Conference Explores New Research in the Deep Earth and Planetary Volatiles

Some 50 scientists gathered to hear ex-

periments such as J. Leith, T. Owen, D. Hunter, and T. Donahue survey volatile budgets, con-
sideration, decision, and level his impact, and other planetary processes at the International Conference on Deep Earth and Planetary Volatiles, which was held at Caltech last Sep-

tember. The conference provided a forum for the discussion of new research and changing ideas on these hot science topics.

K. Washita reported new results indicating that although some did indeed impact and deliver volatiles to the terrestrial planets, their impact on Earth and Venus was at such high yield that the volatiles they could de-

lace were of lower order and of terrestrial plan-

ey volatile budgets were not augmented by this process. In contrast, D. Page suggested that water from comets could successfully be delivered to Mercury and even be seen from Earth-based solar studies of the shallow

order crater walls at the Mercury plains. He proposed that NASA, by a mission to Mercury, to collect evidence toward this hypothesis.

Shifting toward the Earth, Heinrich Wilke and G. Dermott described their and A. Z. Rimmer’s close almost classical model of a late-stage C-type carbonaceous chondrite, volatile-

bearing veers accreting on the terres-

trial planets. They pointed out that the Earth has water both in its interior and on its sur-

face while, in contrast, Mars’ water budget ap-

pears to be in a near-surface reservoir, as the Serenitatis, that the geologists, and the Geostatistics mic-

teors are from deep-powered sources and ap-

pear to be relatively dry. Wilke attributed this difference to the absence of plate tectos-

ics on Mars, which, if available, would recy-

cle water into the atmosphere.

One interesting point centered on the

volatiles on the earth and atmosphere were vigor-

ously defined by a number of scientists. Of special interest was C. Alléon’s presentation of new isotopic data on adrenal glands from Louis Jamin’s, as well as the discovery of elevated Na/P ratios in the Hawaiian plume. There seemed to be a con-

sensus that the plume is constrained to the lower mantle, that the water is not likely to be derived from the lower mantle. The case for sub-

duction of water remains open.

In contrast, there is little doubt that the major water—water and carbon dioxide—are being subducted, but their fate is ob-

scure. G. Woldt showed results of high-resolution mantle images that repeatedly show evidence of distinct low seismic velocity

zones at 100 and 200 km depth extending outward from several subduction slabs. It is interpreted as a consequence of dehydration of various hydrous mineral

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ples and loss of volatiles into the mantle wedge.

The geophysical consequences of water in planetary silicate sources were discussed by several participants. S. King, et al., pointed out the unique presence of volatiles in subducting slabs on the Earth affects the influence on which mantle sources in subduction regions plumps up the and possible to preferential for (OH) formation (proposed) at low transition

zones and influence in the rate of

availability of large volumes of MgO

aversalable in the mantle. They also noted that concentrations in the mantle could give rise to megatons of megaton.

K. Warner pointed out that volatiles do not appear to be a factor in volcanism as much as in

widely studied. S. Prusis and C. Browna conducted parameters from modelin

in the Earth’s interior, for example, from convective

K. Zahnle described his hydrodynamic

model of gas escape from planetary habitability and showed that massive fractionation of Ne isotopes is possible. Such a process oper-

ating on the entire Earth could produce the isotopic composition of atmospheric H with

out substantial fractionation in the isotopic ra-

tions of the heavy noble gases. Adding to the
discussion were C. Wasserburg and D. For-

culli who discussed the implications of a steady state mass transport model (originally used for helium isotopes) for Ne and Xe in

the Earth. Their new self-consistent model suggests that the atmosphere carries only a small fraction of rare gases derived from the Earth’s interior, and the balance was deliv-

ered from unknown extraterrestrial sources. These discussions demonstrated that long-

held beliefs about the origin of the present at-

mosphere are in doubt.

Another important issue addressed was

how the fluxes of volatiles into the mantle at subduction zones—phreatomagmatic—is poorly constrained. The model of Wasser-

burg and Forculli considered various me-

thods described by Zahnle suggest that the heavier noble gases, particularly Xe, are probably being returned to the mantle. K. Faelty described measurements of helium and argon in subducted melt. His work sug-

gested that elemental composition of the 

Earth is going down into the mantle. The case for sub-

duction of Ne remains open.

The conference was held at Caltech and the Lunar and Planetary Institute providing logistical support. Support was also provided by NSF and assistance came from both the Conference Organizing Committee and Coordinating Committee for Study of the Deep Earth’s Interior. A Proceed-

ings volume, edited by Kenneth Faelty and published by the American Institute of Phys-

ics, contains a set of papers. Faelty, D. O. Brown, and J. determination. Faelty, Division of Geological and

Planetary Sciences, California Institute of Technolo-

logy. Pomona.