REVIEW

HIGH-PRESSURE RESEARCH IN GEOPHYSICS. Edited by S. Akimoto and M. H. Manghnani. Publishers: Center for Academic Publications, Japan/Tokyo and D. Reidel Publishing Company/Dordrecht-Boston-London. 632 pages. Price US $ 113/-. Published in 1982.

This volume is number 12 in the series 'Advances in Earth and Planetary Sciences' brought out by the above publishers. It arises from a collection of papers presented at a U.S.-Japan seminar on high-pressure research applications to Geophysics held at Hakone, Japan in January 1981. Forty-five papers appear in this volume, spread out in seven sections: instrumentation, elasticity, mechanical properties, geophysics and geochemistry, high-pressure phase transformation, thermochemistry and shock-wave experiments. All these topics are directly or indirectly connected with the study of properties and processes in the mantle. Comparison of experimental data with the natural geophysical observations is presented in a number of papers. The first section on instrumentation and pressure calibration begins with a report on the new developments in high-pressure gadgets using sintered diamond anvil reaching over one megabar (100 G Pa) static pressure. It has been a challenging feat for experimentalists to reach conditions prevailing in the earth's core. Application of diamond-anvils to high-temperature and high-pressure experiments with appropriate facilities like X-ray diffraction or energy dispersive analyses, Brillouin and Raman scattering, infra-red absorption etc., have expanded the possibility of direct probing of phase transitions or melting processes.

The second and third sections deal with elasticity, attenuation and rheology as well as mechanical properties and melting behaviour of the crust and upper mantle. Brillouin scattering technique has been employed by a number of workers to study the elastic properties of oxide and silicate minerals. Dynamic recrystallisation of olivine and near equilibrium melting studies on silicates and rocks at high pressures are good contributions. The papers under geophysics and geochemistry of mantle lack coherent coverage of these topics. The geochemical papers have a large element of speculation. Under the section on high-pressure phase transitions and crystal chemistry, those on rutile-type dioxides, silicate-spinels, ilmenites and perovskites are well presented. Particular mention may be made on the papers dealing with the kinetics and mechanism of olivine-spinel transformation where diffusion-less martensitic conversion gained considerable support over the lattice rebuilding model. Disproportionation of fayalite under pressure to yield metallic iron is interesting, in view of a possible earth's core separation process. The sixth section contains some papers on thermochemistry and crystal growth, though one fails to understand how these two topics are put together. Specific mention may be made on the high temperature calorimetric studies and the attempts to grow larger diamond crystals. The final section deals with shock wave experiments where dynamic effects of pressure on fused silica, single crystals of forsterite and haematite are reported. Temperature induced by shock waves in minerals may have wider geophysical applications.

There are few papers directly linked to petrology and geophysics. It is not the upper-most pressure or temperature that is important but systematic experiments with natural systems. The present trend in experimental work is significantly tending to solid pressure systems with less attention on the effect of volatile components. This volume is no exception to this trend. It is an important publication to the specialists and falls short of attracting general readers.

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