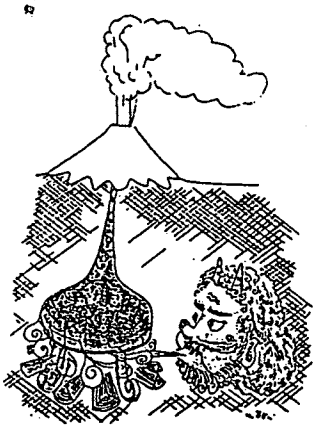


ASH FALL

Newsletter of the Volcanology Division
Geological Association of Canada

ASH FALL #28 JUNE, 1991

On June 4, 1991 the Japanese news media reported the death of volcanologists Dr. Harry Glicken, M. Maurice Krafft, and Mme. Katia Krafft on Unzendake. A group of 40 scientists and journalists led by Dr. Glicken were climbing a narrow valley up Mt. Unzen when they were overwhelmed by a pyroclastic flow. Dr. Glicken had been a student of R. V. Fisher, was currently at U.S.C. Santa Barbara, and had completed post-doctoral work in the Mt. Unzen area. The Kraffts were filming pyroclastic flows while Glicken and other members of the party were gathering data in their passion for examining volcanic events at first hand. Most of the best observations of volcanic events have come from dedicated people. By June 10, 1991 the death toll from this eruption had risen to 38.

MEETINGS

EDMONTON '93

A forum on the many aspects of Quaternary Volcanism in western Canada (mainly) will form part of the 1993 GAC/MAC meeting in Edmonton. Prof. John Westgate (U. of T.) has volunteered to chair the meeting. It is hoped that unpublished material (and old) from a variety of disciplines will meld to form a more coherent picture.

1991 ANNUAL GENERAL MEETING

The Annual Meeting of the Volcanology Division of the GAC was held in Toronto on May 29, 1991, at the close of the GAC/MAC meeting. Minutes and business are included here and should be of interest to every Division member.

GREECE 1992

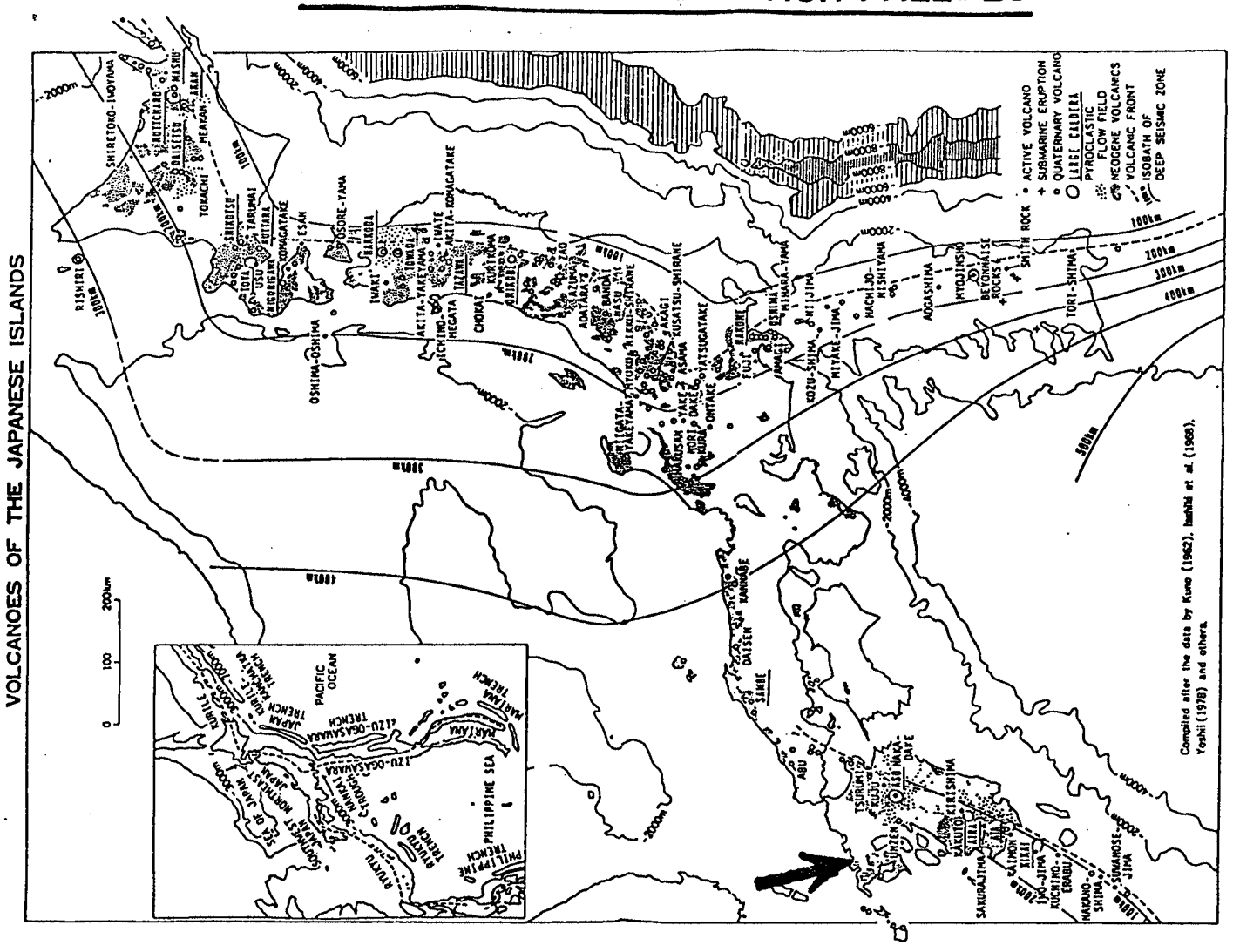
The Greek Islands field tour will be in conjunction with Wolfville '92. The tour will feature stops on the mainland and on six islands to study outstanding volcanic features. Transport will be mainly by inter-island ferry and will allow time at classical Greek localities for volcanologists and family members.

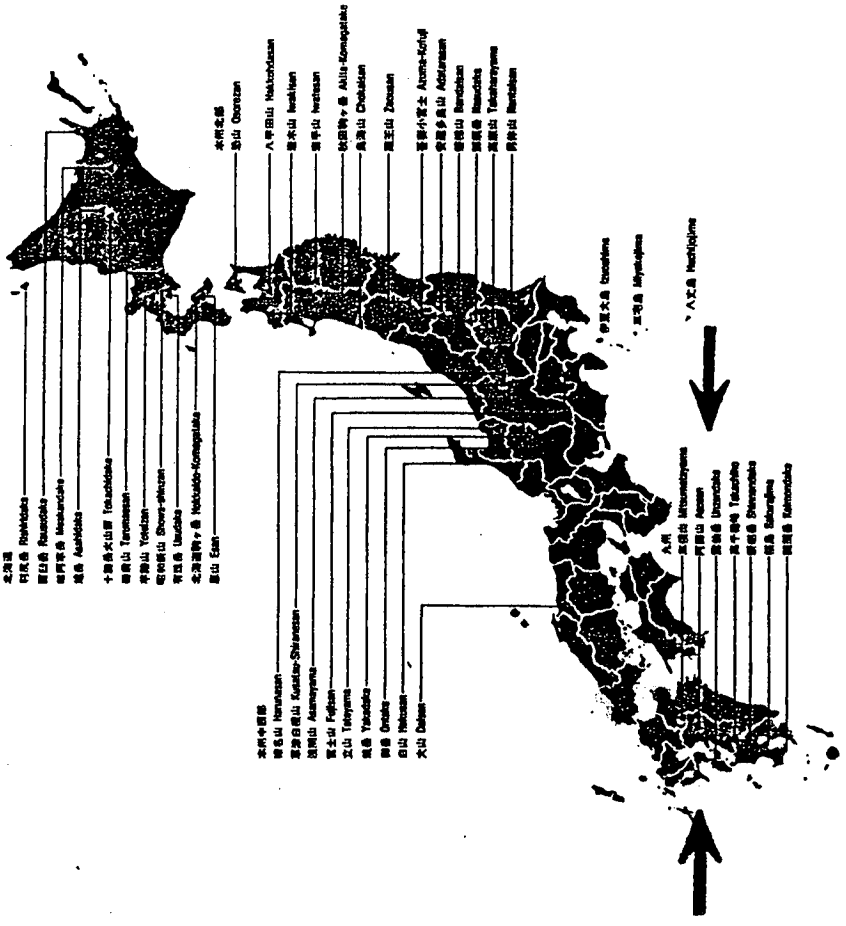
BOOK REVIEWS

Volcanoes of North America: (C.A. Woodward and J. Kienle)
- this long awaited product is a coffee-table style book with thumbnail sketches of mainly Neogene volcanoes of western U.S.A., Canada, and Hawaii. Mexico has been excluded. The book forms a ready index for volcanologists and amateurs with descriptions, maps and photos. The photos are generally small and murky. The references are generally not up to date and some advice on access to volcanic areas is misleading. The price, at $72.00 (±), is excessive. (EWG)

Volcanism and Tectonism in the Columbia River Flood Basalt Province: (edited by Stephen P. Reidel and Peter R. Hooper; US $52.50)
- GSA Special Paper 239 on the Columbia River Basalt Group embodies 25 reports in 386 pages covering topics from stratigraphy and physiography to structural and chemical evolution of this major volcanic deposit.
The basalts are divided into 5 formations ranging in age from 6 to 17.5 million years. New estimates of the total area and volume covered by the 38 major flow units comprising the group give 163,700 km³ and 174,300 km³ respectively. The sequence includes the largest known terrestrial lava flows. The regional tectonic setting in which the eruptions occurred appears to be one of a NNW-SSE shortening and WSW-ENE extension stress scheme that has not changed significantly during the last 17 million years.
The chemistry of the lavas ranges from high magnesium MORB type basalts to very different high-silica basaltic andesites (=>55% SiO_2). The most useful major oxides for discriminating flow units are FeO, MgO, CaO, TiO_2 and P_2O_5. Numerous magma sources seem likely but there is no agreement on the type or degree of crystal fractionation nor the sigificance of crustal assimilation in the evolution of these lavas.
This most recent and comprehensive work on the Columbia River basalts does not answer questions such as why did this massive series of eruptions occur, what were the responsible tectonic controls, what processes were involved in the evolution of the various magmas and how do these volcanics relate to contemporaneous volcanism such as the Chilcotin plateau basalts of interior British Columbia and the Cascade volcanic province. It is expected that Volume 2 of this major ongoing study will answer many of these questions. (B.N. Church)

VOLCANOES IN THE NEWS ASH FALL #20





日本の火山分布図 Map of volcanoes of Japan

June 4, 1991

Mt. UNZEN
(Unzendake)

Japanese volcano kills 11, 36 missing

The Associated Press

TOKYO — A volcano belched searing gases, ash and hot rocks on to a small community in southwestern Japan on Monday, killing as many as 11 people and setting dozens of homes ablaze.

About three dozen people were unaccounted for, including 16 journalists as well as policemen, firefighters and researchers who had been monitoring the volcanic flow.

Officials said the fires and risk of further eruptions made it impossible for them to search the area to determine the real toll.

Kyodo News Service said a 25-year-old policeman was killed in his patrol car as he tried to warn residents to leave.

A military rescue helicopter spotted at least six other bodies near a river early today, Kyodo and television reports said. The reports later said as many as 11 bodies had been spotted.

The bodies could not be retrieved because of their proximity to the

people, 15 of them seriously burned.

The area was jolted by 11 earthquakes during the night, the Meteorological Agency reported today.

White clouds boiled up hundreds of metres into the sky, and television reports today showed parts of the mountain still afire from lava flows.

The volcano, Mount Unzen, caused landslides and tidal waves that killed 15,000 people when it erupted 200 years ago — Japan's worst volcanic disaster. It is among 19 active volcanoes in Japan listed as dangerous and kept under constant surveillance.

Authorities ordered some 5,000 people evacuated Monday after the volcano, which began its latest series of eruptions May 24, started spewing out ash, hot gases, rock and lava.

Scientists watching the volcano said the torrent rushed down a valley on the mountainside at speeds up to 200 kilometres per hour Monday afternoon. White clouds boiled up hundreds of metres above the flow.

After dark, fires still were burning in homes and patches of forest, and a new eruption was reported before midnight. Grey ash covered the area.

Kyodo said about 80 homes were burning in Kamikoba, a residential area of about 50 houses at the foot of Mount Unzen.

Mount Unzen, in Nagasaki prefecture 980 kilometres southwest of Tokyo, erupted Nov. 17 for the first time in 198 years. It also erupted Feb. 12.

The area is known for its hot springs, which draw many tourists

Disaster a fact of life in land of fiery peaks

The Associated Press

TOKYO — The Japanese have always lived a precarious existence among rumbling peaks of fire, cataclysmic earthquakes and tidal waves.

Mount Unzen, site of the most recent eruption, is only one of Japan's many volcanic peaks.

Some 250 volcanoes form the backbone of the Japanese archipelago — eight per cent of all the volcanoes in the world. About 75 of them are active and 19 are considered dangerous and under constant surveillance.

Many, including majestic Mount Fuji, are topped with shrines attesting to the divinity that Japanese bestow on the mighty forces of nature. Abundant volcanic hot springs also are worshiped for their healing and relaxing powers.

Unzen, in Nagasaki prefecture 980 kilometres southwest of Tokyo, is the deadliest of Japan's volcanoes after the 1792 eruption that killed 15,000 people.

It returned to life after 200 years of silence on Nov. 17, spewing mud and steam from two new craters.

It erupted again Feb. 12 and May 24 before Monday's catastrophic activity.

It is the first time a volcanic eruption in Japan has caused deaths since 1962, when five people died during the eruption of Mount Tokachi on the northernmost island of Hokkaido.

The most recent major eruption was in November 1986, on Izu-Oshima Island, 110 kilometres south of Tokyo, when Mount Mihara blasted molten rock 600 metres into the air. The island was evacuated but there were no direct casualties.

The island's 11,000 residents returned about a month later and now live a cautious existence. The volcano attracts thousands of tourists each year but could blow at any time.

Japan's most famous peak, Mount Fuji, last erupted in 1707, but is considered an active volcano.

Records dating back to 685 A.D. show 60 volcanic eruptions in Japan with more than 19,200 people killed. More than 1,000 have died in the past 100 years.

Times-Colonist news services

SHIMABARA, Japan — Soldiers raced for their lives as Mount Unzen in southwestern Japan billowed showers of searing stones and deadly gas for the second day Tuesday, a day after a major eruption killed at least 30 people.

Local authorities could not say how many other people might still be missing on Mount Unzen, although troops said they had sighted more trapped cars.

"We had just recovered four bodies when Unzen began spewing again," said a spokesman for the army unit spearheading rescue work.

Volcano experts, after analysing ash and debris from activity Monday and Tuesday, said a full-scale eruption could occur any time.

"We should take no chances," Kikuo Moriya, a seismologist at Nihon University in Tokyo, said.

One official said the army operation was a battlefield. It took place under a mass of billowing gas and smoke on the slopes of the 1,370-metre volcano.

Seven tracked armored cars were sent in with about 60 soldiers wearing metallic heat-resistant suits. Army ambulances waited for casualties as military helicopters hovered above.

"We raced out just ahead of a scorching downpour that left everything black," the army spokesman told reporters in Shimabara, a seaside city of 45,000 at the foot of the long-dormant volcano.

The army was forced to call back its entire unit of 1,000 troops after Tuesday's activity from the Mount Unzen crater which continued to spew out a mixture of gas, rocks and smoke.

Troops recovered only four bodies but pinpointed 24 others during their operation. The four bodies were burned beyond recognition.

Five others died in hospital, including one who died late Tuesday. A firefighter was among nine in critical condition from severe burns.

Among those feared dead were 16 journalists, — many who ignored warnings and stayed near areas restricted to rescuers — a renowned French vulcanologist couple, an American researcher, firefighters, policemen, farmers and taxi drivers.

Army officials said they would send in helicopters today to check Mount Unzen's crater for signs of fresh activity before resuming a search for the charred remains of victims.

A huge black cloud hung over Shimabara, 14 kilometres from the volcano's foot. The thick layer of grey ash covering houses, streets and fields made the resort look like a ghost town.

Haruyoshi Baba, 65, said his family managed to escape from their mountain home after the first eruption Monday.

"It was like repeated waves of searing stones, ash and gas pouring down," said Baba. "I haven't seen anything like this since the A-bomb."

"First it was like showers of tiny rocks, but the very next moment I found myself surrounded by burning rocks and a wave of intense heat. I had difficulty breathing," said a cameraman who received minor burns from Monday's eruption.

Asked why so many newsmen had risked their lives on the mountain, one cameraman said: "There is a lot of competition between companies."

People with severe burns and their clothes in shreds were taken to hospitals after the volcano erupted.

The liquid fire set scores of homes ablaze, detroying nearly all the 50 homes in one residential area at the base of the mountain.

The volcano has been spewing what scientists call a pyroclastic flow, or glowing avalanche. Much faster than a lava stream, a glowing avalanche can move dozens of kilometres in an hour and consists of a superheated, fluid-like emulsion of volcanic ash, gas and rock fragments too heavy to rise skyward.

Mount Unzen came to life last November after a 200-year dormancy. In its 1792 eruption, Unzen sent a tidal wave across a bay and killed 15,000 villagers.

In Tokyo, Prime Minister Toshiki Kaifu ordered his cabinet to set up a special task force to help with the clean up.

Television pictures Tuesday showed the mountainside covered in grey ash and debris. Fires were still burning.

"It was a really heart-breaking scene," said vulcanologist Kazuya Ohta of nearby Kyushu National University, after flying by helicopter above the billowing crater.

A GEOLOGICAL SKETCH OF NORTHERN KYUSHU

Kyushu is the southernmost of Japanese main islands and is geologically a part of Southwest Japan. In view of geotectonics, however, Kyushu is located at the intersection of the main island-arc and Ryukyu-arc. Thus, the geology of this island bears the characteristics of both arcs.

In Southwest Japan, a tectonic line called the Median Line runs nearly parallel with the island-arc from central Honshu, through Shikoku to Kyushu. This line divides Southwest Japan into the Outer Zone (the southern side) and the Inner Zone (the northern side). The most characteristic feature of the Outer Zone is a zonal arrangement of pre-Neogene rocks parallel to the general trend of the arc. In the Inner Zone, acid intrusives and related metamorphism are conspicuous. The western extension of the Median Line is not so clear in central Kyushu, but is traceable and divides Kyushu into two parts, northern Kyushu and southern Kyushu.

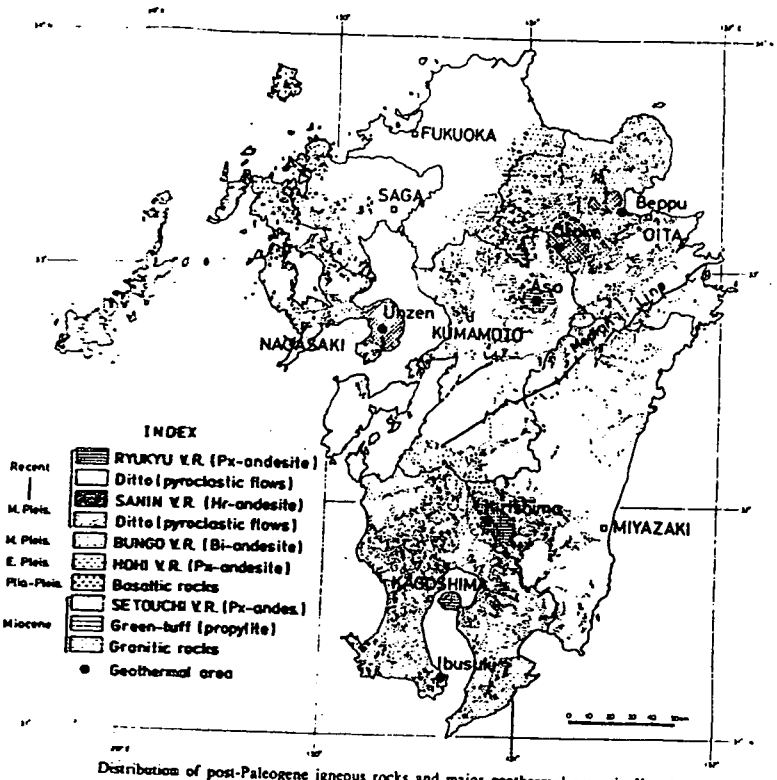
The oldest rocks in northern Kyushu are the Paleozoic formations and their metamorphosed members which are distributed in several places. The Paleozoic formations, assigned to Permian and Carboniferous ages, are composed of geosynclinal sediments. Graywacke, clayslate, chert, limestone, and basic submarine volcanic products are the main constituents. The Paleozoic formations show complicated structures, being regionally metamorphosed to a considerable extent. The metamorphic complexes consist mostly of graphite-sericite schist, green schist, epidote amphibolite, and their phyllitic equivalents, and are usually accompanied by basic and ultrabasic intrusives.

The Mesozoic formations are exposed in the northernmost Kyushu. They belong to Cretaceous age, and are composed of sediments in inland basins and also rich in andesite and rhyolite, being closely related to the Cretaceous of the southern part of Korea. There are wide exposures of granitic rocks around Fukuoka city. Most of them are designated as the intrusives of early or late Mesozoic time.

The Paleogene formations are developed in the northern and western parts. They consist mainly of clastic sediments and intercalated coal measures.

The volcanic activity in Paleogene time is represented only with a small amount of rhyolitic tuff in the coal-bearing formation. In early Miocene, a more remarkable volcanic activity took place (Fig. 1). Thus, the effusive rocks are common in the Neogene formation. they are calc-alkaline, ranging from andesite to rhyolite, and the older parts have been subjected to propylitization or altered to green-colored rocks (Green tuff). Gold-bearing quartz veins occur in these altered volcanic rocks. Basaltic rocks of Pliocene or Pleistocene age are distributed in northwestern Kyushu.

In early Pleistocene, another intense volcanic activity (Hohi) took place. Thick effusive rocks of this time cover widely north-central Kyushu. The volcanism continued until Recent time, and have formed many lava plateaus and volcanic zones. Across the central Kyushu one volcanic zone runs in WSW-ENE direction and extends east to the Chugoku area through Beppu (Sanin volcanic zone). Another volcanic zone coming up through southern Kyushu from the Ryukyu islands meets the former at the center of Kyushu, where Aso Volcano, famous for its gigantic caldera, is situated. Most of these Quaternary effusive rocks are calc-alkaline, and the rocks of andesite-dacite series are most abundant.



Distribution of post-Paleogene igneous rocks and major geothermal areas in Kyushu. (Geologic map after Y. Matsumoto)

Related to the volcanic activity from Pleistocene to Recent, many deposits of sulfur, iron sulfide, limonite, kaolin, and opaline silica were formed.

There also distribute a large number of geothermal areas with such manifestations as fumaroles and hot springs along the two volcanic zones. Among them, at Otake and Hatchobaru, geothermal energy is being used for electric power generation, and Beppu is the largest hot spring resort in Japan.

(M. HAYASHI)

June 5, 1991

12 dead, 36 missing as volcano erupts

People burned as searing gases, hot rocks set dozens of homes ablaze in Japanese community

Associated Press

TOKYO — A volcano belched searing gases, ash and hot rocks onto a small community in southwestern Japan yesterday, killing several people and setting dozens of homes ablaze. Twelve were confirmed dead and 36 other people were reported missing.

Most of those unaccounted for were people who had been expected to report in: policemen, firefighters, volcano researchers, taxi drivers, and 16 journalists. Officials said the fires and risk of further eruptions made it impossible for them to search the area to determine the real toll.

A military rescue helicopter spotted 11 bodies near a river early today, Kyodo News Service said. The bodies could not be retrieved because of their proximity to the broiling debris.

The news service said a 25-year-old policeman was killed in his patrol car as he tried to warn residents to leave.

White clouds boiled up hundreds of metres into the sky, and television reports today showed parts of the mountain still afire from lava flows.

About 200 years ago, an eruption of the same volcano, Mount Unzen, caused landslides and tidal waves that killed 15,000 people — Japan's worst volcanic disaster. It is among 19 active volcanoes in Japan listed as dangerous and kept under constant surveillance.

An American researcher, Harry Glicken, was among the missing, according to Joan Magruder, a spokeswoman for the University of California at Santa Barbara, where Mr. Glicken was an assistant researcher in geological sciences.

Mr. Glicken, who worked for the U.S. Geological Survey until 1989, narrowly escaped death in the 1980 eruption of Mount St. Helens in Washington State. He was scheduled to be on an observation post the day the mountain blew up, but happened to switch shifts with another man, who died in the eruption of May 18, 1980.

Kyodo said a French couple, including a researcher the agency identified as Maurice Kraft, also were missing.

Police and firefighters said 20 people were injured, 15 of them seriously burned by the volcanic flow.

Authorities ordered some 5,000 people removed yesterday after the volcano, which began its latest series of eruptions on May 24, started spewing out ash, hot gases, rock and lava.

"I heard on radio that it was happening. We ran as quickly as we could," one woman told a television interviewer from the safety of a school.

Scientists watching the volcano said the lava torrent rushed down a valley on the mountainside at speeds up to 200 kilometres an hour yesterday afternoon. White clouds boiled up hundreds of metres above the flow.

After dark, fires still were burning in homes and patches of forest, and a new eruption was reported before midnight. Grey ash covered the area.

Kyodo said about 30 homes were burning in Kamikoba, a residential area of about 50 houses at the foo of Mount Unzen.

"There is no guarantee that ar other flow of this scale will not occu again," Daisuke Shimozuru, chai man of the Co-ordinating Commi tee for the Prediction of Volcan Eruptions, told reporters. "But it nearly impossible to say when o where."

Mount Unzen, in Nagasaki pr fecture 1,000 kilometres southwe of Tokyo, erupted Nov. 17 for th first time in 198 years. It also erupte Feb. 12.

Lava recently approached Kam koba, leading to a number of tempo rary evacuations, but yesterday wa the first time it reached the home said Fumiyasu Tokunaga of the fi department in Shimabara, a neart city of 45,000.

June 10, 1991

Filipinos flee as sleeping volcano comes to life

June 10, 1991

Mount Pinatubo, about 100 kilometres northwest of Manila, began to show signs of activity in April for the first time in more than 600 years, and last week it belched small amounts of steam and ash.

The eruption sent searing gases, ash and rock pouring from two craters of the 1,460-metre mountain at speeds up to 100 km/h. Debris was sprayed as far as the South China Sea, 30 kilometres to the west.

"Unfortunately, this is just the beginning. ... Stronger and bigger eruptions are still possible," Philippine volcanology chief Raymundo Punongbayan said in a radio interview.

He predicted Mount Pinatubo's next eruption would be "the explosive type, characterized by pyroclastic [lava] flows which could be very destructive.

The volcano may be building up for a second, more powerful and destructive eruption, said the Philippines' chief vulcanologist, Raymundo Punongbayan.

"The present lull is deceptive. Stronger eruptions should be expected," he said in a television interview today.

"These are rocks, ash and gas which are very hot.

"They can kill people in their path."

The governor of Zambales province, Armor Deloso, said he tried to approach the volcano's slope, but turned back because of the thick ash.

"I could not breathe because the ashes were getting into my nose," he said. "It's raining ashes. The plants were all covered with ashes."

Of the 12,000 people evacuated from the area, about 3,100 are primitive Aeta tribesmen who lived on the slopes of the mountain. They were moved last week.

At Clark Air Base, about 15 kilometres east of the volcano, U.S. air force spokesman Lt.-Col. Ron Rand said volcanic activity had increased overnight, prompting the order to evacuate the base's 16,000 troops, dependents and civilian employees.

June 11, 1991

The Philippine Institute of Volcanology and Seismology said it measured continuous harmonic tremours yesterday, indicating that magma was rising to the surface of the volcano's craters.

Raymundo Punongbayan, director of the institute, said a magma dome about 100 metres long, 60 metres wide and 30 metres high could be seen above the crater.

He said most of the ash and molten rocks had been flowing westward, away from Clark but geological studies showed that, in the previous eruption 600 years ago, the main path of the pyroclastic materials cut across what is now the western portion of Clark.

Mount Pinatubo was in the early eruptive stage, Mr. Punongbayan said, and "after that we will have bigger" eruptions.

In Japan, meanwhile, a 38th person died yesterday from burns suffered in last week's eruption of Mount Unzen in the south and authorities in the area warned that mudslides of volcanic debris could be set off by heavy rain.

Some volcano experts also suggested that the eruptions of Mount Unzen, along with increased volcanic activity elsewhere, could be a prelude to other eruptions.

Even Mount Fuji, Japan's most famous mountain, was showing signs of restiveness. Underneath Mount Fuji, 100 kilometres west of Tokyo, "there is no mistaking the fact that magma is piling up," Masaaki Kimura told the newspaper Asahi Shimbun.

June 13, 1991

MANILA — Tremendous explosions rocked Mount Pinatubo throughout yesterday, shooting streams of ash and steam 25 kilometres high and sending molten rock down the steep mountain slopes.

Thousands of Aeta tribesmen fled the lush, green slopes on buffaloes and ox-drawn carts after stones as big as a man's head rained down on them.

Only one death was reported as a result of the eruptions, the largest at Pinatubo in more than 600 years.

The huge plume could be seen in Manila, 95 kilometres to the south. The cloud drifted westward into the South China Sea, raining ash over a wide area of Zambales province on the western slopes of Pinatubo.

Airlines are keeping close track of the cloud of volcanic rock and ash floating downwind from the eruption, and experts said the debris could bring down any plane that tried to fly through it.

Heavy rains drenched the area late yesterday and scientists warned that mudflows threatened the slopes and nearby plains.

After three eruptions during the day, the volcano calmed, then exploded late at night with a fury.

In Japan, a powerful explosion of Mount Unzen early this morning hurled stones more than five kilometres. It was the second eruption in nine days, and scientists warned that a new and far more dangerous blast was in prospect.

'The Never Ending Story'

ANNUAL MEETING OF THE VOLCANOLOGY DIVISION, GAC
May 29, 1991

Attending: Les Coleman, Chairman; Cathie Hickson, Vice-chairman; Jarda Dostal; Georgia Pe-Piper; Tony Fowler; Cathy Timms; Angela Kolisnik; Tom Pearce; Gunter Muecke; David Lentz; Sharon Templeton; Barry Cameron; Walter Gibbins; Neil Church; Tark Hamilton, Councillor for research; Bob Baragar; John Stix; Pierre Verpaelst; Karen St.-Seymour, Councillor-central; Bill Podgham. Regrets: Ted Grove, secretary/treasurer; Paul Wodjak Councillor-west; Scott Swindon, Councillor-east.

1. The meeting was called to order by Les Coleman, Chairman, at 16:00 in the Halton Room, L'Hotel, Toronto.

2. Agenda for the meeting was presented by the Chairman and approved as presented.

3. Minutes of the previous annual meeting were distributed and read by the Chairman, and approved as presented.

4. No business arising from the minutes

5. The Chairman's report was presented and accepted with one correction. (appended)

6. Report of the secretary-treasurer was presented and accepted. (appended)

7. Lepold Gelinas Award. There were two equally deserving winners chosen from the 7 thesis submitted: Angela Kolisnik and Barry Cameron. (list of thesis considered is appended)

Mr. J. Remick, a friend of Lepold Gelinas, has written to the chairman, proposing that a medal be struck in honour of Lepold Gelinas, and that it be presented along with the certificate to the recipients of the award. This was accepted in principal with the proviso that the cost be assessed to ensure that it is within the means of the Division and that GAC approves the rewarding of a Student Medal, by the Division. If cost becomes an issue, the present recipients of the award indicated that they would prefer a medal over money because a medal would have lasting value.

> Action: Les Coleman to write to Mr. Remick to get specific details of the cost and if the expenditure is considered within the means of the Division by the Chairman and Secretary-Treasurer, then permission from GAC will be sought.

Tom Pearce moved that the Lepold Gelinas Best Thesis Award be given each year for a Ph.D. and M.Sc. thesis if a thesis of suitable standard is received. Motion 2nd by Walter Gibbons.

Discussion: 1. Jarda Dostal said that only 2-3 thesis are submitted each year, and this may not be enough to choose from. 2. Tark Hamilton raised concern over finding enough people to evaluate the thesis. 3. Tom Pearce maintained that there are not an overwhelming number of thesis to review and that a good thesis will be apparent. He also noted that it is unfair for the student to have to wait for what could be as long as two years to receive an award when they will be searching for jobs and may benefit from receiving the award in their job search. 4. If a medal is to be given for the award, then the possibility of giving up to two medals each year must be taken into consideration (see above).
Motion carried with one against.

8. Response to the proposed Greek field trip to be held this year was insufficient to run the trip. It will be offered again as a pre-meeting trip in conjunction with Wolfville '92. Some of the inter-island flights associated with the trip will be reassessed in order to reduce costs.

9. Wolfville '92: Jarda Dostal is organising a special session on Appalachian Volcanology for the meeting. The Division sponsored field trip will be to Greece.

Edmonton '93: Three special sessions/symposia were suggested: Tephra Chronology, Quaternary Volcanism, and Magmatic Processes. The session on Tephra chronology and Quaternary volcanism could be combined.

> Action: Cathie Hickson will contact John Westgate to explore options for a Quaternary volcanology/Tephra Chronology session for Edmonton with an accompanying field trip. Field trip would be a bus trip from Vancouver to Edmonton to visit Eocene, Pleistocene and Holocene volcanic exposures. Tom Pearce will contact other interested people to assess the feasibility of a Magma Processes session for the conference. Les Coleman will write the Technical Program Chairman, Grant Mossop, for Edmonton '92, expressing the desire of the Division to sponsor at least two sessions and that the Technical Committee for Edmonton should correspond directly with Tom Pearce and Cathie Hickson.

10. Election of officers: Two positions on the executive expire this year: Tark Hamilton, Councillor for Research and Scott Swindon, Councillor-east. Bob Baragar made a motion to accept the nominations of Tark Hamilton for Councillor for Research (3rd term) and Georgia Pe-Piper, Councillor-east. 2nd by Neil Church. Tom Pearce moved to nominate Kelly Russell for Councillor for Research. 2nd by Tony Fowler. Georgia Pe-Piper declared elected for Councillor-east. Kelly Russell elected Councillor for Research.

Action: Les Coleman to contact Tark Hamilton and express the Divisions thanks and gratitude for his service to the executive. Contact Kelly Russell and inform him of his new position.

11. Tony Fowler moved that the Division should recognize the work of researchers by awarding a certificate for the best paper in Volcanology/Igneous Petrology. 2nd by Karen St.-Seymour. Discussion: Walter Gibbons noted that MAC gives a best paper award for papers published in the Canadian Mineralogist. Walter suggested that the motion be amended to include a distinguished Career Award. 2nd by Tom Pearce. discussion continued as to the Divisions ability to pay for the striking of a medal for the Distinguished Career Award or other appropriate token. The Distinguished Career Award should be given out at the GAC Annual Meeting Luncheon. This award would not necessarily be given out annually, but it was noted that there is a backlog of deserving recipients at this time. To facilitate the awarding of such a prize by the next Annual meeting the motion was adopted as made and an ad hoc committee set up to look into the matter. This committee will solicit suggestions from the general membership on these awards through Ashfall. The Ad hoc Committee members are: Bob Baragar, Tony Fowler, Tom Pearce and Cathie Hickson.

Possible options regarding the time of the Annual Business meeting were discussed. Possibilities were a breakfast meeting or luncheon. Luncheon meeting did not seem desirable as many Division members like to attend the GAC, MAC or MDD Luncheons. It was agreed that the best time would be on the afternoon of the Volcanology General Session, unless that was the last day of the meeting.

Action: Les Coleman to correspond with the organizing committee for Wolfville to find the most suitable time for the meeting.

12. Les Coleman moved that the meeting be adjourned at 17:30. 2nd by Cathie Hickson.

Minutes taken and prepared by Cathie Hickson.

Volcanology Division Awards
Report of the ad hoc committee

The ad hoc committee struck to look into awards for the Volcanology Division met immediately following the Annual General Meeting. The committee consists of Bob Baragar, Tom Pearce, Tony Fowler and Cathie Hickson. The members present at the Annual General Meeting agreed in principal to the awarding of one or more awards to researchers in the fields of volcanology and Igneous petrology. Based on the discussion held in the Annual General Meeting the following recommendations were reached by the committee:

An Awards Committee should be established, chaired by the Chairman of the Division. The committee should consist of at least four members, two from the executive and two from the members at large. Committee members would serve for at least two years; overlap of members would occur to ensure continuity in award standards. The committee would be responsible for the following awards.

1. Lepold Gelinas Student Prize for the Best Ph.D. Thesis written at a Canadian University.

2. Lepold Gelinas Student Prize for the Best M.Sc. Thesis written at a Canadian University.

3. Distinguished Researcher Award for contributions to volcanology and/or Igneous Petrology.

4. Prize for the best paper in volcanology and/or igneous petrology for a paper published in an internationally recognized Journal by a researcher at a Canadian Institution or Company.

There are a number of individuals across the country who have contributed significantly to our understanding of volcanic rocks and igneous processes. The work of these individuals should be recognized by the GAC through the Volcanology Division. The recipient of the award should be given some token of lasting value. This token could be in the form of a medal as given by other Divisions, but could also be something uniquely volcanological - there must be a material out there that could be used to produce a plaque, medal, book ends(?). We would like to receive suggestions from division members on what they think would be suitable.

If you have any suggestions or comments on the proposed awards, we would very much like to hear from you. We would like to receive your suggestions and comments as soon as possible so that the proposed new awards can be presented to the GAC National Council at their next meeting, sometime in October. This would give us sufficient time to call for nominations for the awards and present the first Distinguished Research Award at the GAC Luncheon in Wolfville '92.

May 22, 1991

Dr. L.C. Coleman, Chairman
Volcanology Division, GAC

Report of the Secretary-Treasurer:

The annual meeting of the Volcanology Division was held in the Boardrooom of the Hotel Vancouver, Vancouver, B.C., on May 18, 1990. Minutes of the 1990 meeting were recorded by the Secretary and published in Ash Fall #25, July 1990.

In 1990 the membership of the Division expanded to 192 including 10 in the USA, 4 in Australia, 1 each in France, Greece and Indonesia. The 1991 membership is unknown because of the lack of a new GAC list.

The Division financial statement as of December 31, 1990 is attached. The current Division finances total $2,860.77 as of April 30, 1991. No funds have been received from the GAC for 1991.

The 1990 Leopold Gelinas Award of $250.00 was given to John Stix (Ph.D., 1990, Univ. of Toronto) who previously won the award for his M.Sc. thesis.

Report of the Editor, "Ash Fall":

In 1990 four editions of Ash Fall (#23, 24, 25, & 26) were published. A complete volume of abstracts re Mt. St. Helens was also distributed to Division members. An outline of the proposed Greece field tour was included in Ash Fall #26. This trip was cancelled and deferred to 1992 because of a lack of response.

Because of increased postage costs and in order to conserve Division funds it was decided to limit Ash Fall 1991 to three editions. Because the GAC mailing list is not complete until December 31st of the year at least two Division members did not receive Ash Fall in 1990. Other members missed editions because of changes of address which were not reported.

Edward W. Grove, Ph.D., P.Eng.
Secretary-Treasurer
Editor, Ash Fall

GEOLOGICAL ASSOCIATION OF CANADA
FINANCIAL STATEMENT
VOLCANOLOGY DIVISION
FOR THE YEAR ENDED DECEMBER 31, 1990

Opening Balance, January 1, 1990		$3,307.00
Revenues and Receipts:		
Bank Interest	$258.04	
Division Dues for 1989	680.00	
Sale of Trans Mexican Field Trip Guide Book	0.00	
TOTAL	$938.04	
Expenses		
Production of Ash Fall (4 issues)	1,134.35	
Leopold Gelinas Volcanology Thesis Award	250.00	
Miscellaneous office expenses	18.98	
TOTAL	1,403.33	
Net Revenue (Deficit)		(465.29)
Closing Balance, December 31, 1990		$2,841.71
Represented by:		
Chequing Account (Pacific Coast Savings Credit Union)		$2,841.71

LEOPOLD GELINAS AWARD

Seven M.Sc. theses were submitted for consideration for the Leopold Gelinas Award for 1991. They were as follows:

Paul Budkewitsch - University of Toronto
"Deformation of pillowed and massive metabasalts in the early Proterozoic Cape Smithh tectonic belt, New Quebec, Canada"

Barry Cameron - Dalhousie University
"Petrochemistry and origin of altered Permian basalts in the Sverdrup Basin, Arctic Canada"

Angela Kolisnik - Queen's University
"Phenocryst zoning and heterogeneity in andesites and dacites of Volcan Popocatapetl, Mexico"

Henry Marsden - Carleton University
"Stratigraphic, structural and tectonic setting of the Shasta Au-Ag deposit, north-central British Columbia"

David Seneshen - University of Manitoba
"The genesis of Archean pyroclastic rocks of the Manigotagan River Formation, southeastern Manitoba"

Ralph Swinamer - Queen's University
"The geomorphology, petrography, geochemistry and petrogenesis of the volcanic rocks in the Sierra del Chichinautzin, Mexico"

Ian Trinder - University of Western Ontario
"Epithermal base and precious metals, Buck Creek, central British Columbia"

The conclusions of the jury, which consisted of L. Coleman, J. Dostal, D. Hall, T. Hamilton, R. Laurent and D. O'Hanley, were that there should be a joint award to Barry Cameron and to Angela Kolisnik.

In the words of one juror, Barry Cameron's "M.Sc. thesis is worth a Ph.D. It is outstanding because of its logical structure and methodology.....It is an example of what should be done to define old volcanic sequences in Canada." Another juror commented that Angela Kolosnik's thesis is "an impressive piece of work in which considerable originality is displayed in arriving at a convincing answer to a petrogenetic problem of great volcanological significance. In many places, work of this quality and clarity would be deemed worthy of the award of a Ph.D."

While these two theses were judged best, it should be emphasized that all that were submitted are of a very high quality which augurs well for future volcanological work in Canada.

PHENOCRYST ZONING AND HETEROGENEITY

IN ANDESITES AND DACITES OF VOLCÁN POPOCATÉPETL, MEXICO

A thesis submitted to the Department of Geological Sciences in conformity with the requirements for the degree of Master of Science
Queen's University Kingston, Ontario, Canada

Angela M.E. Kolisnik July, 1990

ABSTRACT

Intermediate volcanic rocks from Popocatépetl (5,452 m), a major Quaternary strato-volcano in the central part of the Trans-Mexican Volcanic Belt, were examined for petrographic and chemical features consistent with magma mixing. In addition to standard petrographic methods, two interference imaging techniques -- narrow fringe laser interferometry, and Nomarski differential interference contrast microscopy -- were used to study compositional zoning and other microscopic textures of the phenocrysts.

The study samples include calc-alkaline two-pyroxene andesitic and dacitic lavas (60 to 68 wt.% SiO_2) taken mainly from the active modern cone (Popocatépetl Volcanic Series, < 0.04 Ma). Several of the study samples are thought to be part of an eroded basal volcano (Nexpayantla, < 0.73 Ma) which underlies the modern structure.

No basic composition lavas were found within the volcanic pile, but the andesites and dacites contain abundant chemical and textural evidence of pre-eruptive interaction with a more primitive magma. In addition to high whole-rock MgO, Ni, and Cr contents, the lavas are characterized by mineralogical and textural disequilibrium features including: sparse forsteritic olivine crystals (Fo_{90-71}), coexisting pyroxenes of contrasting composition (Mg opx: En_{87-70}; Fe opx: En_{69-60}; Mg cpx: $En_{49.1}$ $Fs_{7.8}$ - $En_{46.5}$ $Fs_{9.9}$; Fe cpx: $En_{45.9}$ $Fs_{10.9}$ - $En_{39.2}$ $Fs_{19.3}$), strong reverse zoning in pyroxene crystals (opx: max. ΔEn 18 %; cpx: max. ΔEn 10 %), and Mg-rich groundmass pyroxene grains. Olivine crystals commonly have orthopyroxene reaction rims. Although the lavas are mostly homogeneous in hand sample, patchy groundmass textures (possible relict evidence of mixing) are common, and macroscopic mixing and "mingling" textures were observed in one lava flow.

Plagioclase phenocrysts (An_{71-21}) are characterized by complex discontinuous normal-oscillatory-even or normal-oscillatory-normal zoning patterns, and contain evidence for repetitive events of erosion (by dissolution) and renewed growth. Cross-cutting zone interfaces (indicating erosion of underlying zones) are typically overgrown by sharp calcic shifts in composition (Δ10 to 37 An % enrichment). Glass inclusion-charged zones commonly display evidence of partial dissolution and reaction of the crystal, compatible with magma mixing. Extremely heterogeneous crystal populations, with little correlation of zoning between coexisting grains, are strongly suggestive of relative movement in a turbulent mixing environment.

The results are consistent with a petrogenetic model of magma mixing involving periodic injections of primitive basaltic (olivine-phyric) magma into an upper crustal dacitic magma reservoir. The intermediate lavas are interpreted as hybrid products of complex pre-eruptive mixing, showing varying degrees of preserved heterogeneity. Contrary to the petrogenetic model proposed in previous work, however, plagioclase zoning stratigraphies are not consistent with growth of plagioclase in a stagnant upper region of a stratified magma chamber, isolated from the lower mixing zone.

Petrochemistry and origin of altered Permian basalts in the Sverdrup Basin, Arctic Canada

Submitted in partial fulfillment of the requirements for the degree of Master of Science

Barry Ian Cameron

Dalhousie University
Halifax, Nova Scotia
Canada

September, 1989

ABSTRACT

This thesis presents new geochemical and stable-isotope data on hydrothermally altered Permian basalts of the Esayoo Formation and describes their role in the formation of the Sverdrup Basin in Arctic Canada.

Basaltic magmatism, coincident with late Paleozoic rifting, consists mainly of subaerial basaltic flows of the Late Carboniferous Audhild and the Permian Esayoo formations on northern Ellesmere and Axel Heiberg islands. North of Greely Fiord, Ellesmere Island, the Esayoo Formation attains a maximum thickness of 300 m, but rapidly thins westward, where pillow lavas, epiclastic basalt conglomerates, and associated marine sediments indicate proximity to an ancient shoreline.

Elemental mobility studies incorporating discriminant function analysis demonstrate that modifications in Fe_2O_3, K_2O, CaO, CO_2, Li, Ba, Rb, and Cu contents accompanied hydrothermal alteration. Significant enrichments in the $d^{18}O$ of the Esayoo basalts required interaction with a high ^{18}O hydrothermal fluid. The favoured hydrothermal model proposes that formation waters formed in the subsiding Sverdrup Basin by isotopic equilibration between Artinskian seawater and high-^{18}O marine sedimentary rocks at 240°C. A minor contribution to the elevated ^{18}O values of the fluid may have originated by seawater evaporation in a closed basin.

Familiar discriminant diagrams involving relatively immobile trace elements and the composition of relict clinopyroxenes reveal within-plate, alkaline to transitional basalt affinities. Rare-earth-element ratios and compatible trace element concentrations suggest that variable degrees of partial melting (between 5 and 20%) of an enriched garnet lherzolite from an asthenospheric source, and combined olivine-clinopyroxene crystal fractionation, respectively, can account for observed compositional variations. Trace-element data do not indicate significant lower-crustal contamination.

Small degrees of partial melting of a garnet lherzolite source generated primitive alkaline basalts of the Audhild Formation in response to small values of lithospheric stretching during Carboniferous rifting. Following a brief period of thermal relaxation, the alkaline to transitional Esayoo basalts were produced from a similar mantle source (minus the Audhild melt fraction). Slow conductive cooling throughout the Mesozoic caused accretion and coupling of this residual asthenospheric mantle to the thickening lower lithosphere. An elevated geotherm inherited from the initial Carboniferous rifting episode may account for the voluminous, tholeiitic lavas of the Early Cretaceous.