



GSIJ NEWSLETTER

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GUEST EDITORIAL

Dwight Smikle
Hydrogeologist
Water Resources Authority

THE GEOLOGY OF JAMAICA: ITS DETERMINATION OF THE WATER RESOURCE TYPE

Jamaica may be divided, based on a simplified geology, into five hydro stratigraphic units. These include two (2) aquicludes, one (1) aquifer and one that functions as aquifer and aquiclude depending on local lithology.

The rocks that function as aquicludes are of volcanic and metamorphic origin as well as limestones and marls. Due to their low permeability surface water dominates in these rocks. The rock groups classified as aquicludes are the Basement complex, termed the Basement Aquiclude as well as Limestone Aquiclude which is constituted by Coastal Limestone Formation. Alluvial deposits act as aquiclude in areas where the lithology is dominated by clays. The sections of the Island characterized by aquiclude constitute 41% of the land surface and are mainly in the Blue Mountain, Central and Hanover Inliers.

Aquifers constitute the remaining 59% of the island's surface. Of this, 15% is alluvium and 85% is Limestone aquifer. The Rocks of the White Limestone Group are the main aquifers on the island as well as the rocks of the Falmouth Formation. Aquifers are also constituted by various alluvial deposits in the areas that sands and gravels dominate these lithologies. Aquifers are found in those areas outside of the Cretaceous Inliers. Groundwater is the major resource type in these areas. As such many wells are located in these areas.

"Geo-thought" for the day

"People are like rocks, some take a polish, some don't"

(Adapted)

At present, 84% of Jamaica's water supply is sourced from groundwater through the drilling of over 300 wells throughout the Island. Surface water is a less reliable resource as it is more subject to climate extremes. This makes the maintenance of groundwater quality and quantity essential to the island's sustainable development.

"Identity Crisis"

You know that you are taking the "geology thing" too far when what you identify as feldspar crystals in a weathered matrix is really a chunk of good 'ole concrete!



D. Trotman

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Assistant Editor: Joel Moo-Young

The GSIJ Newsletter is a quarterly magazine published by the Geological Society of Jamaica. For further information about the Society, contact the Secretary/Treasurer, Department of Geography & Geology, University of the West Indies, Mona, Kingston 7. (Telephone - 927-2728)

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SEISMIC NEWS

M.D. Wiggins-Grandison, Seismologist
Earthquake Unit
U.W.I.

- 1 Jamaica Seismograph Network Earthquakes**
January to March 1997.
- 2 The Quick Step, Trelawny, Earthquake**
April 16, 11:34 p.m. M 3.7.
- 3 JSN News, Visitors**
- 4 Caribbean Eventualities**

1. JSN Activity - January to March 1997.

No earthquakes were reportedly felt in Jamaica during the first quarter of this year. Among the events that were detected, seven were located. These are shown in the table below:

Date	EST	Mag.	Area
January 06	01:43 AM	5.1	Enriquillo Fault Zone
January 26	08:15 PM	2.7	Mile Gully, Manchester
January 30	10:32 AM	2.4	Cockpit West, Trelawny
February 10	11:50 PM	2.4	North St. Elizabeth
February 11	08:31 AM	2.7	North Manchester
March 06	05:35 AM	3.4	Oriente Fracture Zone E.
March 18	06:50 PM	2.4	Blue Mtns. W., St. And.

Two were offshore, or near-Jamaica earthquakes of moderate and minor magnitudes, respectively. The others were very minor on-land events. It was a seismically quiet period, but note the location of the January 26 and 30, and February 10 and 11 events. These earthquakes occurred within a 15-kilometre radius along the north Manchester, north St. Elizabeth and south Trelawny border and are probably all related to the felt event of April 1997, which is described below.

2. The Quick Step Earthquake

Quick Step is a seemingly quiet farming village located at the St. Elizabeth-Trelawny border. This is the southern border of the Cockpit Country of west-central Jamaica. The tertiary road stops at Quick Step and district names like, 'Me no sen

yuh no come', 'District of Look Behind', and 'Quick Step' itself, makes one wonder about the past in this place. On the night of Wednesday, April 16, at 11:34 p.m., residents of Quick Step were awakened by an earthquake of magnitude 3.7 to 3.8. It was a minor one, but zinc roofs rattled, crockery clattered, and calm prevailed among these rural folk. It was an earthquake, they said, rolled over, went back to sleep and forgot to chat with their neighbours about it the next day. Had this occurred in Kingston, the Earthquake Unit would have been inundated with calls, and it would have made the major news headlines. Not a soul in Quick Step complained about the earthquake. "We're used to it", said one resident, "it happens all the while, wrecking people's concrete tanks, and bursting house walls. There was a big one around 1953 and before that in the 40's when I was young, before I got married. That's why hardly anybody have tanks anymore - earthquake mash them up. When the house walls burst, we just patch it out and paint them." Her husband declared that they had seven weeks of tremors in 1953.

Indeed, a town just 9 km to the south-east, Auchtembeddie, was the focus of an Intensity (Modified Mercalli) 7 earthquake in 1943. Considerable damage was experienced, not only in the former, but in Quick Step and most likely, in other surrounding communities. And, there is a report of an earthquake of MMI 4-5 in Trelawny in 1953.

In Quick Step, this April earthquake had MMI 4 to 6. A rent developed at the corner seam in a house that was estimated to be within 30 to 100 metres of the epicentre, based on a GPS location. This house was on a hill to the east, overlooking the main square of the village. It was of nog construction, seemingly strong, reinforced with diagonal timber beams. It stood at the edge of a huge ravine with a spectacular view of the Cockpits to the north. The owner, Mr. Green, said his house withstood Hurricane Gilbert with no damage. Already greying, he lived with his 95 year-old, blind mother and was anxious to move to the flat-land, since he was constantly under threat of nature - wind-storms, earthquakes, lightning, whose attacks he claimed he experienced more severely than persons living on the plain. Just outside his house there was a tree burnt by lightning. During the earthquake, his "home-sweet-home" lampshade had rattled against the wall and was thrown off its base to the floor, where it broke. The morning after the earthquake, he could see sunlight streaming through the north-western corner of his bedroom.

Over in Montego Bay, a few ideally placed persons felt the Quick Step earthquake. One employee of the BA office said she was the only one in her office that had felt it and she was sure that she was not crazy, it was an earthquake. She found someone from the Air Jamaica office that shared her view. Reports to Hot-102 Radio revealed that a few folks at Montego Bay Freeport, Redding, Ramble, Montpelier,

Tucker-Irwin, St. James and Great River, Hanover, had indeed felt the earthquake. The BA employee said she was on the third floor of her apartment block, sitting up reading in bed, and leaning against a wall. On the ground floor, another woman said her television moved as she watched it, and at first she thought something had fallen on the ceiling. Two other ground floor dwellers reported that it was as if someone had pushed their mattresses from underneath, and that the jolt was sudden, definite, but fleeting. The tremor was felt in these places with MMI 3, where it was slight and had no-time or strength to rattle anything. Even as near as the villages of Pullet Hall, Goodwin and Aberdeen, within 5 km of the epicentre, scarcely anyone felt the earthquake. In fact, the quake didn't awaken anyone, west or east of Quick Step.

3. The JSN benefited from the visit of Mr. Florin Ionica, Network Engineer, of the Romanian Earthquake Institute, Bucharest.

Florin spent three (3) weeks working with us equipping existing remote seismograph stations with new, industry standard equipment, testing new transmission links and essentially offering training and advice regarding the new equipment and future developments. Florin has had over 16 years experience in seismic installations. Though the equipment is new in Jamaica, it is standard in many countries for local networks, and is manufactured in the USA. We have just caught up with the rest of the world.

Most of our field stations are operating at enhanced levels of sensitivity, from less than 60 db heretofore, to 78 and even 84 db, a magnification 16 times the previous levels. Already we are in a better position to detect smaller events from remote areas such as the Cockpits. However, we still need to reduce the spacing of stations in order to obtain more reliable focal depths. Later this year after more equipment is received, we plan to field at least 6 new stations. When this is done, we should be better able to find and delineate faults like the one that caused the Quick Step earthquake!

4. Regional Events

Inhabitants of the Caribbean Tectonic Plate are being constantly reminded of this as the turn of the century approaches. It is interesting to note that some of our worst experiences arising from living on the edge of the Caribbean Plate have occurred near the change of centuries: 1690, 1692, 1727, 1794, 1818, 1897, 1902, 1907, etc.

The Langs Soufriere Volcano has kept scientists busy and the people of Montserrat on a fearful alert, since 1995, with periods of dome growth and intense activity interspersed with calmer times. The island of Saba had a scare of a volcanic crisis in 1992. Now, it is the turn of the twin island Republic

of Trinidad and Tobago. Despite the often talked about lack of touristic allure of Trinidad, personally, I always find the place appealing. I visit at least once each year and I am often intrigued by the diversity of not only the cultures of people, but the wildlife, landscape, the fascinating pitch-lake, and now - the seismic activity.

It started on February 3, 1997, when a mud volcano in the town of Piparo, central Trinidad, came to life and eventually erupted violently on February 22. The area of influence was 10 acres; fourteen houses and 100 persons were affected. I haven't heard of any mud volcanoes in Jamaica, but they are actually volcanic vents built of mud, occurring in hot spring areas. The extruded material from these volcanoes is mud as the name suggests, and this happens in response to seismic activity in the region of interest. Piparo volcano spewed kaolinite mud of intermediate viscosity with some silts and boulders (SRU homepage).

On April 2, 1997, an earthquake sequence began off the coast of Tobago. The first had a magnitude of 5.6 and caused only superficial to minor damage. On April 22, a magnitude 5.9 event occurred. This time it caused 6 houses to collapse and 2 persons were hospitalized. Changes in the flow of water in springs were also observed. (SRU homepage). One of the last damaging earthquakes experienced by T & T nation was in December 1954, when an event having MMI 8 caused serious damage to structures (Robson, 1964). I contend there's nothing lacklustre about Trinidad at all!

The information on seismic activity in Trinidad and Tobago was taken from the Web-page of the Seismic Research Unit of the St. Augustine Campus, Trinidad. It's worthwhile checking (<http://community.wow.net/sru>).

GENERAL

Allan Sappleton
 Director of Environment, Safety & Health
 Mines and Geology Division

ENVIRONMENTAL MANAGEMENT OF MINE SITES: THE CASE OF TAILING DAMS AND IMPOUNDMENTS

** [Part 1 of a series of two]*

Introduction

Mining is the removal of minerals from the Earth's crust for use by man. All mining activity causes some changes in the natural environment and is therefore said to have an environmental impact. The nature and size of an impact varies with the type of mineral working, the method of mining and various other features of the mine sites and their surroundings.

With the emergence of an environmental consciousness over the past two to three decades, mining developers have understandably made an effort to address environmental matters. Nonetheless mining remains a potentially destructive activity. Yet the extraction and use of minerals, especially metallic minerals, have gained in importance, and mining continues to be a key industry in its contributions to human activities.

The increasing demand for metals world-wide, and present large-scale mining operations - due to improved technology - are occurring at a time when demand for higher environmental standards is being given increased emphasis. As such, conflicts are usually centred around issues such as: landscape destruction; degradation of the visual environment, disturbance of water courses, destruction of agriculture and forest lands; damage to recreational lands; dust; noise; sedimentation and erosion; among other issues.

Tailings Impoundments - an overview of the main issues

Demand for increased environmental quality has focused attention on not just the production cycle of a mine, that is exploration and exploitation, but ancillary operations such as tailings dams and impoundments are increasingly seen to have a high environmental impact as well.

The recent failure of a tailings dam, at Omai Gold Mine in Guyana, has brought into sharp focus the need for proper environmental management of such facilities in our region. Even here in Jamaica, it has been reported that bauxite tailings

(Red Mud) dams have leached sodium into groundwater aquifers.

The United Nations Environmental Programme (UNEP) Bulletin Number 106 points out that major failures of tailings impoundments have been reported in all continents. Some recent failures resulted in serious impacts upon both terrestrial and aquatic environments and occasionally loss of life. More widespread incidents such as groundwater seepage, effluent discharge, dust generation, and interference with wildlife, are common impacts which companies should be expected to mitigate.

Tailing and their Sources

During the processing of various industrial materials, fine residual particles arise. These particles are classified as tailings. The vast majority of tailings arise from the processing of minerals. Beneficiation - the on site processing of minerals, may include crushing and grinding of the ore to finer particles, to aid in the extraction of the mineral desired. Mineral tailings is the finely grounded particles left over after the valuable mineral has been extracted.

Mineral tailings arise mostly from metalliferous mining and coal mining. However, the conversion of bauxite to alumina, and the hydraulic mining of china clay deposits are examples of other significant sources. Whatever the source, tailings must be removed from the process. Impoundment is one of the most common tailings disposal methods.

** [Be sure to see Part 2 in the September issue of Newsletter]*

EXCERPTS OF PRESENTATION MADE BY COMMISSIONER - COY ROACHE - AT THE "INVESTING IN THE AMERICAS CONVENTION"

Introduction

The 1990's is continuing as the decade of liberalization, deregulation and the period in which most countries have joined the global competition of attracting foreign investment to stimulate growth. This scenario is evidenced by the rapid changes in mining laws, taxation and incentive regimes within Latin America, the Caribbean and more recently Asia and Africa. Phenomenal deals are being offered to the foreign investor in all sectors of our economies and Jamaica has long ago positioned itself to harness a portion of the foreign investor's capital!

Jamaica is the third largest producer of bauxite in the world, with a mature industry dating back to 1952. The country now enjoys a very stable relationship with the major bauxite mining companies; these companies have displayed confidence in the country by their ongoing expansion of the alumina plants even though the aluminum industry is under severe strain. Production for 1996 exceeded that of 1995 by one million tonnes of bauxite, a 10% increase in production. In 1996, 11.9 million tonnes of bauxite was produced.

The Mining Policy

The crucial element within the mining and chemical sector continues to be the bauxite and alumina industry. The Government is committed to providing an environment for the Mining Industry that is conducive to its long term development and expansion.

Incentives

In addition to the various export-related incentives currently in place, the decision was recently taken by the Government to provide additional incentives to the Industry, namely:

- I) Since April 1, 1994, duties on imported raw materials have been removed in order to increase export competitiveness.
- II) As of January 1, 1994 accelerated capital depreciation over two years is available to facilitate quick "write off" and to enhance cash flow.
- III) Tax holiday relative to the size of the investment; two lime manufacturing companies were recently given 10 years tax holiday.
- IV) No custom duty or consumption tax is payable on capital goods imported for mining operations.

Taxation

Corporate profits tax is at a rate of 33 1/3% and personal income tax is at a flat rate of 25% over an initial tax free allowance of J\$80,496.00 (US\$2,300.00)

Double Taxation Treaties

Jamaica has double taxation treaties with eight countries as part of its efforts to encourage foreign investment. They are: The United Kingdom, The U.S.A., Canada, Germany, Denmark, Norway, Sweden and France.

Trade Facilitation

The Government has a Trade Promotion Agency (JAMPRO) which was created to be a one-stop-shop for investors, exporters and the business community both national and international. The agency develops and implements programmes to:

- (I) Encourage, expand and diversify investments
- (II) Modernize the production and management systems of companies
- (III) Stimulate trade from Jamaica; a trade facilitation board was formed in 1990 with responsibility to examine and resolve bureaucratic hindrances to trade.

Mining Sector

Jamaica is a world leader in the production of bauxite and alumina - the raw materials for the production of aluminum. This industry is well developed with present participation by four major multinationals. The experience gained over 45 years with these companies have created a wealth of technical and other resource skills equal to any other country in the mineral industry.

The country now earns over 50% of its mercantile trade revenue from the mining sector and is striving to improve its earning, not by additional taxation, but by expansion of bauxite production, industrial minerals and base metals.

It is intended to establish an integrated limestone based chemical complex, taking this raw material to the end of the product line. Significant amount of by-products will be produced including lime and caustic soda. The chemical lime company of the United States has approval to construct a modular lime plant with initial investment of US\$60 million.

Present Exploration

Although copper was mined in the distant past in small quantities, there is not now any mining of base metals.

The Jamaican Geological Survey Department and the Canadian International Development Agency (CIDA) undertook a countrywide geochemical survey which was aimed at identifying the country's potential for metallic minerals.

This survey revealed several areas with high potential for gold and copper and as a result has attracted a fair number of investors with Broken Hill Proprietary (BHP) International Minerals taking the lead role. BHP discovered a small deposit which was optioned to Orvana Minerals Corporation.

In an early sampling program, the average of 33 pits along 120 metres strike, was 36.5 g Au/tonne over an average 1.1 metres thickness. This has proven to be a small high grade deposit averaging about 17 grams per tonne with about 40,000 oz of gold. Orvana has optioned AUSJAM, a small mining and processing company from Australia to produce this gold. Environmental permission was recently given and the company is preparing its financing to commence construction. The country should be producing gold by the end of 1997!

GSI MEMBERSHIP UPDATE 1997 - 1998

Professional		Title
BAXTER	Carlton	Mr.
HENRY	Lawrence	Mr.
LAUGHTON	Dionne	Ms.
M ^C KENZIE	Noel	Mr.
Associate		
BRYAN	Livingston	Mr.
WILLIAMS	Kay-ann	Ms.
WILLIAMS	Michael	Mr.

APOLOGIES: OOPS!!

- * The surname of Council member *Donovan Blissett* was incorrectly spelt on the first page of the last issue of the GSI's Newsletter (Vol. XVI No. 2, March 1997). We apologize Blissett!
- * We failed to mention in the last issue of the GSI's Newsletter (page 5, under the heading - "Publications"), that *Rafi Ahmad* was the Assistant Editor of Volume XXX of the Journal of the Geological Society of Jamaica.

INFOBITS

- Paul Manning (formerly at Geology Department U.W.I.) is at the Industrial Minerals Unit of the Mines and Geology Division, where he now serves in the capacity of Chief Geologist.
- The Regional Mapping Unit of the Mines and Geology (headed by Leighton Williams), is currently in the process of redrafting the geological sheets to conform to metric standards. The coverage will coincide with that provided by the latest published topographical sheets at a scale of 1:50,000. The aim for this year is to concentrate on publishing five (5) maps including those encompassing the eastern section of the island. This will hopefully be done via the acquisition of a new plotter, the final editing of side notes and final field checks to be made by unit personnel.
- During the second phase of the Metallic Mineral project (Mines and Geology, 1992) geochemical and geophysical research were completed in the Connors area of Clarendon. The results of this work are to be published this year.
- World Day for Water was in Jamaica on March 20-22 under the theme "Jamaica's water Is there enough?" The day was marked with a ceremony at the WRA on March 20, which was addressed by the Minister of Public Utilities and Transport. The Minister also opened the two day exhibition and open day at the WRA held to mark the day.

Attendance at the exhibition was below expectation with the exception of the opening ceremony guests who also toured the exhibit. On both days of the exhibition schools failed to take advantage of the opportunity to glean some of the information available. The response from those who saw the exhibits was an overall rave review for the WRA who the visitors felt had done a tremendous job of presenting some clear cut facts about the island's water resources. Many expressed regrets that the exhibition was not permanent or even an annual event. At present, the exhibition may still be viewed in part at the offices of the WRA in Hope Gardens.
- The International Union of Geological Sciences (IUGS) is a scientific and non-governmental organization that promotes and encourages the study of geological problems, especially those of world-wide significance and supports and facilitates international and interdisciplinary cooperation in the earth sciences. The International Geological Correlation Programme (IGCP) focuses on the worldwide organization and distribution of knowledge about geological resources and environment. Currently

about 50 research projects involving more than a thousand participants are operating under the auspices of the IGCP.

Jamaica has been a member of the IUGS for a number of years. Present members on the local committee for the year 1997 are: Lawrence Henry (IGCP National Committee Director), Margaret Aratram (Secretary), Dr. A. Geddes, Dr. Trevor Jackson, Prof. Edward Robinson, Mr. Earl Wright and Mr. Paul Saunders. Presently Jamaica is participating in two projects, IGCP Projects Nos. 364 and 393.

**Project No. 364
(1994-1998)**

Project Leader:
Local Participant:

**Caribbean Volcanic Arcs and
Ophiolites**

G. Draper (United States)
Dr. Trevor Jackson.

Description: The objectives of this project are to determine the beginning and ending of magmatic episodes in the various arc terranes in the Circum-Caribbean and the degree of diachroneity of magmatic events. The project will use up-to-date stratigraphic and geochronological information gathered from various Circum-Caribbean ophiolite association and any identified dispersed arc terranes.

The project will establish a data base to compare different ophiolite compositions, develop a detailed correlation chart for both volcanic arc terranes and ophiolite suites and an accompanying map of volcanic and ophiolite suites in the Caribbean realm, showing the distribution of genetically and temporally related arc.

**Project No. 393
(1996-2000)**

Project Leader:
Local Participant:

**Neritic Middle-Upper Eocene
(Neritic events at the Middle-Upper
Eocene boundary)**

E. Caus
Professor Edward Robinson

Description: The objective of this project is to correlate shallow water benthic sequences with global time scales. The project will improve the biostratigraphic correlation across the Atlantic ocean by means of benthic microfossils.

The project is concerned with providing a time-scale to understand the evolution of sedimentary basins and the resources they contain.

- Dr. Barbara Carby (Department of Geography & Geology, U.W.I.) attended the 4th International Earthquake Engineering Conference in Teheran, Iran between May 4-6. There, Dr. Carby presented a paper entitled - "A Scientific Basis for Earthquake Contingency Planning: an Example from Jamaica". This conference was staged by the Sharif University of Technology.
- Mr. Coy Roache - Commissioner of Mines, at Mines and Geology - attended the "Investing in the Americas Convention" in Miami Beach, Florida, between April 7-11 where he represented the Minister of Agriculture and Mining. Mr. Roache presented a paper on: "Jamaica as a Mining Country within the Caribbean".

• *Be sure to see excerpts from this paper! (page 4)*

- A joint U.W.I./I.D.B. course on Remote Sensing in the Caribbean region was held between May 5-9 at the Computer Science Department at the U.W.I.. A diverse field of scientists from the U.W.I. community as well as a few outside agencies (eg. Mines & Geology Division), participated in this one week course conducted by Prof. Geoffrey Wadge. Our own Prof. Robinson was the chief course coordinator.

MISSION OF THE MINES AND GEOLOGY DIVISION

To develop a comprehensive scientific understanding of the Geology of the island and to direct the orderly development of the country's mineral industry, ensuring that all activities proceed in accordance with the Mining Legislations and in harmony with the environment.

CONGRATULATIONS!!

- ◆ Congrats to Margaret Aratram (Mines & Geology Division) who recently gave birth to her first bundle of joy - the most beautiful baby girl!

UPCOMING EVENTS

PLEASE REMEMBER:

The 15th Caribbean Geological Conference will be held in Jamaica from June 29th to July 2nd 1998. The meeting will comprise four (4) days of technical sessions and will examine the full range of geological research in the Caribbean. There will be pre- and post- conference field trips schedule for June 27-28 and July 3-4, respectively. It is important that we support this conference!

FIELD TRIP REPORT

The Easter period saw members of the Department of Geography & Geology engaged in fieldwork with visitors from North America. From March 21-28, Professor Stephen Donovan and Dr. Simon Mitchell were 'local experts' for an undergraduate/graduate field course of the University of Chicago that was based at the Discovery Bay Marine Laboratory. The Chicago contingent included four (4) professors and twenty-four (24) students, who combined examination of modern sedimentary environments around the reef at Discovery Bay with a tour of many of the exposed rock successions on the north coast and inland. This is the second such trip by the University of Chicago, the first having taken place in 1993.

Professor Donovan and Dr. Mitchell were also in the field during the mid-semester break, where they were mainly involved in the examination of the late Pleistocene Port Morant Formation of southeast Jamaica in collaboration with Professor Ron Pickerill of the University of New Brunswick.

Professors Donovan and Pickerill have been working on the late Cenozoic rocks of southeast Jamaica since 1992, and this short field season was an extension of this work. On Saturday, 5th April, all three (3) researchers led a field meeting of about twenty (20) members of the Geological Society of Jamaica to this area.

Geo-Science Caught On Camera



Aquifer testing at Low Ground, Clarendon



Well drilling at Low Ground, Clarendon



THE GEOLOGICAL SOCIETY OF JAMAICA

c/o The Department of Geography & Geology

University of the West Indies,

Mona, Kingston 7,

Jamaica, West Indies

REGISTRATION FORM

PREFERRED TITLE: Ms./Mrs./Mr./Dr./Prof./Sir

NAME (surname first):

OFFICE ADDRESS:

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FEE (ANNUAL)

Institutional
Professional
Associate
Student

\$ 3,000.00
\$ 500.00
\$ 100.00
\$ 30.00

AREAS OF INTEREST:

.....
Membership in the Society is open to all persons with an interest in Geology and related earth sciences.
Application for membership may be made to the Secretary/Treasurer.