2000 years, as determined from archeological specimens, have also been investigated. Kawai (Osaka) found that in western Japan the intensity of the field has decreased rather smoothly from about 0.7 oersted in A.D. 500 to its present value of 0.5 oersted. In tracing the apparent pole motion (as seen from Japan) he found that the motion consists of one complete anticlockwise rotation on which several minor clockwise loops are superposed. Nagata, Kobayashi, and Schwarz, working on Bolivian and Mexican pottery, found two intensity maxima and one minimum (at about A.D. 1100) between the year 0 and the present. Watanabe and DuBois, working in Arizona, found inclination minima around A.D. 900 and 1500 and a maximum at about A.D. 1200; dating of specimens was based on counts of tree rings and is somewhat uncertain for many specimens.

Turning to the study of secular variation of the earth's field during Pleistocene times, Scharon (St. Louis) reported on his work in Taiwan. The stratigraphy seems rather uncertain. He found a somewhat orderly motion of the virtual geomagnetic poles around a mean position which, for the whole of the Pleistocene, appears to have been 87.4°N, 40°W. Scharon also reported provisional results for several other late-Tertiary sites in Taiwan. Cox (Menlo Park) described work in the Hawaiian, Galapagos, and Pribiloff islands, and in the western United States on lavas less than 700,000 years old; his work confirms the idea that the very small nondipole field and weak secular variation characteristic of the central Pacific Basin today seem to have prevailed throughout the period covered by his sampling. It appears that the earth's field in Hawaii may be taken to represent the main dipole field. The mean pole for Hawaii falls about 5 degrees away from the present geographic pole in the direction of Greenland. Results of studies in the Pribiloff Islands and western United States show considerably more scatter than would be expected for the magnetic latitude; the corresponding poles and the pole for the Galapagos Islands do not coincide with the Hawaiian pole, although the mean of the first three poles does. Thus it seems that the average pole, obtained from many carefully demagnetized specimens covering a time span of the order of 500,000 years, may still depart significantly from the geomagnetic pole for the time in question.

Doell (Menlo Park) reported on recent additions to and modifications of the chronology of the latest reversals of the earth's field [*Science* **144**, 1537 (1964)]. The Olduvai event now seems well confirmed. Kawai and Sasajima (Kyoto) found significant difference between late-Tertiary and Cretaceous rocks in Japan with respect to the distribution of declination and inclinations; distribution is Gaussian for the late Tertiary but not for the Cretaceous. Ozima reported on Pleistocene Izu-Hakone lavas, which unfortunately are not yet well dated.

The position of the pole in Cretaceous times had been a topic emphasized at the Tokyo meeting because of Kawai's observations that declinations measured on Cretaceous and earlier rocks for northeastern Japan seemed to point consistently to the west, whereas declinations in southwestern Japan were most easterly; this arrangement seemed to imply a relative rotation or bending of the Japanese arc. Sasajima described measurements on Cretaceous and Paleogene rocks from southwest Japan which generally confirmed the easterly declination. Kawai also reported on Korean red beds dating from the Jurassic and Cretaceous ages; most of the corresponding poles seem to fall on a fairly smooth path. Kato (Tohoku) found north declination in Cretaceous (100-million-year-old) rocks and easterly declinations in 200-million-year-old rocks in northeastern Japan, contrary to Kawai's earlier report. Most of these Cretaceous poles fall in much the same region as the pole reported by Gromme and Merrill (Berkeley) for the Sierra Nevada granites. This pole is not very different from the one reported earlier, except that addition of a few more sites destroys the apparent regularity of the motion of "instantaneous" poles about their mean positions. A group of Late Jurassic or Early Cretaceous intrusives, also from the Sierra Nevada, gives a pole a few degrees to the south of the late-Cretaceous ones. Some of these late-Jurassic intrusives are remarkable for carrying, in the same specimen, two remanent magnetizations about 172 degrees apart; the rocks seem to contain evidence for both field reversal and self-reversal. Kawai and Yaskawa (Fukui) had made a preliminary sampling of Cretaceous and earlier rocks in western South America.

In a general discussion of dating problems in paleomagnetic work Watanabe pointed out the value of tree-ring counts for dating archeological materials in regions where the climate tends to preserve timber. Dalrymple (Menlo Park) described the variation in potassium and argon contents observed in a large number of runs on 12 samples from a basalt flow (whole-rock analyses). His results are encouraging; the average age of this flow is 3.42 million years, the standard deviation is 0.065 (1.9 percent), and the spread is only 0.26 million year.

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Meteorites

Intense interest in meteorites as natural space probes and as carriers of information from the far reaches and cosmological past of our solar system has attracted the concerted efforts of investigators in many branches of physical and biological sciences. The broad spectrum of interested scientists was well represented at the 27th meeting of the Meteoritical Society, Arizona State University, Tempe, 30 October through 1 November 1964.

Many of the 37 formal papers were concerned with selected aspects of crater formation, ranging from historical review of "Daniel Moreau Barringer and His Crater" by Brandon Barringer to the report of Donald Gault on theoretical and experimental studies, "On the Terrestrial Accretion of Lunar Material" (ejected by impact mechanisms). Edna O'Connell (Rand Corporation) reported on an extensive "Catalog of Meteorite Craters Based on a Study of the Literature." This study covered not only authenticated, probable, and possible craters, but many discredited and improbable ones. W. A. Cassidy and co-workers reported on the field studies carried out in the Campo del Cielo meteorite-crater area by joint American-Argentine teams. Nine craters have been identified as of impact origin by the presence of associated meteoritic material; they range in diameter from 20 to 115 m and in maximum depth from 0.4 to 5 cm. A C^{14} date from a charcoal from under one rim gave a probable age of 5800 years. The meteorites associated with these craters are hexahedrites; specimens recovered range in weight from 50 g to 4210 kg.

T. E. Bunch, F. R. Park, and T. B. Massalski reported that silicate inclusions found in the Campo del Cielo hexahedrites are comparable in chemical composition, texture, and mineralogy with certain terrestrial peridotite and with olivine-rich inclusions in basaltic rocks. Other craters of probable meteoritic origin, on the basis of comparison with known craters, were discussed by Robert Dietz; these include the Lonar Lake Crater in India, Pretoria Salt Pan, Roter Kamm Crater in Southwest Africa, and the Vredefort Ring. The Lonar Lake Crater was investigated in detail by T. P. Kohman and P. W. Sahasrabudge. They reported a throwout area 0.5 km wide and 10 m thick surrounding the crater; no meteoritic fragments have been found.

Meteorites themselves continue to be intensely studied by both classical and newly developed techniques. R. A. Schmitt, R. H. Smith, and G. G. Goles gave recent results of their analyses of meteorites, chondrules, and mineral separates by neutron activation; indications are that, although the abundance values of selected elements in chondrules from type II carbonaceous chondrites agree approximately with solar-abundance values, the concentration of many other elements with diverse chemical properties must be determined in these chondrules before they can be regarded as approximating condensations from the primordial solar nebular matter. M. Nishimura and T. Nasu (Hokkaido University) indicated that zinc is enriched in carbonaceous and enstatite chondrites, as compared with ordinary chondrites. This pattern was also indicated by Edward Anders who, in order to explain the distribution data of more than 20 trace elements in carbonaceous chondrites, presented a paper supporting the idea that meteorites are a blend of two types of material: an undepleted fraction rich in volatiles, and a depleted fraction from which the volatiles were lost.

Studies of natural and cosmic-ray produced nuclides in meteorites were presented by several investigators. Dieter Heymann presented evidence to indicate that the Canyon Diablo Nos. 2 and 3 meteorites probably originated inside the original mass rather than as independent falls or satellites of the Canyon Diablo fall. Cosmic-ray exposure ages of about 40 iron meteorites were determined by H. Voshage and H. Hintenberger (Max-Planck-Institut, Mainz) by the potassium method. Isotope-abundance ratios, $^{41}K/^{40}K$ and $^{39}K/^{40}K$, indicate that meteorites with exposure ages over 10^9 years are very rare. Sharp peaks in the age-distribution curves are obtained for coarse octahedrites at 900 million years and for medium octahedrites at 650 million years; these suggest two major collisions in space.

Application of the electron microprobe to meteorite research was discussed by Klaus Keil. This modern, powerful tool has enabled mineralogists to investigate the chemical composition of minute phases in meteorites and has been instrumental in elucidating several new minerals from meteorites. Data obtained by this technique were used by J. I. Goldstein and R. E. Ogilvie to throw some light on the age-old problem of the growth of the Widmanstalten pattern in metallic meteorites; they proposed a low-pressure model which successfully explains the formation of plessite, the development of the two-phase structures in ataxites, and the decrease in nickel concentration in kamacite near its boundaries.

Robert Dodd presented data on chondrite fabrics which indicate deposition from a moving medium. This new approach to the study of chondrites seems to promise useful and interesting data. Detailed optical studies of the opaque phases in chondrites by Peter Buseck (Arizona State University) indicated a remarkable range of microtextures which support previous evidence that violent shocking occurred in each meteorite studied, and which indicated another area in which further detailed work is needed.

Because the Meteoritical Society provides an opportunity for many individuals interested in some aspects of the recovery and study of meteorites to participate, papers range from aspects of recovery and discovery of new specimens to sophisticated investigations of well-documented ones. Each is an important contribution to the overall task of discovering the circumstances of the origin and history of meteorites. Those attending the meeting could also inspect the outstanding collection of more than 600 meteorites at Arizona State University. A field trip to the famous Barringer Meteorite Crater near Winslow, Arizona, and the U.S. Geological Survey's Astrogeology Branch facilities at Flagstaff, Arizona, concluded the meeting.

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Transformation of Peasant Societies

The Vicos (Peru) project for transforming Andean Indian serfs into free commercial farmers was analyzed at a symposium (Montreal, 26 December 1964) cosponsored by the American Political Association and the sections on social and economic sciences (K) and anthropology (H) of the AAAS. With Philip Morrison (Cornell) presiding, transformation of the political, legal, and social systems of suppressed peasant systems was discussed.

The opening speaker, A. R. Holmberg (Cornell), described the setting, goals, procedures, and achievements of the Cornell Peru Project which he directs. Noting that most of the world's population is peasantry, Holmberg emphasized the importance for national development of enabling peasants to participate in the modernization process. Under traditional conditions, peasants take little or no part in making decisions, accumulate little wealth, suffer denigration, are illiterate, lack modern skills, and endure ill health; they are beaten into submission.

The Vicos project set out to promote human dignity and form local institutions that would widen rather than restrict the sharing of values, and to augment productivity through increasing control over the natural environment. Operating with research funds only, the Cornell Peru Project utilized Indian labor and the land base for capital development. Classrooms, teachers' quarters, clinic, warehouses, and the like were constructed with reinvested profits from commercial agriculture, profits always siphoned off before Cornell's intervention. Holmberg stressed that lasting modernization of Vicos depended upon land-tenure reform which placed title in the hands of the new peasants, a step made possible only by the firm backing of the intellectual elite of Peru.

M. C. Vázquez (Cornell) explored the relation between power and wealth. He pointed out that virtually the only form of wealth possessed by Indian manor serfs at Vicos was cattle. Intervention by the Cornell Peru Project has equipped the new peasants to engage in family- and community-scale commercial farming that brings in significant cash income. Land-tenure reform brought about by purchasing the lands has changed houses, trees, and land that formerly belonged to the absentee owner of the manor into Indian-peasant assets. Vázquez stressed the de-