**Geoscience Canada**

# International Volcanological Congress

Dolores Durant

Volume 18, numéro 1, march 1991

URI : https://id.erudit.org/iderudit/geocan18_1con04

Aller au sommaire du numéro

Éditeur(s)

The Geological Association of Canada

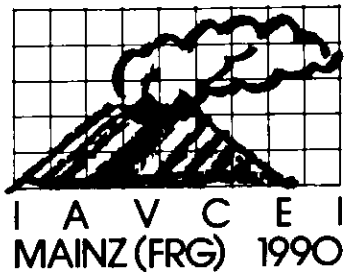
ISSN

0315-0941 (imprimé)
1911-4850 (numérique)

Découvrir la revue

Citer cet article

Durant, D. (1991). International Volcanological Congress. *Geoscience Canada*, *18*(1), 22–24.




# International Volcanological Congress

Dolores Durant
*Department of Geology*
*McMaster University*
*Hamilton, Ontario L8S 4M1*

Over 600 people from more than 40 countries met in Mainz, West Germany, from 3-8 September 1990, to contribute to the many disciplines of volcanology at the International Association for Volcanology and Chemistry of the Earth's Interior (IAVCEI) biannual meeting. Eight Canadians presented talks and posters.

The conference was divided into twelve sessions, two running concurrently over each of four days. Each session had 90 minutes devoted to four-minute oral poster presentations. This arrangement was an excellent way to familiarize oneself with particular authors and their work from the more than 100 posters being displayed each day. A further 90 minutes of each session was devoted to oral presentations of 15-, 20- or 30-minute duration.

Sixty-seven oral presentations were made and are summarized below in order by session. The presenter is indicated by italics.

In Symposium I, entitled **Planetary Volcanism and Remote Sensing**, *E. Jagoutz* and H. Wänke discussed the composition, age and probable origin on the planet Mars for SNC meteorites. *L. Wilson*, E.A. Parfit and J.W. Head suggested that magma chamber location depends on neutral bouyancy levels between melt density and crustal rock density, vertical growth of the magma chamber via dyke propagation, and horizontal growth by lateral dyke injection. A case for young volcanism on Mars was made by *J.B. Plescia* and R. Greeley, based on location and preservation of features such as shields, lava lakes, cinder cones and fissure eruptions. Compositional similarity in terrestrial and Venusian basalt and high alkali materials led *A.T. Basilevsky*, V.P. Kryuchkov and E.N. Slyuta to postulate probable similarities in the upper mantles of Earth and Venus and to invoke a comparable radiogenic heat source.

Symposium II contained papers on **Sources and Segregation of Intraplate Magmas**. *P. Olson* explained the origin of hot spots from mantle plumes of various shapes through to diapir formation and the small amount of partial melt that may actually reach the surface. *U. Christensen* suggested that isotopic variation in mid-oceanic ridge basalts could, in part, be due to incomplete stirring in a whole mantle convection scenario where "blobs" and "streaks" of differing compositions could survive for >1 Ga, if viscosity increases strongly with depth.

Symposium III centred on **Alkaline Volcanism**. *S.R. Hart* discussed how the compositions and locations of four mantle reservoirs support the whole mantle convection theory. *B.L. Weaver* studied the composition of alkali igneous rocks from oceanic islands that have evolved via crystal fractionation from different parental basalts. Based on isotopic characteristics and trace element ratios, three end member compositions could be derived from recycled, subducted ancient oceanic crust (HIMU), with an ancient sediment component (EMI) or with a young sediment component (EMII). *M. Condomines*, C. Deniel and O. Sigmarsson remarked upon how the U-Th-Ra radioactive disequilibria in intraplate alkaline and hyperalkaline volcanic rocks can be explained by metasomatic processes which affect both the mantle source and the magmas. The generation of the wide range of differentiated K-rich magmas in the Roman Province, Central Italy, was discussed by *R. Trigila*. The interaction of variable amounts of $H_2O$ and $CO_2$ with a parent magma that evolves from trachybasaltic to tephritic, tephriphonolitic and phonolitic compositions could lead to multiple intracrustal and subvolcanic reservoirs that would account for these various K-rich magmas. L. Civetta, *S. Conticelli* and A. Peccerillo explained that Sr and Nd isotopes in the Roman Province alkali potassic volcanics preclude extensive interaction with upper crustal material, but that these rocks could be formed in a heterogeneous upper mantle comprising mafic material combined with subducted upper crust. The origin and conditions during formation of western Mediterranean Cenozoic lamproites from a depleted mantle source were outlined by *G. Venturelli*, S. Capedri, L. Toscani and E. Salvioli. *N.W. Dunbar* and P.R. Kyle gave reasons for the similarity of melt inclusions to degassed matrix glass in anorthoclase phenocrysts from an active lava lake at Mount Erebus, Antarctica. *N. Metrich* and M.J. Rutherford determined the solubility and concentration of chlorine gas at different pressures in various natural and synthetic hydrous silicic melts. *P. Ulmer*, V. Trommsdorff and V.J. Dietrich showed experimentally that primitive mid-Cretaceous basanite dykes from the Austrian Alps were probably generated from a garnet-wehrlite mantle source.

Symposium IV, **Carbonatite Volcanism**, concentrated on Oldoinyo Lengai, Tanzania. *M. Krafft* and K. Krafft showed an excellent video depicting active vents, lava lakes and lava flows during a natrocarbonatite effusive eruption. *G.E. Norton*, H. Pinkerton and J.B. Dawson measured the thermal properties of natrocarbonatite lavas that erupted in November 1988, from Oldoinyo Lengai, while *J.B. Dawson*, H. Pinkerton, G.E. Norton, D.M. Pyle, D. Jackson and A. Fallick studied their geochemistry and petrology. Mineralogy and chemical analyses of the January 1988 natrocarbonatites were reported by *J. Keller*, comparing natrocarbonatite lavas with peralkaline combeite-bearing nephelinite lavas suggests a liquid immiscibilty relationship. From Nd and Sr in carbonatites, nephelinites and phonolites, *K. Bell* felt that the emplaced magma is probably heterogeneously mixed from two mantle sources to obtain nephelinite and carbonatite, while phonolites also have a lower crustal component. *T.D. Peterson* and B. Kjarsgaard suggested fractionation trends that could form low peralkaline nephelinites at Shombole, East Africa, and the strongly peralkaline nephelinites that can coexist immiscibly with natrocarbonatites at Oldoinyo Lengai. Since $H_2O$ concentration is low, B. Jago and *J. Gittins* showed that a high fluorine content, up to 14 wt.%, is much more effective in lowering liquidus temperatures, by ~200°C to ~500°C, than 10 times as much water. *J.A. Wolff*, D.J. Miller and B.N. Turbeville explored the mixing and immiscibility between carbonatites and alkali silicate magmas, where the range of end products will depend on temperature, pressure, composition of initial liquids, and mixing or separation dynamics. In phase equilibria experiments on nephelinites and phonolite-sövites, *B.A. Kjarsgaard* and D.L. Hamilton found that during cooling, immiscible carbonatite and silicate liquids form, in which the carbonate liquid composition is associated with the peralkalinity. *T.J. Falloon* and D.H. Green discussed stability fields and phase relationships for carbonate in peridotites and lherzolites as a clue to carbonatite formation in the mantle.

In Symposium V, **Submarine Volcanism**, *G.P. Avdeiko* elaborated on aspects of volcanism in the Kurile Island Arc and proposed a magma generation model for the frontal arc zone, which has mainly subaerial volcanism, and the back arc zone, which has mainly submarine volcanism. From lava morphology studies, *N. Binard*, R. Hekinian and J.L. Cheminee proposed models for seamount formation and growth in the southeastern Society Island chain. At Rakiraki, northeastern Viti Levu, in the Basaltic Group, *J. McPhie* described three volcanic facies: primary volcanic, redeposited volcaniclastic, and sedimentary facies. *G.T. Orton* detailed the disruption of pyroclastic flows as they enter the sea.

Symposium VIa discussed **Explosive Volcanism**. In describing the current phase of phreatomagmatic eruptions at Mt. Redoubt Alaska, *J. Kienle* and S.E. Swanson

suggested an eruption model dominated by hydrothermal activity above a magma chamber at about 6 km depth. *R.B. Waitt*, T.P. Miller and R.J. Janda described the formation of lahars and floods from the interaction of glaciers and snow with pyroclastic flows from several collapsed domes on Mt. Redoubt. *P. Francis*, L.S. Glaze, C.M.M. Oppenheimer, D. Pieri and D.A. Rothery pointed out the confusion surrounding the term "strombolian" as presently used to describe pyroclastic fall deposits as well as a type of eruption activity. Since strombolian eruptions do not cause strombolian fall deposits, the latter should be renamed microplinian, a term that better reflects their origin.

Symposium VIb concluded the session on **Explosive Volcanism**. *W. Hildreth* described the composition, mineralogy and topography of the ash fall from the 1932 plinian eruption at Quizapu, Chilean Andes. The classification and formation of five flow units during the Campanian Ignimbrite eruption in the Mediterranean 35 ka was discussed by *M. Rosi* and L. Vezzoli. Discrepancies in measured eruption column heights for a given eruption were remarked upon by *S. Self*, L.S. Glaze and D.C. Pieri. For example, depending on the data source used, either temperature or shadow measurements, vastly different plume heights for the 1986 eruption at Lascar volcano can be obtained. With all the different remote sensing equipment in use today, these discrepancies must be rectified.

Symposium VII was called **Volcanic Aerosols, Climate and Tephrochronology**. *F. Oberli*, H. Fischer, M. Meier and T. Gubler elaborated on the problems in choosing the correct zircons to date a particular event and in comparing dates from U-Pb and Ar/Ar dating for the same samples. In pantellerites from Pantelleria, Italy, *J.B. Lowenstern*, G.A. Mahood, M.L. Rivers and S.R. Suton found "leaked" (or degassed) inclusions having low Cu and $H_2O$, while "non-leaked" inclusions were Cu-rich and higher in $H_2O$. M.R. Rampino and *S. Self* remarked upon worldwide *versus* regional temperature variations and effects that can mask temperature change after a large eruption and the consequent difficulty in predicting the climatic effects following a very high magnitude eruption.

Symposium VIII contained **Experimental and Theoretical Volcanology** sessions. Upwelling of a liquid phase (chimneys) in a crystal mush during fractional crystallization was experimentally demonstrated by *S. Tait* and C. Jaupart in order to define stability conditions, number density for given flows, viscosity, thermal effects, and chemical evolution in the total magma chamber. Three stages of explosive eruption column evolution were proposed by *M.I. Bursik* and A.W. Woods. In stage 1, gas velocity in the convective and gas thrust regions decreases. During stage 2, velocity in the lower convective region increases. Stage 3 is column collapse. *A. Freundt* and H-U. Schmincke discussed the transport mechanism for a welded, high temperature basaltic ignimbrite on Gran Canaria. Extensive experiments on phreatomagmatic explosions in liquid melts of various compositions, and the physical nature of the products, were conducted by *V. Lorenz*, G. Fröhlich and B. Zimanowski. *C. Jaupart* explained that as internal gas pressure decreases, so do the eruption rate and gas content, since gases are lost more easily to the country rock at slower velocities. The eruption changes from explosive to dome building, but pressure variations as small as one bar can result in large changes in gas content that can alter the eruption style. This could explain why some eruptions alternate between explosive and dome building phases. *G.S. Steinberg* and E.S. Persikov experimented on andesitic melts in order to model periodic explosions in a cyclic closed and open "capped" eruption. Near the surface in the volcanic pipe, a magma cap solidifies due to rapid degassing at air temperature, while beneath the cap, the rising magma degasses due to changing pressure, until the volatile pressure is high enough to blow out the cap. In mathematical modelling of the ascent and vesiculation processes for subplinian eruptions, *A. Toramaru* focussed on how mean bubble radius and bubble density per unit volume change with changing ascent velocity, saturation pressure, surface tension and volatile diffusivity.

Symposium IX was called **Physics of Volcanoes**. In their study of ground oscillations during the evolution of the Campi Flegrei caldera (Southern Italy), *G. Luongo*, E. Cubellis, F. Obrizzo and S. Petrazuolli found that posteruptive crustal deflation could cause enough tectonic stress that the caldera might uplift either by magma replenishment or by isostasy, thereby causing cyclical caldera collapse and magma resurgence. *S.A. Fedotov*, N.A. Zharimov, V.I. Gorelchik, Y.V. Demenchuk and V. P. Khanzutin discussed seismic activity, magmatic source migration, pile deformation and magma temperatures in the Klyuchevskoy stratovolcano in the Kurile-Kamchatka arc as a means of eruption prediction. *T.H. Thordarsson* and S. Self updated flow volume estimates for the 1783-84 basaltic Skaftar Fires from fissure eruptions in Iceland. Ten lava surges from fountains up to 1400 m high fed 14.7 $km^3$ of mainly pahoehoe flows at effusion rates up to 8700 $m^3 \cdot s^{-1}$. Seismic data from the Mt. Etna region, Italy, between 1977 and 1987 were studied by C. Cardaci, G. DiStefano, G. Lombardo, G. Patane and *R. Scarpa* in order to model the conduit and magma reservoir geometry. *A.W. Hurst* and S. Sherburn treated volcanic tremors as single-resonator or multi-resonator processes. Single-resonator tremors have a spectrum with a sharp peak and often occur in organ-pipe model volcanoes, such as Ruapehu, N.Z. Multi-resonator tremors have broad, incoherent spectra, caused by combinations of numerous events. Thermal feedback instabilites causing eruptions in pressure-driven magma moving between the source and the reservoir suggested to *J. M. Espindola* and S. De La Cruz-Reyna that the length of time between eruptions may be found as a function of heat conduction into the conduit walls and magma viscosity. *A. Shteinberg*, G.S. Shteinberg and A.G. Merzhanov compared the mass exchange and thermal characteristics of natural geyser eruptions to volcanic explosions. Acoustic data collected from Mt. Kelut crater lake, Java, indicated to *J. Vandemeulebrouck*, M. Halbwachs, J.C. Sabroux and W.S. Tjetjep, that frequencies between 200 and 500 Hz were related to bubbling of underwater volcanic gases which increased eight fold from the first sign of seismic activity, 9 November 1989, to the eruption on 10 February 1990.

In **Current Volcanic Activity and Hazards**, Symposium X, *J.C. Thouret*, A. Murcia, R. Salinas and J. Cantagrel described the three main generations of the stratovolcanoes in the 2 Ma Ruiz-Tolina massif in Columbia with emphasis on activity in the last 10 ka. A "low cost", "low technology"method for constructing volcanic hazard maps has been devised by M. Hall, *C.G. Van Hillebrandt* and B. Beate for Chinborazo volcano, Ecuador, which focusses on lahar events and large volume ignimbrite eruption probabilities. Using stratigraphic data and comparing eruptive history with other similar volcanoes, this method could be used effectively by third world countries to make similar maps. *G. Macedonio*, M.T. Pareschi and R. Santacroce mathematically modelled lahar flow with the St. Venant equations to include fluid viscosity, velocity profiles, grain inertia and flow depth in given channels. *R. Hazlett*, D. Buesch, J.L. Anderson and R. Scandone described landslides caused by volcanic tremors during the 1944 Mt. Vesuvius eruption. The surface morphology and stratigraphy of these low volume slides ($<1.5 \times 10^6$ $m^3$) have been preserved, but modified by fractures, thrusts and shear zones that formed during movement.

Symposium XI contained **General Session** presentations. From experiments at controlled oxygen fugacity, *C. Ballhaus* and D.H. Green were able to obtain equilibrated olivine-orthopyroxene-spinel melts at mantle compositions, to calibrate the ol-opx-sp oxygen barometer. Studying paleo- and recent geotherms in eastern Australia, *F.L. Sutherland* found that geothermal gradients have increased from the Mesozoic through the Cenozoic, probably due to recurring volcanism from numerous hot spots. *O. Sigmarsson* and M. Condomines, using Th isotopic data, asserted that Hekla, Iceland flows which have evolved from rhyolitic to andesitic were due to partial melting of Icelandic crust, while the intermediate compositions are obtained by mixing silicic crustal and

icelandite melts; they cannot be derived from fractional crystallization of a parental icelandite. The chemistry for 1480 Ma anorogenic terranes of granite and rhyolite from the St. Francois Mts., Missouri, suggested to *B.K. Nelson* a likely origin, subduction-related tectonics at a craton margin.

The last session was Symposium XII, **Arc Magmatism**. The origin of Kamchatka flows was found by *M.P. Semet*, A. Zaimi, J.L. Joron, G.E. Bogoyavlenskaya and V.M. Okrugin to have resulted from high (~10 $cm \cdot yr^{-1}$) subduction rates. Mixing MORB-type magma with elements from the sinking slab can explain trace element patterns. Using trace element concentrations across five volcanoes in the Sunda-Banda Arc, Indonesia, *P.Z. Vroon*, M.J. Van Bergen, J.C. Varekamp and R.P.E. Poorter postulated sources varying from N-type MORB magma mixed with 3-5% subducting sedimentary material to E-type MORB magma mixed with 1-3% sediment. From a study of the major and trace element concentrations in fresh high-Ca boninites from the North Tonga ridge, *T.J. Falloon* and A.J. Crawford suggested an origin by crystal fractionation in a mixture of depleted OIB mantle rich in incompatible elements, carbonatite melts, and hydrous fluids from subducting lithosphere. The Tonga boninites seem to be comparable to the upper pillow lavas in the Troodos ophiolite. *G. Wörner*, S. Moorbath and R.S. Harmon studied the trace element composition of Central Andean Neogene-Recent volcanics, where the continental crust is extremely thick (60-70 km), to determine an origin for sub-arc mantle wedge mafic melts that have risen through and interacted with the recently thickened continental crust. In cummingtonite phenocrysts from 3 ka silicic Mt. St. Helens magmas, *C.H. Geschwind* and M.J. Rutherford found a stability temperature of slightly less than 810°C. Since cummingtonite is absent from all magmas erupted in the last 3 ka and the flows have changed to basalts and andesites, chamber temperatures have probably increased by 100°C, while water pressure has probably decreased. After extensive stratigraphic and geochronologic studies at Vulcano, southern Italy, *P.Y. Gillot*, S. Chiesa and G. Alvarado developed a detailed evolution for magmatic activity during its 120 ka history.

Nine field trips were held in conjunction with the conference. Pre-congress excursions were run in Germany to the East and West Eifel Volcanic Fields to examine Quaternary volcanism, to the Rhinegraben for Cenozoic alkaline intraplate volcanism, and to see Devonian/Early Carboniferous submarine intraplate volcanism in the Lahn-Dill area and Sauerland Rhenish Massif. An excellent mid-conference excursion visited the Laacher See for the day. Post-congress excursions included the Eifel Volcanic Fields again, alkaline and carbonatite volcanism in the Kaiserstuhl, Steinheim and Nördlinger Ries impact craters, and the oceanic volcanic island, Gran Canaria.

The excellent two-day trip to the Ries craters, run by Dr. Günther Graup, concentrated on impact breccia suevite, its variable composition and formation at differing locations in and around the crater. With only 16 people and 8 stops, there was time for many stimulating discussions with contributions from everyone.

An excellent video, called "Volcanic Hazards", by M. Krafft, C. Newhall and S. Brantley, that discussed many types of dangers inherent in volcanic activities, was shown several times each day throughout the conference.

All who attended the conference would acknowledge the friendly conference personnel who went to all lengths to take care of everyone. Many young scientists (including the writer) benefited from financial aid generously offered by the organization to assist with expenses incurred in attending the conference. Overall, this was an excellent conference, and many people are looking forward to the next International Volcanological Congress.

Accepted, as revised, 31 December 1990.

# A Decade of Evolution in Archean Thought: The Third International Archean Symposium

Andrew Kerr
*Geological Survey Branch*
*Department of Mines and Energy*
*St. John's, Newfoundland A1B 4J6*

The Third International Archean Symposium (3IAS) was held in Perth, Western Australia, on 17-21 September 1990. It was closely followed by the Seventh International Conference on Geochronology and Isotope Geology (ICOG7), held in Canberra on 23-29 September. Geochronology and Precambrian geology are inextricably linked, and some relevant aspects of the Canberra conference are also addressed in this report.

The Archean symposia are held at ten-year intervals to review the developments of the past decade and provide a forum for presentation of current research. The vast 3IAS program included about 50 oral and over 100 poster presentations squeezed into five days of technical sessions. The oral program emphasized "keynote" review presentations of recent work and outstanding problems in specific fields or geographic areas. Poster sessions focussed on more localized and/or problem-oriented studies, and contained much "current" (*i.e.*, late 1980s) research. Although there were the usual complaints from some delegates about a "lack of new information", I found the oral program a useful framework that placed the numerous posters in a wider context. In terms of numbers of delegates, Canada was second only to the host country, and our contributions were mostly lucid and well presented.

The symposium was broken into sequential thematic sessions, which I have used as a framework for discussion. It was augmented by seven field trips, including a 10-day marathon to the classic Pilbara Craton and Hamersley Basin sequences, visits to gold and nickel deposits of the Yilgarn Craton, and a trip to the Mount Narryer gneiss terrane, where the oldest crustal materials have been identified in the form of *ca.* 4.3 Ga detrital zircons in metaquartzites.