The LIP Reader

Newsletter of the Commission on Large-Volume Basaltic Provinces
International Association of Volcanology and Chemistry of the Earth's Interior IAVCEI

Number 6 October 1995

This Issue...

Leader

Mike Coffin
Institute for Geophysics
The University of Texas at Austin
8701 North Mopac Expressway
Austin, TX 78759-8397, USA.
Tel: 1.512.471.0429
fax: 1.512.471.8844
internet: mikec@coffin.ig.utexas.edu

Secretary

John Mahoney
Department of
Geology and Geophysics
School of Ocean and Earth Science and Technology
University of Hawaii
2525 Correa Rd.
Honolulu, HI 96822, USA.
Tel: 1.808.956.8705
fax: 1.808.956.2538
internet:
jmahoney@soest.hawaii.edu

Newsletter Production

Toni Lee Mitchell, Lisa Gahagan and Janelle Berry

The next major IAVCEI meeting is the 1997 General Assembly scheduled to be held in Puerto Vallarta, Mexico. Now is the time for Commission members to propose and start organizing associated symposia, workshops, field trips, and short courses. Please contact Mike Coffin and John Mahoney, who are coordinating Commission input to the meeting's organizers, with ideas or plans. In this issue, recent research on lava flow dynamics, the Karoo basalts, and planetary missions is summarized, as are recent meetings focusing on large-volume basaltic provinces. This issue is also the first to be distributed solely via the internet; only those Commission members without an internet address will receive hard copy via snail mail. As always, we welcome your contributions to The LIP Reader, and your recruiting of interested scientists to join the Commission.

Commission News

Commission Meeting—IUGG XXI General Assembly

The Commission's meeting on 7 July was attended by about twenty scientists. The possibility of implementing a major new research initiative on LIPs, akin to RIDGE-InterRIDGE, was discussed; W. Johnson suggested that the Commission seek assistance from the IUGG and IUGS executive committees to help kick-start such a move. Preliminary Commission plans, including field trips, for upcoming IAVCEI meetings in Mexico and South Africa were discussed (ideas are welcome!). A probable field trip to the East China basalts, in connection with the 1996 30th International Geological Congress (IGC), was announced by X.X. Mo. A.N. Zemtsov proposed a workshop on the Siberian Traps in 1997. Regarding Commission products and services, suggestions were made that DOS versions of the LIP bibliography and data base be offered, and M. Pringle proposed compiling an up-to-date radiometric-age data base for LIPs. Last but not least, support was strong for an internet version of The LIP Reader, which has been initiated with this issue.

Volume on Large Igneous Provinces

The LIP volume is progressing steadily. It will be published by the American Geophysical Union Press as part of their Geophysical Monograph series, and should be coming out in September, 1996. Currently, manuscripts of seventeen chapters have been or are being submitted and sent out for peer-review.

Steering Committee

An updated list of Steering Committee members and their addresses follows:

Hans Barsczus (Univ. of Montpellier, France ..... barsczus@sajou.dstu.univ-montp2.fr
Ian Campbell (Australian National Univ., Australia) ..... ihc1561@huxley.anu.edu.au
Mike Coffin (Univ. of Texas, USA) ..... mikec@coffin.ig.utexas.edu
Keith Cox (University of Oxford, UK ..... trishm@earth.ox.ac.uk
Geoff Davies (Australian National Univ., Australia) ..... geoff@rses.anu.edu.au
Bob Duncan (Oregon State Univ., USA ..... rduncan@oce.orst.edu
Jean Goslin (Univ. of Brest, France) ..... goslin@univ-brest.fr
Chris Harris (Univ. of Cape Town, South Africa) ..... kv@geology.uct.ac.za
Chris Hawkesworth (Open Univ., UK) ..... j.l.dryden@open.ac.uk
Jim Head (Brown Univ., USA) ..... head@pggipl.geo.brown.edu
Jan Hertogen (University of Leuven, Belgium)..... jan.hertogen@geo.kuleuven.ac.be
Rosaly Lopes-Gautier (Jet Propulsion Lab, NASA) ..... rlopes@jpluvs.jpl.nasa.gov
John Mahoney (Univ. of Hawaii, USA) ..... jmahoney@soest.hawaii.edu
Sverre Planke (Univ. of Oslo, Norway)..... sverre.planke@geologi.uio.no
Jakob Skogseid (Univ. of Oslo, Norway) ..... jakob.skogseid@geologi.uio.no
Kensaku Tamaki (Univ. of Tokyo, Japan) ..... tamaki@ori.u-tokyo.ac.jp
Dominique Weis (Free Univ. of Brussels, Belgium) ..... dweis@resulb.ulb.ac.be
Dave Williams (Univ. of Alabama, USA) ..... dwillia3@wgs.geo.ua.edu

Full addresses and contact numbers for the above are available over the internet, on diskette, or as hard copy (see below) from Mike Coffin.

Recent Research Summaries

Lava Flow Dynamics and Cooling

We have examined the dynamics and cooling of a typical, 30 m thick, continental flood basalt lava flow. For reasonable values of viscosity and slope, a 30 m thick sheet of lava could flow turbulently. Such a turbulent lava flow is predicted to cool and crystallize significantly along its length and to cause significant thermal and mechanical erosion of the underlying lava flows. The thin, quenched, flow tops preserved between lava flows in the Columbia River Basalts show that (1) there was little crystallization during flow and (2) that neither thermal nor mechanical erosion were important during emplacement. We conclude that the Columbia River Basalts, at least, did not flow turbulently. The most reasonable alternative is that flood basalt lava flows were originally emplaced as thinner flows that were later inflated to their final thickness.

contributed by Laszlo Keszthelyi, Thorvaldur Thordarson, and Stephen Self (University of Hawaii, USA)

Karoo Geochemistry, Paleomagnetism, and Timing

Uplift and erosion in southern Africa over the last 30 my has dissected and eroded much of the Karoo CFB. This has resulted in superb exposure of the subvolcanic sheet and dyke complex but has left only erosional remnants of the once extensive volcanic carapace (2.3 x 106 km2). Despite a wealth of research, detailed correlations between the remnants, particularly between Lesotho, Botswana and the Lebombo-Mwenezi-Save monocline, have remained elusive. New geochemical studies in the central cratonic remnants of Botswana (A. Duncan), Lesotho (Hooper, Marsh) and Springbok Flats (Marsh), and the rift-related sequences of Tuli (Duncan, Marsh) and Lebombo (Duncan, Hooper), together with Ar-Ar dating (R. Duncan) and palaeomagnetic work (R. Hargraves, Hooper), have allowed correlations to be established and a preliminary reconstruction of the evolution of the Karoo Province. Volcanism commences with sporadic nephelinite eruptions in north Lebombo and Mwenezi, followed by high-Ti picrites in these areas, Tuli and Save. Contemporaneous low-Tiactivity commences in the Central area, and waxes rapidly. The main stage of basaltic activity (both high- and low-Ti) in the Lebombo, Mwenezi, Tuli, and northern Botswana coincides with and succeeds the waning of Central area activity. All this occurs in a very short period at 180 Ma.

Eruptives in the Lebombo-Mwenezi-Tuli-Save rift zones are confined to rift grabens and areas to the north and east; virtually none of these volcanic products flow west and south into the interior of South Africa. The main Karoo activity concludes with rhyolite activity in Lebombo and Mwenezi at about 177 Ma.

contributed by Goonie Marsh (Rhodes University, South Africa)

Spacecraft Data on Extra-terrestrial Volcanoes

Large volcanic provinces have been found on the Moon, Mars, Venus, Jupiter's moon Io and, possibly, on Mercury. The study of volcanoes on these bodies relies largely on data acquired by spacecraft. Below is a summary of the most recent data sets and a glimpse of the missions we can look forward to in the next few years. More detailed information on available data sets can be found in these two WWW pages:

Planetary Data Systems (PDS) imaging node:
http://cdwings.jpl.nasa.gov

National Space Science Data Center (NSSDC):
http://nssdc.gsfc.nasa.gov/planetary/planetary_home.html

Moon: We have more information about volcanism on the Moon than on any other planets, thanks largely to the Apollo missions which brought back samples. The latest Moon data available are from the Clementine spacecraft, which orbited the Moon in 1994. Data from all of Clementine's imaging systems (UV/Visible, Long-Wave Infrared, Near Infrared, High Resolution, and Star Tracker) have been released as raw images in CD form. For more information, see the Clementine page in the PDS homepage.

Mercury: The existence of volcanic plains on Mercury has not been confirmed and the only data available are from the Mariner 10 mission which imaged 45% of the surface in 1974-75. Mariner 10 camera data are available in CD form from the NSSDC, but the CDs are in an old format and are not easy to work with. Some images are available on-line through the PDS Browser (see URL above) and can be converted to various formats and downloaded using the Browser.

Venus: Volcanism is widespread on the surface of Venus, where some of the solar system's most spectacular lava flows and lava channels are seen. The Magellan spacecraft arrived at Venus in 1990 and mapped 99% of the planet using synthetic aperture radar to "see" through the thick cloud cover. Magellan provided altimetry, radiometry, and gravity data in addition to radar images. The copious Magellan data set is available from the NSSDC as CDs and subsets can be viewed using the PDS Browser.

Mars: The most recent data sets are those from the two Viking orbiter and lander missions, which arrived at Mars in 1976. Images from Viking Orbiters 1 and 2 are available as CDs through NSSDC. Images from the two Landers should be available in CD format by early 1996, but can be obtained now through the PDS Browser.

We can look forward to exciting new data in 1997 from the Mars Pathfinder and the Mars Global Surveyor missions. Pathfinder is a lander mission which will carry a rover equipped with an imager (visible to near IR) and an alpha-proton X-ray spectrometer for in-situ sample analysis. It is scheduled to land on July 4, 1997. Mars Global Surveyor is an orbiter carrying a camera, laser altimeter, and thermal emission spectrometer in its complement of instruments, and is scheduled to reach Mars in September 1997.

Io: The two Voyager spacecraft which flew by Jupiter in 1979 showed the enormous extent of volcanism on Io and sparked debates about the composition of the flows and volcanic units (sulfur or silicates?). Voyager imaging data are available in CDs through the NSSDC. We can look forward to new data on Io very soon: the Galileo spacecraft will arrive at Jupiter on December 7 of this year and begin a two-year tour of the Jupiter system, during which Io will be monitored by four remote sensing instruments: the Solid State Camera (SSI), the Near Infrared Mapping Spectrometer (NIMS), the Photopolarimeter Radiometer (PPR), and the Ultraviolet Spectrometer (UVS). Galileo's closest encounter with Io occurs on December 8 but, due to the functional loss of the spacecraft's main antenna, data will recorded and transmitted to us during the first half of 1996. Galileo data will be released in CD format once calibrations and initial analysis are completed. The spacecraft's 2-year tour will allow us to monitor Io's activity at (relatively) close range and will provide a steady supply of exciting data for the next few years.

contributed by Rosaly Lopes-Gautier (Jet Propulsion Laboratory, California Institute of Technology, USA)

Summaries of recent research programs are invited; please send your contribution to Mike Coffin or John Mahoney. For the sake of brevity, references are omitted; please contact the contributors directly for more information.

Previous Meetings

***IUGG/IAVCEI "Origin of Large Igneous Provinces" Commission Symposium,** Boulder, Colorado, USA, 6 July 1995*

The Origin and Evolution of Large Igneous Provinces full-day symposium, convened by Mike Coffin, Nick Arndt, and John Ludden, was well-attended and the scene of lively debate. Papers were presented on individual LIPs, including Karoo basalts (J.S. Marsh, A.R. Duncan), oceanic plateaus (M.F. Coffin, E.L. Winterer, C.G. Farnetani, M. Cloete, A. Kerr, W.W. Sager), Deccan Traps (J.J. Mahoney, K.V. Subburao, U. Raval), Paraná basalts (P.R. Renne), Ethiopian Traps (V. Courtillot), Siberian basalts (P.R. Renne, M.S. Pringle), and Chinese flood basalts (X. X. Mo), as well as on environmental effects of flood basalts (V. Courtillot, S. Self) and on flood basalt statistics (A. Zemstov). Among the most exciting results were new 40Ar-39Ar dates from many LIPs, demonstrating that they were emplaced in short periods; correlation of the Siberian flood basalts and the Permo-Triassic mass extinction event; and other environmental havoc wrought by flood basalt eruptions.

***IUGG/IAVCEI "Evolution of Large Volcanic Systems and Restless Calderas" Symposium and Related Field Workshop,** Boulder, Colorado, USA, 25 June-4 July 1995*

An excellent summary of this exciting LIP-related symposium/workshop, convened by Ken Hon and John Pallister, appeared in the 17 August 1995 issue of Nature (Hon, K., & Pallister, J., 1995. Wrestling with restless calderas and fighting floods of lava, Nature, 376, 554-555.)

***Plume2 Alfred-Wegener-Conference,** Tegernsee, Bavaria, Germany, 16-21 July 1995*

This conference at Schloß Ringberg, a sequel to the 1991 Plume Symposium at Caltech, was attended by approximately 60 geoscientists. D.L. Anderson, S.R. Hart, and A.W. Hofmann, with the invaluable assistance of K. Lehnert, convened the conference, and organized one plenary lecture in the morning and one in the afternoon, each followed by a forum session. Plenary lectures included "Fluid Dynamics of Plume Formation, Ascent, and Interaction with Lithosphere" (U. Christensen); "Geochemistry of Plumes" (S.R. Hart); "To Plume or Not To Plume—Alternatives to Plume Convection" (D.L. Anderson); "Tomographic and Other Seismological Evidence for Plumes" (G. Masters), "Mixing and Recycling: Time Scales and Length Scales" (C. Allègre); "Mineral Physics and Plumes: Phase Changes and Thermal Constraints" (R. Boehler); "LIPs, Plate Tectonics, and Plumes: Pas de Deux or Ménage à Trois?" (M.F. Coffin). Participants were treated to the latest results in "plumology" from geodynamics, seismology, geochemistry, mineral physics, and radiometric dating, and lively discussion and superb hospitality were hallmarks of the conference. Extended abstracts are scheduled to appear in Terra Nostra, the journal of the Alfred-Wegener-Foundation.

Synopses of recent meetings are welcomed—please send your ~200 word review to Mike Coffin or John Mahoney.

LIPs and the Ocean Drilling Program

Each northern hemisphere spring, the four thematic panels of the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES)—Lithosphere, Tectonics, Ocean History, and Sedimentary & Geochemical Processes—rank all active ODP proposals. These global rankings, plus logistical considerations, form the basis for the JOIDES Planning Committee's choice of ~12 highly-ranked proposals for inclusion in the annual prospectus. Each northern hemisphere fall, the four thematic panels rank the proposals in the prospectus. Finally, in December of each year, the Planning Committee examines the rankings of the proposals in the prospectus and determines a rational scientific program for the drillship JOIDES Resolution one year in advance; i.e., in December 1995, the program for 1997 will be scheduled.

One large igneous province, the Southeast Greenland volcanic margin, is now being drilled during ODP Leg 163. The Planning Committee has chosen two LIP proposals—the Caribbean flood basalt province and the Kerguelen Plateau/Broken Ridge—for inclusion in the 1997 prospectus. As described in The LIP Reader #4, formal links between ODP and our Commission have been established. Mike Coffin represents our Commission within the ODP advisory structure, as a member of the Lithosphere Panel, and welcomes input from Commission members.

The Ocean Drilling Program is proposal-driven, and anyone may submit a drilling proposal. Guidelines for writing and submitting proposals may be obtained from Rob Kidd or Julie Harris, JOIDES Office, Dept. of Earth Sciences, University of Wales, Cardiff, PO Box 914, Cardiff CF1 3YE, UK. Telephone 44.222.874.541. Facsimile 44.222.874.943. Internet: joides@cf.ac.uk. Information on ODP's long-range thematic plans can be obtained from the same address.

The Ocean Drilling Program is now undergoing a mid-term review. The goal of the international review is to provide a comprehensive and balanced evaluation of the science, operations, and organizational structure of the international program of scientific ocean drilling. IAVCEI, through the Commission on Large-Volume Basaltic Provinces, has been asked to "review and evaluate the scientific and technological accomplishments of the Ocean Drilling Program and the future goals." Commission members were solicited for input, and the Steering Committee has forwarded its submission to the ODP International Review Committee. The letter is available over the internet (see below).

Commission Products and Services

LIPs on Internet

LIPs have an internet presence, accessible via standard internet tools. The Commission's LIP bibliography of ~2000 references, directory of ~450 members, and digital database of LIP areas (Figure 1 of Coffin & Eldholm, Reviews of Geophysics, 1994) are available, as well as the calendar of events and text versions of The LIP Reader. The internet site is currently set up as a Gopher server, which allows users to log in with anonymous ftp or World Wide Web (WWW) tools, such as Netscape or NCSA Mosaic. As time allows, the site will be enhanced for WWW users. Ideas on how the site could be improved are most welcome. For copies of materials on Macintosh diskette, please send a blank 3.5 inch diskette to Mike.

Anonymous FTP

With ftp, open ftp.cc.utexas.edu, use the login name "anonymous" and your internet address as a password. Then change directory to /pub/lips.

Gopher

Using your Gopher client software, open gopher.utexas.edu. Navigate to UT-Austin, to Colleges and Departments, to Institute for Geophysics, to Research Projects, and then to Commission on Large Igneous Provinces.

World Wide Web

The Universal Resource Locator (URL) is gopher://gopher.ig.utexas.edu:70/11/research/lips.

Upcoming Meetings

11-15 December: **American Geophysical Union Fall Meeting**, San Francisco, California, USA. Information: AGU Meetings Dept., 2000 Florida Ave., Washington, D.C., USA. Telephone 1.202.462.6900. Facsimile: 1.202.238.0566. Internet: meetinginfo@kosmos.agu.org

1996

25-30 January: **Deccan Trap Volcanism and Its Effect on Climate**, Mahabaleshwar, India. Abstract and registration deadline: 1 November 1995. Information: G. Sen, Geology Dept., Florida International University, Miami, Florida 33199, USA. Telephone 1.305.348.2299. Facsimile: 1.305.348.3877. Internet: seng@servax.fiu.edu or K.V. Subbarao, Earth Sciences Dept., Indian Institute of Technology, Powai, Bombay 400 076, India. Telephone: 91.22.578.2545 ext 3217. Facsimile: 91.22.578.3480 or 3702. Internet: subbu@zircon.geos.iitb.ernet.in

February: **Symposium on Deccan Flood Basalts of India**, Nagpur, India. Information: K.K.K. Nair, Geological Survey of India, Central Region, Seminary Hills, Nagpur - 440 006, India. Telephone: 91.712.534.448. Facsimile: 91.712.532.636.

13-26 February: **13th Australian Geological Convention and Celebration of Jubilee of BMR/AGSO**, Canberra, Australia. Information: M.J. Rickard, Secretary, 13th AGC, ACTS, GPO Box 2200, Canberra, ACT 2601, Australia. Telephone 61.6.249.2056. Facsimile: 61.6.249.5544

20-22 February: **Tectonic, Magmatic, and Depositional Processes at Passive Continental Margins**, Burlington House, London, United Kingdom. Information: Nick Kusznir, Dept. of Earth Sciences, University of Liverpool, Liverpool L69 3BX, United Kingdom.

28-30 March: **Geochemical Earth Reference Model Workshop**, Lyon, France. Information: GERM Workshop, Ecole Normale Supérieure de Lyon, 46, Allee d'Italie, 693647 Lyon Cedex 7, France. Telephone: 33.72.72.8414. Facsimile: 33.72.72.8677. Internet: germ@geologie.ens-lyon.fr. WWW: http://www.ens-lyon.fr/~albarede/germ.html

26-28 May: **The Ocean Lithosphere & Scientific Drilling into the 21st Century**, Woods Hole, Massachusetts, USA. Information: H.J.B. Dick, Dept. of Geology & Geophysics, Woods Hole Oceanographic Institution, Woods Hole, MA 02543, USA. Telephone: 1.508.563.3523. Internet: hdick@whoi.edu; Catherine Mével, Laboratoire de Pétrologie, Univ. Pierre et Marie Curie, T26 E3, 4 Place Jussieu, Paris Cedex, 75230 France. Telephone: 33.1.44.27.51.93. Internet: cam@ccr.jussieu.fr

1-9 July: **Earth - Ocean - Atmosphere Forces for Change**, Melbourne, Australia. Information: IAMAS/IAPSO Secretariat, Convention Network, 224 Rouse Street, Port Melbourne, Victoria 3207, Australia. Telephone: 61.3.9646.4122. Facsimile: 61.3.9646.7737. Internet: mscarlett@peg.apc.org

11-21 July: **Long Basalt Flow Workshop**, Townsville, Australia. Information: P.J. Stephenson, Dept. of Earth Sciences, James Cook University, Townsville 4811, Australia. Telephone: 61.77.81.5061. Facsimile: 61.77.25.1501. Internet: jon.stephenson@jcu.edu.au

29 July-2 August: **Pan Pacific Hazards '96**, Vancouver, Canada. Information: Disaster Preparedness Resources Centre, University of British Columbia, 2206 East Mall, 4th Floor, Vancouver, B.C. V6T 1Z3, Canada. Telephone: 1.604.822.5518. Facsimile: 1.604.822.6164. Internet: dprc@unixg.ubc.ca

4-14 August: **30th International Geological Congress**, Beijing, China. Information: Prof. Zhao Xun, Deputy Secretary General, 30th International Geological Congress, PO Box 823, Beijing 100037, PR China. Telephone: 86.10.8323188. Facsimile: 86.10.8328928. Internet: zhaox@bepc2.ihep.ac.cn

9-14 September: **XXV General Assembly of the European Seismological Commission**, Reykjavik, Iceland. Information: LOC XXV General Assembly ESC, Attn: Mr. Bardi Thorkelsson, The Icelandic Meteorological Office, Bústadavegur 9, 150 Reykjavik, Iceland. Telephone: 354.560.0600. Facsimile: 354.552.8121. Internet: esc96@verdur.is

21-25 October: **International Symposium on Geology and Geophysics of the Indian Ocean - GIO, 1996**, Goa, India. Information: Ch. Madhusudana Rao, National Institute of Oceanography, Dona Paula, Goa 403 004, India. Facsimile: 91.832.223.340. Internet: msrao@bcgoa.ernet.in

1997

19-24 January: **IAVCEI General Assembly**, Puerto Vallarta, México. Information: Instituto de Geofisica, UNAM, Circuito Exterior, Ciudad Universitaria, C.P. 04510, México, D.F. Facsimile: 5.550.24.86. Internet: lourdes@igiris.igeograf.unam.mx

The LIP Reader

Institute for Geophysics
The University of Texas at Austin
8701 North Mopac Expressway
Austin, Texas 78759-8397 USA