

believes there may be oscillations of the main field with periods of several thousand years and reversals of the field at intervals of hundreds of thousands of years.

But all this leads to still another question: Is a trigger needed to set off this change, and if so, what? The time of the last reversal coincides with the meteorite or comet collision thought to have created the Australian tektite field, and several scientists have suggested this as a trigger.

Dr. J. R. Heirtzler of Lamont-Doherty Geological Observatory speculates that major earthquakes may cause wobble in the earth's spin axis which in turn might trigger a reversal. Since stress release is often manifested in volcanic activity, Drs. Kennett and Watkins reasoned recently that an investigation of past volcanic activity might reveal a correlation with magnetic polarity changes. The two scientists took cores from various locations in the South Pacific, demagnetized them to remove the effects of the present magnetic field, and measured their remanent magnetism. They found that when geomagnetic polarity changes were taking place, volcanic maxima were also occurring.

Another team of researchers, Drs. I. K. Crain and P. L. Crain of the Australian National University in Canberra and Dr. M. G. Plaut of the University of Western Ontario, analyzed the alternation of geomagnetic polarity over a long period of time—about 350 million years. They found two peaks in the proportions of normal polarity at about 300 million and 80 million years. These, they say, represent a magnetic era of 150 million years and a magnetic period of 40 million years.

The period of rotation of the Milky Way is about 280 million years and the vibrational period of the sun perpendicular to the galactic plane is about 84 million years. "This apparent correlation between the galactic oscillations and observed geomagnetic periods may indicate an external cosmological influence on the earth's magnetic field," the three conclude.

The cause of magnetic reversals is generally agreed to be some variation on the dynamo theory, though the nature of this variation, and the event that might set it off are uncertain. What does seem clear is that geomagnetic reversals are tied in some as yet undefined way to a number of other physical phenomena. But, in the words of three prominent magnetic field researchers, "after centuries of research the earth's magnetic field remains one of the best-described and least-understood of all planetary phenomena." □

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books OF THE WEEK

CONTROLLING THE WEATHER: A Study of Law and Regulatory Procedures—Howard J. Taubenfeld, Ed.—Dunellen, 1971, 275 p., \$10. Comprehensive report on studies of the legal, scientific, political and social implication of problems raised by national and international weather modification efforts, such as rain making, hail and lightning suppression, and fog clearance.

ELECTRONS IN METALS: A Short Guide to the Fermi Surface—J. M. Ziman—Barnes & Noble, 1971, 76 p., illus., paper, \$3. Deals with the electron gas, bands and zones, dynamics of Bloch electrons and the calculation of band structure, the properties of real metals, and the gauging of the Fermi surface.

ETHICS FOR SCIENTIFIC RESEARCHERS—Charles E. Reagan—C. C. Thomas, 1971, 2nd ed., 166 p., \$9. Combines a theoretical study of the logic and structure of ethics with a casebook of practical applications. Includes annotated bibliography.

HISTORICAL STUDIES IN THE PHYSICAL SCIENCES, Vol. 2—Russell McCormach, Ed.—Univ. of Pa. Press, 1971, 356 p., photographs, diagrams, \$8.50. Contains eight articles dealing with the intellectual and institutional developments in physics from the mid-1840's to the mid-1920's, with primary focus on the quantum and relativity theories.

THE HOE AND THE HORSE ON THE PLAINS: A Study of Cultural Development among North American Indians—Preston Holder—Univ. of Neb. Press, 1970, 176 p., plates, illus., \$6.95. A study of two native modes of life in the Great Plains—the village way of life and the nomadic bison hunters on horseback, and the pattern of their encounters with the encroaching Europeans.

THE KUROSHIO: A Symposium on the Japan Current—John C. Marr, Ed.—East-West Center Press, 1970, 614 p., diagrams, maps, \$17.50. Based on the field work of 98 oceanographic cruises, this intensive study of one of the principal currents in the Pacific covers such subjects as physical and chemical oceanography, fish and fisheries, planktonology and bottom topography of the area.

MEASUREMENTS OF SPECTRAL IRRADIANCE UNDERWATER—John E. Tyler and Raymond C. Smith—Gordon and Breach, 1971, 103 p., diagrams, tables, \$19.50. Quantitative information on the underwater light field, details on its variation with depth, and the optical attenuating properties of various types of natural water.

PALEOZOIC PERSPECTIVES: A Paleontological Tribute to G. Arthur Cooper—J. Thomas Dutro, Jr., Ed.—Smithsonian Institution Press, 1971, 390 p., photographs, illus., paper, \$4. Collection of research papers concerned with the study of brachiopods and their biostratigraphic application to geologic problems, especially the Paleozoic Era.

PILGRIMS OF THE WILD—Grey Owl (Wa-sha-quoin-asin), new introd. by V. B. Scheffer—Scribner, 1971, 282 p., sketches by author, \$7.95. Reprint (1935) of a personal narrative about life in the Canadian wilderness, and the author's efforts to establish a beaver sanctuary.

PLANTS WE LIVE ON: The Story of Grains and Vegetables—Carroll Lane Fenton and Herminie B. Kitchen—Day, 1971, 128 p., illus. by C. L. Fenton, \$4.29. Informative reading for younger readers about the families of grains and vegetables, and the process of their improvement.

PULSATING STARS 2: A NATURE Reprint—Introd. by T. Gold—Plenum Press, 1971, 116 p., illus., \$12. Collection of articles (1968-1969) that deal with the fast pulsars, with pulsar distributions and distances, theories, and observations by radio, optics, gamma-ray and X-ray.

RHIZOCTONIA SOLANI: Biology and Pathology—J. R. Parmeter, Jr., Ed.—Univ. of Calif. Press, 1971, 255 p., photographs, diagrams, \$11.50. Presents comprehensive, condensed treatise, organizing present knowledge of the widely studied pathogenic fungus of the potato tuber, its taxonomy, nomenclature, biology and pathology.

SOCIAL IMPLICATIONS OF BIOLOGICAL EDUCATION—Arnold B. Grobman, Ed.—Darwin Press, 1971, 134 p., diagrams, \$5.95. Prepared in cooperation with the National Association of Biology Teachers, the book offers discussions by distinguished biologists of questions of behavior, medicine, genetics, population control, evolution and other social issues.

THE SUN BENEATH THE SEA—Jacques Piccard, transl. from French by Denver Lindley—Scribner, 1971, 405 p., photographs, \$12.50. Describes the construction of the mesoscaphs, and gives an account of the 30-day drift of the *Ben Franklin*, led by the author, with a crew of six, exploring the currents of the Gulf Stream and observing underwater life.

THEORY AND PRACTICE OF FAMILY PSYCHIATRY—John G. Howells with edited contributions—Brunner/Mazel, 1971, 953 p., illus., \$25. Explains the author's dimensional system of family psychiatry and its clinical practice, and illustrates the different aspects of the system in systematically grouped papers relating to the main theme.

THE UNIVERSE: From Flat Earth to Quasar—Isaac Asimov—Walker, 1971, rev. ed., 315 p., photographs, diagrams, \$6.95. A highly readable scientific survey of what is presently known about the universe, guides the reader from discovery to discovery while explaining the principles.

THE URBAN MOSAIC: Towards a Theory of Residential Differentiation—Duncan Timms—Cambridge Univ. Press, 1971, 277 p., maps, \$11.50. A study of urban structure, characteristics of residential location and choice, the development of social area models, and their use in the spatial patterning of residential differentiation.

THE WORLD OF ANTS: A Science-Fiction Universe—Rémy Chauvin, transl. from French by George Ordish—Hill & Wang, 1971, 216 p., photographs, drawings, \$5.95. Entomologist explores in detail the world of ants from the behaviorist's point of view, shows how the ants' apparent social organization and intelligence is really a combination of chance and cybernetics, resulting from the enormous numbers involved and the variety of their adaptive mutations.

YEARBOOK ON INTERNATIONAL COMMUNIST AFFAIRS 1969—Richard F. Staar, Ed.—Hoover Institution Press, 1971, 1170 p., \$19.95. Provides, chiefly on the basis of primary sources, a comprehensive survey of the organizational structure, internal development, domestic and foreign policies, and activity of the communist parties throughout the world in 1968.

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