ASH FALL
Newsletter of the Volcanology Division
Geological Association of Canada

ASH FALL # 23
January, 1990

ACTIVITIES

Responses for the 1991 proposed field trip should be returned as soon as possible.

CONTRIBUTIONS

Contributions to Ash Fall are welcomed and should be sent to:

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4581 Boulderwood Drive
Victoria, B.C. V8Y 3A5
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FAX (604) 658-5289

RESEARCH SURVEY

Please return your updated research project forms to Tark Hamilton.

CONFERENCES

VANCOUVER '90, GAC/MAC, May 16-18, 1990, Hotel Vancouver

SPECIAL SYMPOSIUM COMMEMORATING THE 10TH ANNIVERSARY OF THE ERUPTION OF MOUNT ST. HELENS

Organizers/Chairmen: Catherine J. Hickson, GSC; & Don W. Peterson, USGS

This symposium will provide an overview of Cascade volcanism, the events leading up to the eruption on May 18, 1980 as well as aspects of the eruption and continuing activity. Several other potential "problem" volcanoes in the Cordillera will also be examined. The oral sessions will be given by invited speakers who have worked in the Cascades, or at Mount St. Helens, however poster presentations on Neogene volcanism are invited and strongly encouraged. The symposium will be held during the GAC/MAC 90 VANCOUVER meeting in mid-May 1990.

1990 MEETING OF FRIENDS OF IGNEOUS ROCKS

The 1990 meeting of the FRIENDS OF IGNEOUS ROCKS will be held at Oregon State University, Corvallis, Oregon from August 25 to August 28, 1990. Invitations have been mailed to selected participants by Roger L. Nielsen, College of Oceanography of Oregon State University.
LEOPOLD GELINAS AWARD
VOLCANOLOGY DIVISION - G.A.C.

Prize: $250.00 for the best thesis submitted.

The rules for this award are now as follows:

2. The thesis must be written by a Canadian, or at a Canadian University. The topic and author can be non-Canadian.
3. The thesis content must be at least 50% volcanology or volcanology-related.
4. The prize need not be awarded.

The nominations will be evaluated on originality, validity of concepts, organization and presentation of the data, understanding of volcanology and depth of research.

For evaluation please send 1 copy of the thesis BEFORE FEBRUARY 28, 1990 to:

Roger LAURENT
Chairman, Volcanology Division
Dept. of Geology
Laval University
Ste-Foy, Qc G1K 7P4

ABSTRACT - 1989 LEOPOLD GELINAS AWARD WINNING M.Sc. THESIS

Author: F. Brissette        Universite de Montreal 1988 M.Sc. Thesis
Director of Thesis: Jean Lajoie

Interpretation sedimentologique de depots pyroclastiques des Monts Vulsini, Italie centrale

The sequence of primary structures in five eruptive units of the Vulsini Volcano, was studied in two stratigraphic sections near the villages of Pitigliano and Sorano, Central Italy.

The basal bed of all eruptive units originated from a turbulent suspension, whereas the overlying bed has "laminar" characteristics. Only one unit has all the characteristics of the model proposed by Sparks et al (1973). The other units lack the "typical" cross-laminations at their base, and all show evidence of a significant time gap between the emplacement of the two beds. The two-bed succession is the only common characteristic shared by all eruptive units, the other succession being random.

It is shown that the terminal fall velocity of the mean grain size best approximates the shear velocity of turbulent nées ardentes, which permits the calculation of shear stresses, and mean flow velocities. Problems related to the transportation of dense pyroclastic flows in a semi-fluidized state can be solved by considering the action of the dispersive pressure.
ABSTRACT — EVALUATION OF MAGMATIC PROCESSES FOR THE PRODUCTS OF THE NEVADO DEL RUIZ VOLCANO, COLOMBIA FROM GEOCHEMICAL AND PETROLOGICAL DATA

N. VATIN-PERIGNON\(^1\), P. GOEMANS\(^1\), R.A. OLIVER\(^2\) & E. PARRA PALACIO\(^3\)
Williams (Editor), Nevado del Ruiz Volume. J. Volcanol. Geotherm Res.

Trace-element concentrations of the eruptive products from the Nevado del Ruiz volcano indicate that at least for the last 1 Ma, the major controlling factor in the evolution of the magma has been a simple fractional crystallization.

The Zr/Hf ratios suggest that the source material is mantle-like in origin and whilst subduction-related contamination of the source material has taken place, there is no evidence that assimilation of continental crust has affected the series.

No convincing geochemical evidence for magma mixing was found, and data on banded pumices of Pleistocene, Historic and the 1985 eruptions strongly support a crystal fractionation model to explain the compositional variation of their glasses. Therefore if mixing has taken place it can only be a mixing of layers within a stratified or partially stratified magma chamber.

Modeling of fractional crystallization using a stepwise program has been undertaken and least-squares approximations with small residuals are commensurate with analysed samples. Crystal fractionation models with plagioclase dominating two pyroxenes and iron oxides give good fits for all calculations. We conclude that simple crystal fractionation is the process most consistent with major and trace-element variations in the Ruiz series. This closed system-model requires at least 77% crystal fractionation of a basaltic parent to generate the observed compositions of dacites.

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PUBLICATION ANNOUNCEMENT: VOLCANOES OF NORTH AMERICA

Volcanoes of North America, edited by Chuck Wood is soon to be published by Cambridge University Press. There are 88 contributors and 260 separate accounts of individual volcanic centres or complexes. This work is a collection of short cv's on volcanoes with activity in the past 5 Ma. Each centre or complex is featured in a photo, topographic map, written description and references. Some regional overviews are also given. The complete volume is 360 pages, of which 36 pages is on Canadiana volcanism, describing and locating 21 complexes. Written accounts include (N to S): Volcano Mountain, Tuya Butte, Level Mountain Range, Mount Edziza, Maitland, Hoodoo Mountain, Iskut-Unuk River Cones, The Thumb, Nazco Cone, Chilcotin Basalt, the Itcha Mountains, Ilgachuz Range, Rainbow Range, Milbanke Sound Cones, Wells Grey-Clearwater Volcanic Field, Mount Silverthrone, Bridge River Cones, Meagher Mountain, Mount Cayley, Mount Garibaldi and Garibaldi Lake. Other Canadian centres are represented in a table and map by Cathie Hickson. Chuck has promised this fine work by spring (Spring in Texas, not spring in the Yukon!).
During 1989 members of the Volcanology Division visited three of the Aeolian Islands. A recent paper on the tectonic setting of the area was in Ash Fall #22. The following four abstracts continue the theme.

THE AEOLIAN ISLANDS
De ROSA R.1, LANZAFAONE G.2 and MAZZOLI R.1
1 Dipartimento di Scienze della Terra, Universita della Calabria, Catanzaro
2 CNR - Istituto Internazionale di Vulcanologia, Catania

GENERAL FRAMEWORK
The Aeolian archipelago consists of seven islands, entirely made up of volcanic products, located in the southern Tyrrhenian sea and lying on the inner edge of the Calabro-Peloritani crystalline belt. Geochronological data indicate that the volcanic products outcropping on the islands were erupted during the last 0.5 m.y. (Gillot and Villari, 1980), while samples dragged from the submarine part of the arc have been dated between 1.3 and 0.2 m.y. (Bacca et al., 1981).

As far as the islands are concerned, two main stages of activity can be distinguished, with a partial overlap in time:

- a first stage during which the islands of Panarea and Filicudi were entirely built up, together with the oldest parts of Salina and Lipari; and
- a second stage, from upper Pleistocene to present, when the islands of Salina and Lipari have completed and later completed and transformed. Stromboli were formed. Lower volcanic eruptions occurred on Lipari, Vulcano and Stromboli, the latter being characterized by a persistent explosive activity (strombollian) which is still in progress. According to a widely adopted classification scheme (Peccei and Taubes, 1976; cald-alkaline, high-K cald-alkaline and shoshonitic products can be found on the Aeolian islands.

Leucite basaltic outcrop on Vulcano and Stromboli and have been interpreted either as low-pressure differentiation products of the shoshonitic basalt (Barberi et al., 1974) or as independent magma (Klink et al., 1974).

The above mentioned authors have also discussed the possible occurrence of crustal contamination affecting the shoshonitic rocks. Recent Sr and Pb isotope studies (Corin, 1981) suggest a more complex history. The shoshonitic basalt erupted at Stromboli would be geologically unrelated to the other Aeolian rocks. Sr isotope data would indicate that Vulcanello and Lipari had independent magma sources. They also suggest that crustal contamination could have raised the Sr isotopic composition of the Lipari rhyolites. In addition the Pb isotope would indicate a mixing of at least two liquids.

Stromboli and Its 1975 Eruption

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ABSTRACT
On November 4, 1975, in the evening, an eruption took place at Mt. Stromboli. On the following days the lava flows reached the Sea of Fossa down to the sea, accompanied by pyroclastic explosions to the crater plane. Direct observations on the volcanic activity were carried out from November 4th, while a seismic survey was made from Nov. 7 to 11. The total volume of lava erupted during this period of activity that lasted 21 days, was estimated to be about 10 m³. This paper reports the results of direct observations, and of the petrological, radiometric, gas and seismic activities studies performed for this eruption.

The eruption was preceded by an insignificant change of seismic activity, which was monitored by a seismic station located about 3 km East of the crater. A sudden activity was strongly related to crater explosions accompanying the eruption phenomenon. Radiometric and chemical samples showed a lack of disturbed materials between 2 m below the sea and 3 m above the crater. Two low velocity layers, which seem to be related to Stromboli, were recognized within the crust, the main one being at a depth of about 10 km. The lateral extent of these layers has not been determined, and their volcanological significance is still unclear.

294 m above sea level. Both the subaerial and submarine part are roughly elongated on E-W. (Scardini, 1969). The central cinder is an elongated cinder cone about 700 m above sea level. It is surmounted by a form of an esker and larger cinder whose older rim is represented by the volcanic material erupted from the northern part of the volcano is formed by the "Scara del Fenice" - an elongated cone that quietly ejects the lava and flows to the sea. Stromboli is considered one of the most active volcanoes in the world because of its persistent moderate explosive activity, known as Strombolian activity. Stromboli is the northernmost island of the Aeolian volcanic arc, located at the border of the Tyrrhenian Sea (Fig. 1). Recent deep sea studies (Moccia et al., 1973) showed the structural crustal area. The northernmost cinder cone, which is relatively 14 km deep. This cone is characterized by a sharp boundary and a steep wall. The average compression is 4.5 to 6.0 km/sec, indicating an anomalously continental crust. Two low velocity layers, which seem to be related to Stromboli, were recognized within the crust, the main one being at a depth of about 10 km. The lateral extent of these layers has not been determined, and their volcanological significance is still unclear.

Geophysical data reveal: a) the existence of intermediate and deep earthquakes foci defining a narrow inclined plane, plunging WNW with a dip of about 50-60°, down to a depth of about 450 km; b) relative gravity lows running alomg the western coast of the Aeolian Archipelago; and c) the NW of the islands, an area (Thyrrhenian Abissal Plain) with high bathymetry values, shallow anomalous mantle (Moho 12 km depth) characterized by a strong seismic wave absorption and filtered by oceanic crust (Barberi et al., 1974; Keller 1980; 1982).

According to this interpretation the boundary between the converging plates probably corresponds to the Ionian coasts of Calabria (sediments filled trench); the mid-oceanic ridge is represented by the Calabro-Peloritani crystalline belt whereas the Thyrrhenian Abissal Plain corresponds to this reconstruction, to a back-arc marginal basin.

Some geological data throw doubt upon this reconstruction: a) the Thyrrhenian Abissal Plain began to take shape before the beginning of Aeolian volcanism (Scandone, 1979; 1982; Gasparrini et al., 1979; Barberi et al., 1980); b) palaeoecosystem reconstructions in the southern Apennines allow to establish that the present Beniolo zone consists of a lithospheric body which began to subdue before the generation of the Thyrrhenian sea.

According to these geological and geophysical evidences Scandone (1979; 1982) proposed a new model of the Aeolian arc in which the Pleistocene volcanism in the southern Tyrrhenian sea is related to the existence of a lithospheric slab with a WNW dipping plane, which could be the relic of the older Olgio-Miocene subduction which built the Apennine chain. Then the present Beniolo zone can be interpreted as a remnant of a larger slab, which is subducting into the lithospheric subducted and after the continent-continent collision.

According to the actual data it seems evident that the geodynamic setting of the southern Tyrrhenian sea is quite complex, and that it is difficult to reconstruct the pre-collisional paleogeography. It is also clear that among the two above mentioned models of geodynamic reconstruction the continental crust subduction assumes vital importance for geological implications as well as for magma's genesis and evolution.

Volcanic Hazards at Fossa of Vulcano:
Data from the Last 6,000 Years (*)

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ABSTRACT

Stratigraphic reconstruction of the complete sequence of deposits that formed the Fossa crater, Vulcano has been achieved using the principal eruptive cycles. Poste, Parte, Lipari, and Michael cycles, with one additional eruptive cycle, one of which made with the Campi Sporaneo, was added to these deposits of the Poste, Parte and Lipari cycles. However, exposure is inadequate for this characterization. The assignment of the identified deposits that follow the Michael crater is uncertain.

Deposits of each cycle form a characteristic, almost stratigraphic pattern that is dominated by the style of volcanism (Rutten et al., 1983). The normal sequence of pyroclastic products for each cycle begins with the primary deposits, followed by dry-ash deposits, then liquid breccia, followed by fluidized deposits. Absolute age determinations have been made on each pyroclastic deposit.

In the early stages of the cycle, when the vent is active, pyroclastic products are erupted. When the vent is quiescent, pyroclastic products are erupted. The deposits of each cycle form a characteristic, almost stratigraphic pattern that is dominated by the style of volcanism (Rutten et al., 1983).

The eruption generated a sequence of pyroclastic products with the primary deposits, followed by dry-ash deposits, then liquid breccia, followed by fluidized deposits. Absolute age determinations have been made on each pyroclastic deposit.

INTRODUCTION
An understanding of the past activity of a volcanic system is necessary for the prediction of future events. Detailed stratigraphy of the products associated with historical records of activity provide the essential data necessary to determine the patterns of activity and periods of repose of a volcano. Knowledge of the frequency of activity of the volcano, the eruptive styles, and the emplacement mechanisms of the products are needed for accurate volcanic hazard assessments. Many volcanoes follow a regular sequence of volcanic events, which are systematically repeated with time. Therefore, if data are available, a complete history of the volcanic activity from the initial events to the most recent eruptions should be considered. With this in mind, we undertook a study of products representing the entire eruptive history of the Fossa crater of Vulcano from its inception about 6,000 years ago up to the present.

Volcanic History of Lipari (Aeolian Islands, Italy) during the Last 10,000 Years

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(Received August 21, 1984; revised and accepted May 1, 1985)

Abstract


Examination of the volcanic stratigraphy of deposits younger than 10,000 years on Lipari indicates four principal periods of volcanic activity related to specific centers. The products from each different volcanic center are defined as volcano-stratigraphic units (VUS). From the oldest these are: the Canetto Dentro, Gabblietto–Piume Bianco, Faglia Vecchia and Monte Plitio–Rocche Rosse VUSs. The study of textures and dispersal of the deposits permits the vents to be localised and the recent volcanic history of Lipari to be reconstructed.

The oldest event formed a small explosion breccia cone with a final obsidian lava in the Canetto Dentro area. Immediately afterward, a complex series of explosions produced the widespread dry-surge deposits of the Gabblietto–Piume Bianco sequence. This activity ended with the extrusion of a domical lava flow. The renewal of activity in the Piffera area with an explosive eruption that produced explosion breccia deposits. The last eruption from this vent were covered with the first eruption of M. Plitio. The rim of the explosion breccia cone was partially destroyed by the Faglia Vecchia lava flow. M. Plitio cone grew in a very short period of time due to a continuous swarm of explosive activity. After a short repose time, a series of more energetic and superficial explosions occurred around a vent slightly to the south. The extrusion of the Rocche Rosse lava flow (about 720 A.D.) ended this cycle of activity.

All the volcanic centers follow a quite similar stochastic pattern starting with a fall or surge eruption and ending with effusion of morex rhyolitic lavas. The four centers are aligned along either NW–SE or NE–SW fault systems according to the structural pattern of the island. They can be placed into two groups: the Canetto Dentro–Gabblietto centers and the Faglia Vecchia–M. Plitio centers. A long quiescence (≥ 3,000 years) separates the activity of these two groups while inside each of the activities were nearly contemporaneous or in rapid succession.

June, 1989

Mount Vesuvius a garbage dump

Reuter

NAPLES, Italy—An Italian scientist who explored the crater of Mount Vesuvius was horrified to find discarded soft-drink cans, old tires and even the rusting hulk of a Fiat 500 car.

Ines Albergamo, who descended 350 metres into the mouth of the dormant volcano, told the Rome newspaper Il Tempo: “People throw things just to hear the noise. They risk transforming the volcano into an enormous rubbish heap.”

Vesuvius has been quiet since an eruption in A.D. 79 which buried the Roman town of Pompeii.

Dec., 1989

Volcano output not fresh ash

The Associated Press

VANCOUVER, Wash. — In the wake of the biggest outburst from Mount St. Helens in nearly four years, there are no signs that the volcano is entering a more explosive phase, scientists said Monday.

Foul weather again kept scientists from the Cascades Volcano Observatory from flying into the crater by helicopter to take measurements, gather more ash samples and replace monitoring equipment that was lost in the ash blast Saturday morning, said scientist Dan Dzurisin.

Ash taken about 19 kilometres east of the peak Sunday was examined under a microscope and found to be pulverized rock from previous eruptions rather than freshly erupted matter, Dzurisin said.

St. Helens ash settles near Yakima

The Associated Press

Mount St. Helens belched volcanic ash that settled over a south-central Washington community Saturday.

The U.S. National Weather Service reported a light dusting of ash near Yakima, about 120 kilometres east of Mount St. Helens.

“It was gritty and it was still falling out of the sky,” said David Foster of Toppenish, who found his two cars coated with dust.

Steve Malone, a seismologist with the University of Washington, said seismographs and other equipment within the crater of Mount St. Helens recorded a small eruption at 5:27 a.m. PST.

The eruption lasted about two minutes and was followed by small earthquakes that lasted about two hours.

Malone said further details on the Mount St. Helens eruption would not be available until crews could take a closer look at the readings.

Mount St. Helens erupted May 18, 1980, levelling 586 square kilometres, leaving 57 people dead or missing and creating an ash cloud that circled the globe.
Cloud cover
Steam still rises from Alaska’s Redoubt Volcano after several weeks of explosive activity. The volcano, southwest of Anchorage, started its eruptions in mid-December after lying dormant for 25 years.

Ash from Alaskan volcano drifts down West Coast
AP and Reuters
ANCHORAGE

Volcanic ash and dust drifted down the West Coast of Canada and the United States on the weekend after Alaska’s Mount Redoubt erupted for the fifth time in three days.

U.S. government scientists said the 3,189-meter volcano erupted five times from Thursday to Saturday after lying dormant for 21 years.

The 200,000 residents of Anchorage, 160 kilometers northeast of the mountain, were told to remain indoors to avoid respiratory problems.

Most flights in and out of Anchorage International Airport were cancelled because of fears that aircraft engines would suck in grit from the volcano, a spokesman for the U.S. Federal Aviation Administration said.

A KLM Royal Dutch Airlines jet, en route from Amsterdam to Tokyo with 231 people on board, was forced to make an emergency landing Friday when its engines failed while passing through the volcanic cloud. The crew was able to restart the engines and the passengers, uninjured, were transferred to other flights.

The community hardest hit by the volcanic outburst was Kenai, an oil and fishing town 65 kilometers east of Mount Redoubt.

“I was just outside. The grey, gritty sediment of the ash is probably an eighth of an inch deep over the snow,” Kenai Mayor John Williams said.

Mr. Williams said the community of 6,600 people had been without television and was suffering power failures as power-generating turbines became clogged with the corrosive grit.

Scientists have warned that the volcano could continue to spew out a foul-smelling plume for weeks.

Redoubt blows again
ANCHORAGE — In its largest eruption since reawakening last month, Redoubt Volcano hurled an anvil-shaped plume of steam and ash more than 10 kilometers into the air Monday.

Most of the ash was carried east and south over the Kenai Peninsula and out over the Gulf of Alaska. The ash plume bisected the peninsula, missing for the most part the major settlements around Kenai and Homer.

Skies darkened briefly, but only a light dusting was reported in Kenai, “just enough to turn the snow brown,” one resident said.

WIZARD OF ID

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HOW COME SO CHEAP?

THE DAYS ARE THE 11TH...12TH AND 13TH...THE NIGHTS ARE THE 21ST AND 22ND
Scientists discover lakes of brimstone

By Robert Cooke

OLD-TIME preachers who warned of fire and brimstone weren't so far off the mark — scientists have discovered the first known "lakes" of molten sulphur bubbling vigorously in the crater of a volcano in Costa Rica.

"To our knowledge, this is the first reported occurrence of sulphur lakes," geologists Clive Oppenheimer and David Stevenson report in the British journal Nature.

Brimstone, an archaic name for sulphur, was traditionally considered the fuel of hellfire.

The two scientists, from the Open University in England, said two small sulphur lakes appeared in April, soon after water boiled away in the crater, which is known as Volcan Poas.

"The sulphur deposits bubbled vigorously because of the flux of hot gases from below, which kept them molten" at a temperature of 118°C, they reported.

Volcanologist Richard Stoiber, at Dartmouth College, commented in a telephone interview that it might be the first time molten sulphur lakes were seen.

"It's an unusual accident of topography. We've seen sulphur come out of volcanoes, and we've seen melted sulphur, but it wasn't in a configuration that gave you a depression," so the hot liquid could collect in pools.

Oppenheimer and Stevenson added that sulphur's low viscosity, the ease with which it flows when molten, "is likely to have been critical in enabling its migration through the lake sediments to collect" downward into ponds.

They reported that a water lake that was in the volcano's hot crater evaporated during a two-year period, leaving a hot floor marked by bubbling mud holes. As the mud pools dried, they said, yellow sulphur cones up to three metres high were seen.

After these cones collapsed into pits in March, the scientists saw a "bubbling pool of brown liquid." Analysis "confirmed the purity of the sulphur, although significant traces of selenium and arsenic were detected."
GEOLOGICAL HOWLERS

VOLCANOES ARE NORMALLY QUITE GENTLE

An Ardente Nuée was experienced at St. Pierre which wiped out all the inhabitants.  J.H.McD.W.

Mt. Etna, Sicily.  J.H.McD.W.

Island of Chertzy.  J.H.McD.W.

Volcanoes have large wide mouths.  J.H.McD.W.

Gallons of molten lava and boiling mud poles.  J.H.McD.W.

Calderela.  J.H.McD.W.

The lack of support for the volcano would mean that it would collapse into the withdrawn area.  J.H.McD.W.

Pompeii a city in ancient Italy was completely wiped out by a volcanic eruption in the 20th century.  J.G.McD.

Krakatoa the 1,000' mountain became a 1,000' hole, in a few minutes.  C.D.G.

A plug is formed in a volcano. The pressure underneath builds up until the plug is finally shot out like a spear, to land quivering in the ground, hundreds of yards away, e.g. Puy de Dôme in France.  C.D.G.

Active volcanos are continually expelling lava and hot gases and are not very dangerous in as much as they are known and given an adequate berth by people.  J.G.McD.

A volcano vomits from the bowels of the Earth.  J.G.McD.

Mt. Killmanjaro, a Pacific island, blew itself to pieces.  C.D.G.

[Describing a cylindrical core sample of Millstone Grit:] This is part of a volcanic plug.  F.H.S.

When the volcano has built up sufficient steam and gases in its bowels, these gases and steam and molten material are forced to the outside through the blowhol.  G.B.

Molten lava flows out of the Mid-Atlantic rift from time to time and covers the surrounding sea floor with sea floor spread.  C.J.B.

An example of a great Caldera is the formation of Lough Neogh, Co. Antrim where the part of the volcano that occupied that space was blown into the channel to form the Isle of Man.  J.A.

Sinter is blasted out of a volcano, blown to bits, and never seen again. The particles are very fine in grain because of the volcanic explosion, and their absence can only be discovered under the microscope. This was one of the most important discoveries made in the nineteenth century and established the science of petrology, but even now there are very few experts who have ever seen sinter.  T.N.G.

Greenland Volcano in Eruption
By arrangement with The Times  D.P.

Peléan eruptions blow volcanic bombs 30 miles into the air.  C.J.B.

The explosion of Krakatoa was heard as far away as Australia, it blew windows out in Bolivia and the force knocked a man off his bicycle, cycling on the east coast of India.  C.D.G.

If it's a big crater, it's known as a caldera.  J.H.McD.W.

The Stromboli type is quiet and noisy.  J.H.McD.W.

On a touring holiday in Italy, being a geologist, I just had to go a little out of my way to see the entrails of Mount Etna.  ConG.

Pumice is used as an abrasive, often in bathrooms.  A.M.E.

The lava has flown out from fissures.  J.H.McD.W.

ed, W.D. Ian Rolfe

GEOLICAL SOCIETY OF SCOTLAND