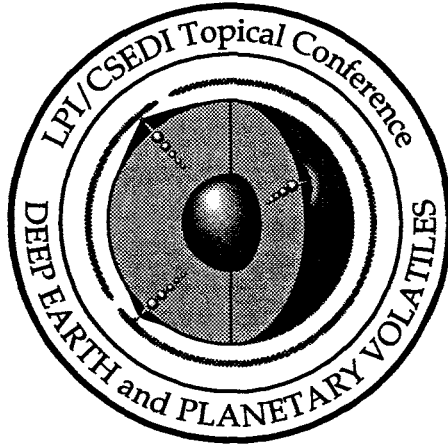


## **Program**

# **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<br>7:00 and 7:30 p.m. Caltech to hotel |
| Thursday, September 22  | 7:30 and 8:00 a.m. Hotel to Caltech<br>5:00 and 5:30 p.m. Caltech to hotel |
| Friday, September 23    | 7:30 and 8:00 a.m. Hotel to Caltech<br>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\*

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\*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

- 4:45–5:00      DISCUSSION  
                     Led by D. Hunten
- 5:30–7:00      RECEPTION  
                     Consumption of Volatiles and Food  
                     The Athenaeum (Caltech Faculty Club)

*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  $^3\text{He}$  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  $\text{H}_2\text{O}$  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 ( $\beta$ -Mg<sub>2</sub>SiO<sub>4</sub>)*  
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. Likhov L. Levisky

*Hydrogen Storage in Earth's Mantle and Core*

C. T. Prewitt