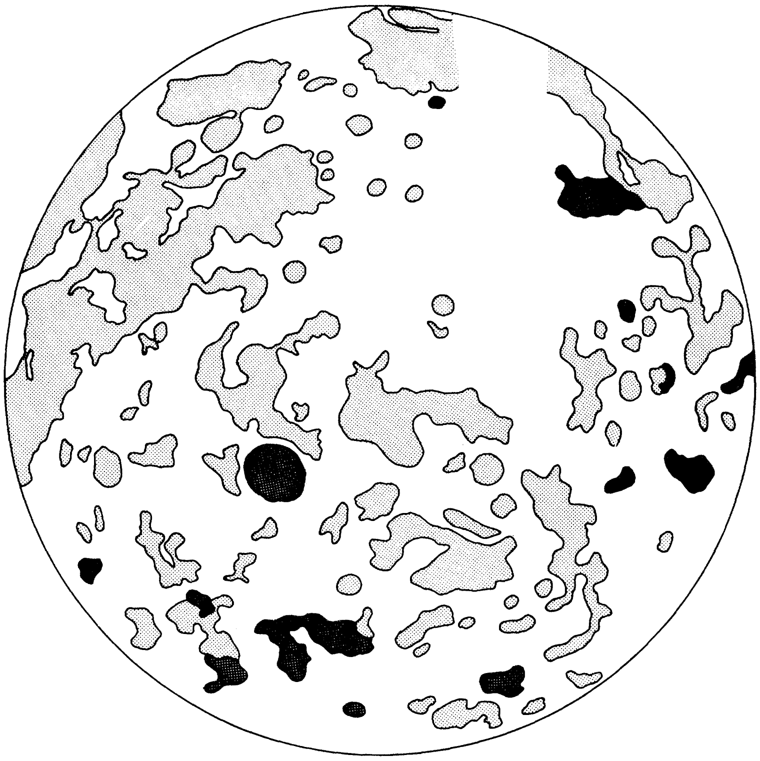

"Distribution of Calorian (light grey) and Calorian and/or Tolstojan (dark grey) smooth plains. Smooth plains cover about 10.4×10^6 km^2 or 40% of the part of Mercury photographed by Mariner 10." [From P. D. Spudis and J. E. Guest, "Stratigraphy and geologic history," in *Mercury*]

compared with magnesian silicates in the cooling solar nebula, in such a manner that at Mercury's distance from the protosun the ratio of metal to silicate was much higher than in the formation zones of the other terrestrial planets. Subsequent calculations of dynamically plausible accretion scenarios, however, have shown that the terrestrial planets probably formed from material originally condensed at a wide range in solar distance. Thus, the high metal fraction of Mercury cannot be primarily a result of condensation temperature.

There are currently three classes of alternative explanations, discussed in chapters by Lewis, Goettel, Wasson, Wetherill, and Cameron and others. One class of models invokes differences in the physical properties of iron and silicates to achieve fractionation during accretion. A second class, championed by Cameron and Fegley, attributes the high metal content of Mercury to preferential vaporization of silicates during the evolution of the solar nebula. In a third class of models, for which Wetherill is the most eloquent spokesman, selective removal of silicate occurred as a result of a giant impact on a previously differentiated protoplanet. These hypotheses could be distinguished by future measurements of the composition of Mercury's surface.

Clever gravity-assisted trajectories have recently been found which will permit, with current launch systems, the insertion of a spacecraft into a circular orbit around Mercury. A Mercury orbiter mission would provide the opportunity for a precise determination of the solar quadrupole moment and an important test of general relativity as well as for a host of measurements of the planet itself. This book provides ample arguments that such a mission is of the highest scientific priority.

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Monitoring Volcanism

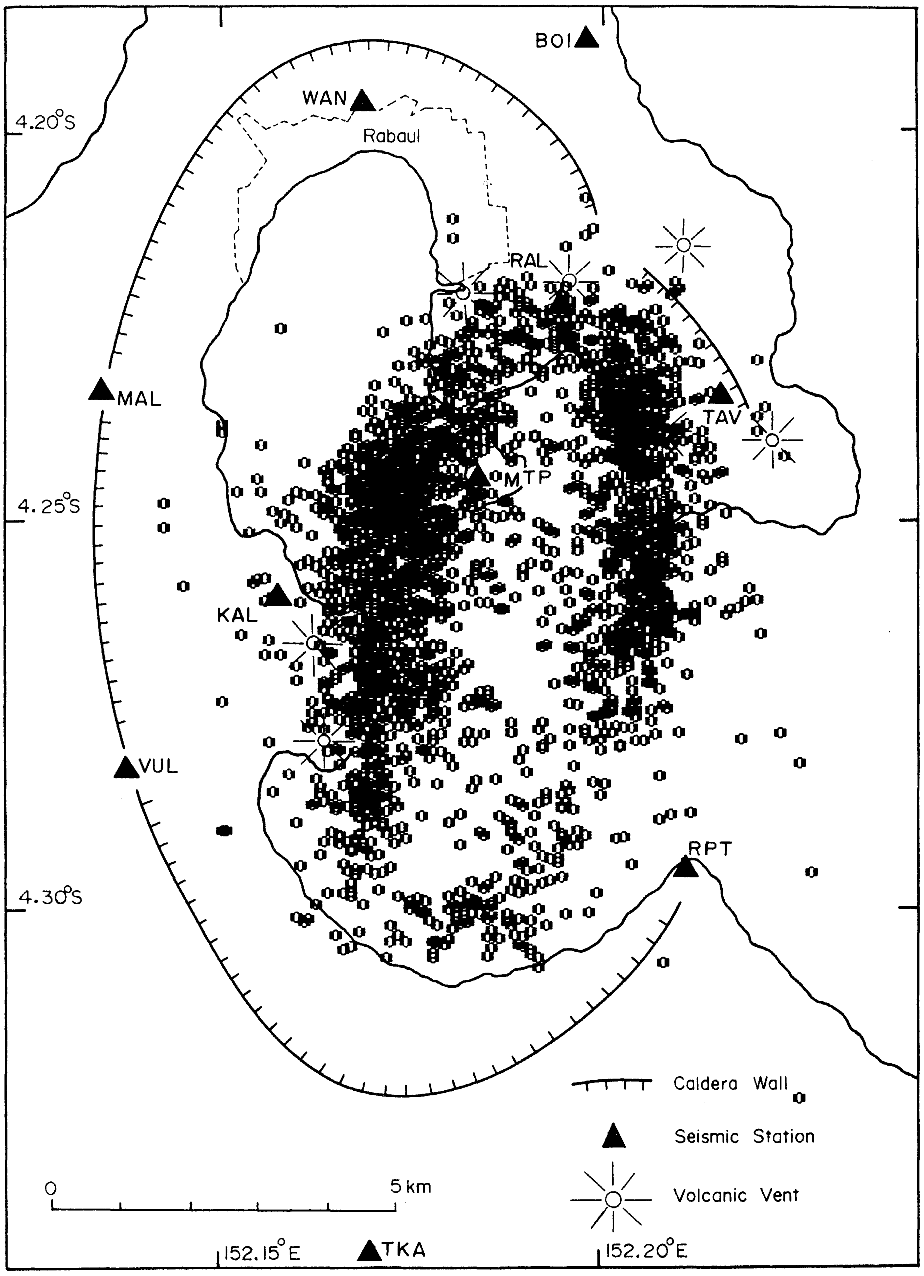
Volcanic Hazards. Assessment and Monitoring. JOHN H. LATTER, Ed. Springer-Verlag, New York, 1989. xiv, 625 pp., illus. $98. Proceedings in Volcanology, vol. 1. From a congress, New Zealand, Feb. 1986.

This excellent book is an outgrowth of a trend that began in the mid-1970s, when events in several parts of the world sharpened the focus on volcanological hazards. In the early 1980s, eruptions of Mt. St. Helens and El Chichón whetted North American interest, and geophysical unrest at three heavily populated calderas drew further attention to the effects on humans of volcanic activity. Then in 1985, after a year of premonitory activity, Colombia's Nevado del Ruiz killed 22,000 people. A small group of volcanologists had prepared excellent hazard maps and warned authorities in October, but that gave little solace in November when news of the disaster rolled in. The effect of the experience on the volcanological community was palpable in the symposium on volcanic hazards, held three months later in New Zealand, that resulted in this book.

The volume contains a stimulating mix of regional reviews, case histories, and technique papers from most of the world's volcanic regions. The book is divided into two parts, with 15 papers under the heading Hazard Assessment, followed by 21 under the heading Monitoring and a 27-page subject index. All the papers read smoothly, regardless of the authors' native language.

A wide range of fine papers reflects the wide range of volcanic behavior. Contrast, for example, Réunion Island, where eruptions come, on the average, only 14 months apart, with Mexico's Popocatepetl, where activity is weak but risk, because of a large local population, is not. Excellent papers review both Papua New Guinea and the West Indies, with one on the latter forthrightly discussing the problems of hazard reports that do not tell tourist-oriented governments what they want to hear. The likelihood of fluid basalt eruptions from low fissures in Iceland belies the conventional wisdom that large, explosive strato-volcanoes are the main threat. Seismicity has been a reliable precursor of eruptions in Japan, Alaska, and elsewhere, but roughly three out of four West Indian seismic swarms turn out to be volcanological false alarms.

A wide spectrum of technology for monitoring volcanoes is described. An amazing tiltmeter at Japan's Sakura-jima regularly measures uplift of 0.01 microradians (equivalent to 1 mm uplift at one end of a carpenter's level 100 km long) and automatically sounds an alarm when the rate exceeds a critical value. A low-cost alternative in New Zealand involves careful measurement of lake-level changes on opposite sides of 25-km-wide Lake Taupo. At Rabaul caldera, however, 1.8 m of uplift was recorded between 1973 and 1985 with no resulting eruption. One paper describes computer-generated movies, showing theoretical eruptions at specific volcanoes for use in contingency planning and education, and another describes the use of vegetation mortality as an eruption warning in the Philippines. Geostationary Meteorological Satellites provide invaluable, hour-by-hour data on plume changes in large eruptions but are



Epicenters of over 2500 earthquakes recorded during the 1983–1985 volcanic crisis at Rabaul Caldera on New Britain Island, Papua New Guinea. About 70,000 people live on the north shore of this natural harbor. The elliptical pattern of earthquakes is thought to outline a caldera ring-fault that is currently being reactivated owing to the stresses caused by rising magma. [From J. Mori *et al.*, "Earthquakes of the Rabaul seismo-deformational crisis," in *Volcanic Hazards*]

unable to distinguish most small eruptions from local clouds. Infrasonic monitoring has been very effective for the eruptions of Mt. Erebus in Antarctica but is, unfortunately, little used elsewhere.

It is the painstaking field studies and careful dating of ancient eruptions, however, that produce a frightening cumulative effect. They demonstrate long-term cycles of activity that dwarf the short historic record and make it clear that current monitoring efforts are woefully inadequate in most parts of the world. There is no high-tech alternative to the slow, unglamorous, but terribly important building of chronologic and petrologic histories covering tens of thousands of years. Those presented here for Kamchatka and the West Indies show unfamiliar volcanoes that clearly deserve attention despite inactivity during their short recorded histories.

This book will inevitably be compared with another of the same name by Russell Blong, published by Academic Press in 1984. Blong's book, subtitled "A Sourcebook on the Effects of Eruptions," treats the subject in a systematic way and with a uniformity of style not possible in a work with many authors. Latter's book provides a depth rarely possible in a single-authored text. Good volcanological libraries should have both. Unfortunately, many will pass up the Latter book because of its cost. If books as good as this present one are to reach the wide audience they deserve, the publishers should be encouraged to adopt a more reasonable pricing policy.

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Genetic Mobility

Mobile DNA. DOUGLAS E. BERG and MARTHA M. HOWE. American Society for Microbiology, Washington, DC, 1989. xviii, 972 pp., illus. $95; to ASM members, $75.

Mobile DNA elements were a major surprise for the biological world, there being no *a priori* reason to expect genes to move about within a genome. The existence of mobile DNA has been generally recognized only for half of the time since it was discovered by Barbara McClintock in the 1940s. Since the discovery of the insertion sequences in *Escherichia coli* in 1968, however, information about the distribution, structures, mechanisms of mobility, and cellular roles of mobile elements has simply exploded. Mobile DNA has been found in every organism in which it has been sought and thus seems likely to be an important component of every genome. *Mobile DNA* provides thorough reviews of a wide variety of topics in the field.

The book consists of 43 chapters, proceeding from simple systems to more complex ones. It begins with chapters on bacteriophages lambda and mu and a chapter on retroviruses that consider all these viruses as free-living DNA molecules that have the essential property of mobile DNA: the viral genomes can integrate into the genome of the host. The next section starts with *E. coli* insertion sequences, and individual chapters cover each of the major complex transposons of *E. coli* and then transposons of Gram-positive bacteria, actinomycetes, and halobacteria. After a review of mobile DNA in the plant pathogen *Agrobacterium*, chapters progress through mobile DNA of yeast, maize (the organism in which mobile DNA was originally discovered), *Drosophila*, and mammals. Later chapters discuss site-specific inversions and other local DNA rearrangements that regulate gene expression and are followed by papers on transposable elements as tools for genetic engineering. Finally, an outstanding chapter, more syn-