO2Zn+
	94.1	PERCENT	BOUND	IN	SPECIES	#8119500	=SO1Zn+
Cr(OH)2+							
	27.2	PERCENT	BOUND	IN	SPECIES	# 211	Cr(OH)2+
	69.9	PERCENT	BOUND	IN	SPECIES	#2113302	Cr(OH) 3 AQ
	2.4	PERCENT	BOUND	IN	SPECIES	#1452110	Cr DOM
A1+3	<u> </u>					and the second se	
	1.1	PERCENT	BOUND	IN	SPECIES	# 303301	Al(OH)2 +
	51.2	PERCENT	BOUND	JN	SPECIES	# 303302	Al (OH) 4 -
	47 6	PERCENT	BOUND	TN	SPECIES	# 303303	AL (OH) 3 AO
CO3-2	11.0	LENGENT	LOOND	T 14	0100100	. 000000	···· (0.11) 0 17X
VVV 4	95 3	DEDCENT	BOUND	TN	SPECTES	#3301400	HC03 -
	50.5	EERCENT	DOUND	TIA	OL DOTED	#3301400	11000
	4.4	PERCENT	BOUND	IN	SPECIES	#3301401	H2CO3 AQ
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Fe+2							
	99.5	PERCENT	BOUND	IN	SPECIES	# 280	Fe+2
E-1							
Fe+3							
	62.7	PERCENT	BOUND	IN	SPECIES	#2813301	FeOH2 +
	25.5	PERCENT	BOUND	IN	SPECIES	#2813302	FeOH3 AQ
	11.7	PERCENT	BOUND	IN	SPECIES	#2813303	FeOH4 -
H+1							
	5.9	PERCENT	BOUND	IN	SPECIES	#1453300	H DOM
	48.8	PERCENT	BOUND	IN	SPECIES	#3301400	нсоз –
	4.6	PERCENT	BOUND	IN	SPECIES	#3301401	H2CO3 AQ
	214.6	PERCENT	BOUND	IN	SPECIES	#8123302	=SO2H2+
	5.3	PERCENT	BOUND	IN	SPECIES	#8113302	=S01H2+
H2O							
	26.3	PERCENT	BOUND	IN	SPECIES	#3300020	OH-
	1.1	PERCENT	BOUND	IN	SPECIES	#8129500	=SO2Zn+
	25.6	PERCENT	BOUND	IN	SPECIES	#8119500	=SO1Zn+
	22.7	PERCENT	BOUND	IN	SPECIES	#8112310	=SO1Cu+
	5.2	PERCENT	BOUND	IN	SPECIES	#8122310	=SO2Cu+
	1.4	PERCENT	BOUND	IN	SPECIES	#8115400	=SO1Ni+
	15.9	PERCENT	BOUND	IN	SPECIES	#8116000	=SO1Pb+

PART 5 of OUTPUT FILE _____

IDX NAME		DISSOL	VED	SORBE	D	PRECIPITATED			
		MOL/KG	PERCENT	MOL/KG	PERCENT	MOL/KG	PERCENT		
100	Ba+2	1.334E-06	96.4	4.988E-08	3.6	0.000E-01	0.0		
150	Ca+2	1.272E-04	98.0	2.593E-06	2.0	0.000E-01	0.0		
160	Cd+2	1.735E-10	3.7	4.542E-09	96.3	0.000E-01	0.0		
231	Cu+2	1.495E-09	0.5	3.132E-07	99.5	0.000E-01	0.0		
145	DOM	5.000E-03	100.0	0.000E-01	0.0	0.000E-01	0.0		
410	K+1	6.647E-05	100.0	0.000E-01	0.0	0.000E-01	0.0		
460	Mg+2	1.440E-04	100.0	0.000E-01	0.0	0.000E-01	0.0		
500	Na+1	2.088E-04	100.0	0.000E-01	0.0	0.000E-01	0.0		
540	Ni+2	1.205E-09	6.4	1.753E-08	93.6	0.000E-01	0.0		
600	Pb+2	2.868E-11	0.0	1.786E-07	100.0	0.000E-01	0.0		
800	Sr+2	5.707E-07	100.0	0.000E-01	0.0	0.000E-01	0.0		
950	Zn+2	5.108E-09	1.7	3.009E-07	98.3	0.000E-01	0.0		
211	Cr(OH)2+	2.592E-09	9.3	0.000E-01	0.0	2.531E-08	90.7		
30	A1+3	3.510E-09	0.1	0.000E-01	0.0	4.815E-06	99.9		
140	CO3-2	2.361E-04	100.0	0.000E-01	0.0	0.000E-01	0.0		
280	Fe+2	2.192E-25	100.0	0.000E-01	0.0	0.000E-01	0.0		
1	E-1	0.000E-01	0.0	0.000E-01	0.0	0.000E-01	0.0		
281	Fe+3	1.614E-15	0.0	0.000E-01	0.0	5.372E-07	100.0		
330	H+1	2.730E-04	59.2	1.880E-04	40.8	0.000E-01	0.0		
2	H20	3.100E-07	27.6	8.147E-07	72.4	0.000E-01	0.0		
Charge Balance: SPECIATED Sum of CATIONS = 1.351E-03 Sum of ANIONS 1.453E-02 PERCENT DIFFERENCE = 8.299E+01 (ANIONS - CATIONS)/(ANIONS + CATI NON-CARBONATE ALKALINITY = 2.666E-07 EQUILIBRIUM IONIC STRENGTH (m) = 1.896E-02 EQUILIBRIUM pH = 7.600 EQUILIBRIUM pe = 13.489 or Eh = 782.67 mv									
****	*** DIFFUSE LAY	ER ADSORPTI	ON MODEL	* * * * * * * *					
***	* Parameters Fo	or Adsorbent	Number 1	****					
El	ectrostatic Var	riables: ps ps ps	i0 = 0.02 ib = 0.00 id = 0.00	6993 si 0000 si 0000 si	g0 = 0.00 gb = 0.00 ad = 0.00	9108 0000 0000			
Ad.	sorbent Concent	ration (q/1): 3.44	2					
Sp	ecific Surface	Area (sq. m	eters/g):	600.00					

		PART 6	of	OUTP	UT F	ILE					
Saturation	n indices and	stoichiometry	of	all	mine	rals					
ID # 1	NAME Sat	Index	Sto	ichi	omet	ry i	n [brac	kets]			
2003000	ALOH3(A)	-3.542 [1.	000]	30	[3.000]	2	[-3.000]	330
5015000	ARAGONITE	-4.022 [1.	000]	150	[1.000]	140			
5046000	ARTINITE	-10.975 [-2.	000]	330]	2.000]	460	[1.000]	140
		Į	5.	000]	2						
2003001	BOEHMITE	-1.755 [-3.	000]	330]	1.000]	30]	2.000]	2
2046000	BRUCITE	-6.798 [1.	000]	460	[2.000]	2	J	-2.000]	330
5015001	CALCITE	-3.865 [1.	000]	150	I	1.000]	140			
2003002	DIASPORE	0.000	-3.	0001	330	ſ	1.000]	30	[2.0001	2
5015002	DOLOMITE	-6.753 [1.	0001	150	ſ	1.0001	460	ſ	2.0001	140
2028100	FERRTHYDRITE	-6.675 [-3.	0001	330	ſ	1.0001	281	ſ	3,0001	2
2028101	FE3(OH)8	-33,487 [-8.	0001	330	r	2.0001	281	ſ	1.0001	280
2020101	110 (011) 0	[8	0001	2	L	21000]	101	L.		200
2003003	CIBBSITE (C)	-1 871	-3	0001	330	Г	1 0001	30	Г	3 0001	2
2003000	D1203	-8 530 [2.	0001	30	r	3 0001	2	ſ	-6.0001	330
2029102	COETHITE	-2 401	-2.	0001	330	r	1 0001	281	L L	2 0001	200
2020102	GOEINIIE	-2.491 [-5.	0000	220	L	2 0001	201	L	2.000]	2
5028100	HEMAILIE	16.600	-0.	0001	350	L	1 0001	150	L	3.000]	140
5015003	HUNTITE	-10.090 [э. г	0000]	400	L	1.000]	100	L	4.000]	140
5046001	HIDRMAGNESIT	-20.927 l	5.	0001	460	L	4.000]	140	L	-2.000]	330
0000101			6.	0000]	220	r	0 0001	001		2 0001	0
3028101	MAGHEMITE	-9.953 [-6.	000]	330	L	2.000]	281	L	3.000]	2
5046002	MAGNESITE	-3.387 [1.	000]	460	L	1.000]	140			0.00
3028000	MAGNETITE	-17.723 [-8.	000]	330	L	2.000]	281	L	1.000]	280
		l	4.	000]	2						
3050000	NATRON	-12.433 [2.	000]	500	l	1.000]	140	[10.000]	2
5046003	NESQUEHONITE	-5.789 [1.	000]	460]	1.000]	140	[3.000]	2
5028000	SIDERITE	-20.914 [1.	000]	280	[1.000]	140			
5080000	STRONTIANITE	-3.730 [1.	000]	800	[1.000]	140			
5050001	THERMONATR	-14.134 [2.	000]	500]	1.000]	140	[1.000]	2
5010000	WITHERITE	-5.893 [1.	000]	100	[1.000]	140			
5023100	CUCO3	-9.600 [1.	000]	231	[1.000]	140			
2023100	CU (OH) 2	-6.397 [-2.	000]	330	[1.000]	231	Ι	2.000]	2
2023101	TENORITE	-5.377 [-2.	000]	330	[1.000]	231	J	1.000]	2
3023100	CUPRICFERIT	-7.540 [-8.	000]	330	[1.000]	231	Ε	2.000]	281
		[4.	000]	2						
95000	ZN METAL	-64.066 [1.	000]	950	[2.000]	1			
5095000	SMITHSONITE	-7.359 [1.	000]	950	[1.000]	140			
5095001	ZNCO3, 1H2O	-7.037 [1.	000]	950	[1.000]	140	[1.000]	2
2095000	ZN (OH) 2 (A)	-8.056 [-2.	000]	330	I	1.000]	950]	2.000]	2
2095001	ZN (OH) 2 (C)	-7.806	-2.	0001	330	ſ	1.000]	950	Ĩ	2.000]	2
2095002	ZN (OH) 2 (B)	-7.356	-2.	0001	330	ſ	1.0001	950	ſ	2.0001	2
2095003	ZN (OH) 2 (G)	-7.316 [-2.	0001	330	ſ	1.0001	950	ſ	2.0001	2
2095004	ZN (OH) 2 (E)	-7.106 [-2.	0001	330	ſ	1.0001	950	ſ	2.0001	2
2095005	ZNO (ACTIVE)	-6.916 [-2.	0001	330	ſ	1.0001	950	ſ	1.0001	2
						·					
TD #	NAME	Sat. Index		Sto	ichie	omet	rv in [brack	et	sl	
2095006	ZINCITE	-7.059 [-2.	0001	330]	1.0001	950	1	1.0001	2
16000	CD METAL	-52 801 [1	0001	160	ſ	2 0001	1	L	1.000]	-
16001	GAMMA CD	-52 903 [1	0001	160	ſ	2 0001	1			
5016000	OTAVITE	-4.836 [1	0001	160	ſ	1 0001	140			
2016000	CD (OH) 2 (A)	-10.904 [-2	0001	330	ſ	1 0001	160	Г	2 0001	2
2016000	CD (OH) 2 (A)	-10.507 [2.	0000]	220	r	1 0001	160	L	2.000]	2 2
2016001	MONTEDONITE	-10.527 [-2.	0000	330	L	1 0001	160	L F	2.000]	2
2010002	DD METAT	-12.551 [-2.	0001	530	L	2.0001	100	L	T.000]	2
50000	PB METAL	-45.996 [1.	0001	600	L	2.000]	140			
5060000	CERRUSTTE	-8.046 [1.	0000]	000	L	1.000]	140		1 0001	0
2060000	MASSICOT	-12.704 [-2.	000]	330	L	1.000]	600	L	1.000]	2
2060001	LITHARGE	-12.509 [-2.	000]	330	L	1.000]	600	L	1.000]	2
2060002	PBO, .3H2O	-12.535 [-2.	000]	330]	1.000]	600	[1.330]	2
5060001	PB20C03	-20.464 [-2.	000]	330	[2.000]	600	[1.000]	2
		[1.	000]	140	36					
5060002	PB302C03	-31.752 [-4.	000]	330	[3.000]	600	[1.000]	140
		[2.	000]	2						

2060003	PLATTNERITE	-7.688	[-4.000]	330	[-2.000]	1	[1.000]	600
3060000	PB203	-17.973	[-6.000]	330	E	-2.000]	1]	2.000]	600
3060001	MINIUM	-31.645	[3.000]	330	[-2.000]	1	[3.000]	600
			[4.000]	2						
2060004	PB(OH)2 (C)	-7.905	J	-2.000]	330	[1.000]	600	[2.000]	2
5060003	HYDCERRUSITE	-24.585	[]	-2.000]	330 2	[3.000]	600	[2.000]	140
2060005	PB20 (OH) 2	-25.310	[-4.000]	330	[2.000]	600	[3.000]	2
5054000	NICO3	-11.032]	1.000]	540]	1.000]	140			
2054000	NI (OH) 2	-6.405]	-2.000]	330]	1.000]	540	[2.000]	2
2054001	BUNSENITE	-8.832	[-2.000]	330	[1.000]	540	[1.000]	2
5023101	MALACHITE	-11.812	I	2.000]	231]	2.000]	2	[1.000]	140
]	-2.000]	330						
5023102	AZURITE	-19.419	J	3.000]	231]	2.000]	2	[2.000]	140
]	-2.000]	330						
2015000	LIME	-24.075	[-2.000]	330	E	1.000]	150]	1.000]	2
2015001	PORTLANDITE	-13.730	I	-2.000]	330	[1.000]	150	[2.000]	2
2028000	WUSTITE	-20.420	[-2.000]	330	[0.947]	280	C	1.000]	2
2046001	PERICLASE	-11.663	[-2.000]	330	[1.000]	460	[1.000]	2
3028001	HERCYNITE	-23.529]	-8.000]	330	[1.000]	280	[2.000]	30
			[4.000]	2						
3046000	SPINEL	-12.793	[-8.000]	330	[1.000]	460]	2.000]	30
			[4.000]	2						
3046001	MAG-FERRITE	-10.921	[-8.000]	330	[1.000]	460	[2.000]	281
			[4.000]	2						
3028102	LEPIDOCROCIT	-3.155	[-3.000]	330]	1.000]	281	[2.000]	2
3021100	FECR204	-12.371	[2.000]	211	[1.000]	280	[-4.000]	330
3021101	MGCR204	-5.507]	2.000]	211]	1.000]	460	[-4.000]	330
3021102	CR203	0.000]	2.000]	211]	-2.000]	330	[-1.000]	2
2021102	CR (OH) 3 (A)	-0.860	I	1.000]	211	[1.000]	2]	-1.000]	330
2021101	CR (OH) 3 (C)	-3.412	[1.000]	211	I	1.000]	2	[-1.000]	330