Program

Conference on Deep Earth and Planetary Volatiles

September 21–23, 1994
Pasadena, California
Conference on Deep Earth and Planetary Volatiles
September 21–23, 1994

Hosted by
California Institute of Technology

Sponsored by
Lunar and Planetary Institute
National Science Foundation
U.S. Coordinating Committee for Cooperative Studies
of the Deep Earth Interior

Program Committee

Thomas J. Ahrens, Chair California Institute of Technology
Kenneth Farley California Institute of Technology
Donald Hunten University of Arizona
Keith O’Nions University of Cambridge
Uli Ott Max-Planck-Institut für Chemie, Mainz
Kevin Zahnle NASA Ames Research Center
CONFERENCE INFORMATION

Messages
Participants may be reached at 818-395-6991 between the hours of 8:30 a.m. and 5:00 p.m. Messages will be posted at the registration and staff desk in Dabney Lounge. Sessions will not be interrupted to deliver messages except in cases of emergency.

Group Meals
A continental breakfast will be served to conference participants beginning at 7:30 a.m. on Wednesday morning and each following morning for one-half hour prior to the start of the conference session. The breakfast and coffee breaks will be served in the Dabney Lounge. Lunch will be provided in the Dabney Courtyard Gardens.

Social Event
A reception will be held on Wednesday evening, September 21, at The Athenaeum, Caltech's faculty club, from 5:30 to 7:00 p.m. All participants and their guests are invited.

Shuttle Service
Limited service from the hotel to the conference will be provided by a hotel van. The schedule for this service is as follows:

- **Wednesday, September 21**: 7:30 and 8:00 a.m. Hotel to Caltech 7:00 and 7:30 p.m. Caltech to hotel
- **Thursday, September 22**: 7:30 and 8:00 a.m. Hotel to Caltech 5:00 and 5:30 p.m. Caltech to hotel
- **Friday, September 23**: 7:30 and 8:00 a.m. Hotel to Caltech 3:00 and 3:30 p.m. Caltech to hotel
PROGRAM
Conference on Deep Earth and Planetary Volatiles
September 21–23, 1994
California Institute of Technology
Pasadena, California

Tuesday evening, September 20, 1994

6:00–8:00 p.m.  Registration and No-host Bar  
                 Lobby of Doubletree Hotel

Wednesday morning, September 21, 1994

7:30–8:30  Registration and Continental Breakfast  
           Dabney Lounge, Caltech Campus

8:30–8:40  Welcome and Opening Remarks  
           T. J. Ahrens  
           Baxter Lecture Hall

8:40 a.m.–12:10 p.m.

PLANETARY VOLATILES I
Baxter Lecture Hall

Chairs: T. Donahue and K. Zahnle

8:40–9:10  Solar System Formation and the Distribution of Volatile Species  
           J. I. Lunine*

9:10–9:40  Comets, Impacts, and Atmospheres  
           T. Owen*  A. Bar-Nun

9:40–10:10  Dynamics of Volatile Delivery from Outer to Inner Solar System  
            W. M. Kaula*

10:10–10:40  COFFEE BREAK/POSTERS  
              Dabney Lounge

10:40–11:10  Nitrogen Isotopic Components in the Early Solar System  
              J. F. Kerridge*

11:10–11:40  Atmospheres of the Moon and Mercury  
              D. M. Hunten*

*Denotes speaker
11:40–12:10  *Surface Ices in the Outer Solar System*
  T. L. Roush*   D. P. Cruickshank

12:10–1:30  LUNCH/POSTERS
  Dabney Gardens and Lounge

*Wednesday afternoon, September 21, 1994*

1:30–5:00 p.m.

**PLANETARY VOLATILES II**
  Baxter Lecture Hall

  **Chairs:** G. J. Wasserburg and H. Wänke

1:30–2:00  *Origin and Loss of the Volatiles of the Terrestrial Planets*
  T. M. Donahue*

2:00–2:30  *Water Abundance and Accretion History of Terrestrial Planets*
  H. Wänke*   G. Dreibus

2:30–2:45  *Degassing History and Evolution of Volcanic Activity of Terrestrial Planets Based on Radiogenic Noble Gas Degassing Models*
  S. Sasaki*   E. Tajika

2:45–3:00  *Volatiles, Rheology, and Mantle Convection: Comparing Earth, Venus, and Mars*
  W. S. Kiefer*

3:00–3:15  *Mantle Devolatilization and Rheology in the Framework of Planetary Evolution*
  S. Franck*   Ch. Bounama

3:15–3:45  **COFFEE BREAK/POSTERS**
  Dabney Lounge

3:45–4:00  *Is Xenon Eldest?*
  K. Zahnle*

4:00–4:15  *Primitive Xe in the Atmospheres of Earth and Mars*
  G. Igarashi*

4:15–4:30  *Implications of Noble Gases in a Recently Recognized Martian Meteorite (ALH84001) for the Degassing History of Mars*
  T. D. Swindle*

4:30–4:45  *Mars Atmospheric Loss and Isotopic Fractionation by Pick-Up-Ion Sputtering and Photochemical Escape*
  B. M. Jakosky*   R. O. Pepin   R. E. Johnson   J. L. Fox
Thursday morning, September 22, 1994

8:00–8:30
CONTINENTAL BREAKFAST
Dabney Lounge

8:30 a.m.–12:00 noon

EARTH VOLATILES I
Baxter Lecture Hall
Chair: J. F. Kerridge

8:30–9:00
Rare Gases Systematics and Mantle Structure
C. J. Allègre*  T. Staudacher

9:00–9:30
Rates of Earth Degassing
R. K. O’Nions*

9:30–10:00
He, Xe and Ne Isotopes in a Steady-State Mass Transport Model and Implications About Terrestrial Volatiles
G. J. Wasserburg*  D. Porcelli

10:00–10:30
COFFEE BREAK/POSTERS
Dabney Lounge

10:30–11:00
Recycling of Volatiles at Subduction Zones: Noble Gas Evidence from the Tabar-Lihir-Tanga-Feni Arc of Papua New Guinea
K. Farley*  B. McInnes  D. Patterson

11:00–11:15
Solar Helium and Neon in the Earth
M. Honda*  I. McDougall  D. B. Patterson

11:15–11:30
Mantle Rare Gas Relative Abundances in a Steady-State Mass Transport Model
D. Porcelli*  G. J. Wasserburg

11:30–12:00
DISCUSSION
Led by K. Farley

12:00–1:30
LUNCH/POSTERS
Dabney Gardens and Lounge
Thursday afternoon, September 22, 1994
1:30—4:45 p.m.

EARTH VOLATILES II
Baxter Lecture Hall

Chairs: R. Jeanloz and R. K. O’Nions

1:30—1:45  Spatial Variation of Primordial 3-He in Crustal Fluids Along the East African Rift System (the Ethiopian and the Kenya Rift Section)
E. Griesshaber*  S. Weise  G. Darling

1:45—2:15  Volatiles in the Earth; All Shallow and All Recycled
D. L. Anderson*

2:15—2:45  Seismic Evidence for Volatiles at Large Depth in the Earth
G. Nolet*

2:45—3:00  Noble Gas Isotopes and Halogens in Volatile-rich Inclusions in Diamonds
R. Burgess  G. Turner*

3:00—3:30  COFFEE BREAK/POSTERS
Dabney Lounge

3:30—3:45  DISCUSSION
Led by R. K. O’Nions

3:45—4:00  Alkali Element Depletion by Core Formation and Vaporization on the Early Earth
K. Lodders*  B. Fegley Jr.

4:00—4:15  D/H Ratios and H₂O Contents of Mantle-derived Amphibole Megacrysts from Dish Hill, California
D. R. Bell*  T. C. Hoering

4:15—4:30  The Primary Carbon and the Formation of Carbon Species in Terrestrial Magmas
A. A. Kadik*

4:30—4:45  Subduction and Volatile Recycling in Earth's Mantle
S. D. King*  J. J. Ita  H. Staudigel
Friday morning, September 23, 1994

8:00–8:30 CONTINENTAL BREAKFAST
Dabney Lounge

8:30–11:30 a.m.

VOLATILES IN PLANETARY MATERIALS
Baxter Lecture Hall
Chair: E. Stolper

8:30–9:00 Storage and Recycling of Water and Carbon Dioxide in the Earth
B. J. Wood*

9:00–9:15 Subduction of Hydrated Basalt of the Oceanic Crust: Implications for Recycling of Water into the Upper Mantle and Continental Growth
R. P. Rapp*

9:15–9:45 Volatiles in the Deep Earth: An Experimental Study Using the Laser-heated Diamond Cell
X. Li R. Jeanloz* J. H. Nguyen

9:45–10:15 COFFEE BREAK/POSTERS
Dabney Lounge

10:15–10:30 Structure and Stability of Hydrous Minerals at High Pressure
T. S. Duffy* Y. Fei C. Meade R. J. Hemley H. K. Mao

10:30–10:45 A Crystallographic Model for Hydrous Wadsleyite (β-Mg2SiO4)
J. R. Smyth*

10:45–11:00 Thermochemistry of Dense Hydrous Magnesium Silicates
K. Bose* P. Burnley A. Navrotsky

11:00–11:15 Phase E in a Water-saturated Peridotite System at 9.3 GPa
T. Kawamoto* K. Leinenweber R. L. Hervig

11:15–11:30 Solubilities of Nitrogen and Noble Gases in Basalt Melt
A. Miyazaki* H. Hiyagon N. Sugiura

11:30–1:00 LUNCH/POSTERS
Dabney Gardens and Lounge
Friday afternoon, September 23, 1994
1:00–1:30 p.m.

VOLATILES IN PLANETARY MATERIALS (cont.)
Baxter Lecture Hall

1:00–1:15 Transportation of Volatile Elements in Thermally Evolving Planetesimals—An Important Role of Metallic Iron
K. Hashizume* N. Sugiura

1:15–1:30 Hydrogen and Related Materials at High Density: Physics, Chemistry and Planetary Implications
R. J. Hemley* H. K. Mao T. S. Duffy A. Goncharov
W. Vos C. S. Zha J. H. Eggert M. Li M. Hanfland

1:30–2:15 p.m.

IMPACT DEGASSING
Baxter Lecture Hall
Chair: B. Jakosky

1:30–1:45 Polar Volatiles in Mercury and the Moon
D. A. Paige* S. E. Wood A. R. Vasavada

1:45–2:00 Semi-Volatiles at Mercury: Sodium (Na) and Potassium (K)
A. Sprague*

2:00–2:15 Impact Degassing of Water and Noble Gases from Silicates
S. Azuma* H. Hiyagon Y. Iijima Y. Syono

Wednesday through Friday, September 21–23, 1994
POSTER SESSION
Dabney Lounge

Degassing Mechanisms of Noble Gases from Carbonado Diamonds
S. Zashu H. Hiyagon

Loss of Solar He and Ne from IDPs in Subducting Sediment: Diffusion and the Effect of Phase Changes
H. Hiyagon

Modeling the Effect of Water on Mantle Rheology
Ch. Bounama S. Franck

PRESENTED BY TITLE ONLY

The Ratios of Carbon and Non-Radiogenic Helium and Argon Isotopes in the Mantle and Crustal Rocks
K. I. Lokhov L. Levsky

Hydrogen Storage in Earth’s Mantle and Core
C. T. Prewitt