thyroids of herbivores after the *Sedan* event, together with data from the literature, he showed that frequency distributions approximate log normal distributions in the cases chosen. He discussed the implications for human health of the possibility that such skewed distributions are more common than normal ones.

Hawley and Markee (Idaho Operations Office, AEC) discussed their field program for studies of the effect on the food chain of the deposition of radioiodine through controlled releases of radioiodine to the atmosphere. In two release experiments deposition velocities on grass were similar when account was taken of grass density. The half-time for radioiodine on grass was found to be 4 to 6 days, which agrees with findings of others. Peak activity in milk in the two tests was found after about two days, with large differences among individual cows. The concentration of radioiodine in milk was found to decrease with a half-time of about one day. From human ingestion of milk obtained in one test, a thyroid uptake of 19 percent was found.

Tamplin and Minkler (Lawrence Radiation Laboratory) described their information-integration system for collection, collation, and analysis of literature on biospheric transport of radionuclides. They mentioned the necessity, in view of the increasing amount of literature, for such a system, manned by scientific personnel, for efficient use of technical information. Perhaps the preceding papers point out the need for such a system, as does the paper of Thompson and Lengemann (Cornell University) on dietary intake of radionuclides. These investigators have attempted to evaluate concentrations of fallout nuclides in the diet of populations, using existing data from surveys of consumption and radionuclides. They discussed the possibility of using the concentration of Sr^{90} in urine as an indicator of concentration in the diet, a method suggested by laboratory experiments with human subjects. They found that the average ratio of Sr^{90} to Ca in the urine was about the same as that in the food eaten. Ratios for a single case of controlled ingestion of food, collected on Rongelap which received heavy fallout during tests in 1954, were reported by Hardy and Rivera (HASL) and Conard (Brookhaven National Laboratory). Whereas the urine was the principal route of removal of Cs^{137}, Sr^{90} was removed mainly in the feces. Whole body counting showed reasonably good agreement with excretion data for retention of Cs^{137}. Relations between concentrations of Sr^{90} and stable strontium in the diet to concentration in bone in children were reported by Beninson, Ramos, and Touzet (Argentine Comision Nacional de Energia Atomica), who developed a preliminary model for estimating factors which determine the amount of strontium which will be retained by children of various ages. Dietary intake and retention of Sr^{90} were discussed by Rivera in terms of prediction and evaluation of population doses in fallout situations.

The relationships among measured levels of Cs^{137} in various samples of interest in the Chicago area were discussed by Gustafson, Brar, and Muniak (Argonne National Laboratory). From these studies, along with the field experiments mentioned earlier and the studies in Norway, a considerably better basis for prediction and evaluation of amounts and distribution of Cs^{137} in fallout is evident. Strømme (Norwegian Radium Hospital) and Madsus (Norsk Hydros Institute) reported that a significant relationship was found between the concentrations of Cs^{137} in milk during one year and the amount of precipitation during the preceding year along the west coast of Norway but that no such relationship was found in eastern Norway. As an extension of these studies, Cs^{137} and potassium body burdens of 22 schoolboys were measured during 1963 and 1964.

The proceedings of the conference will be published as report TID-7701 in the AEC symposium series and will be available in a few months from the Office of Technical Services, U.S. Department of Commerce.

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Paleomagnetism

Paleomagnetism was the subject of the second conference of a group of American and Japanese scientists meeting under the aegis of the U.S.–Japan Cooperative Science Program in Berkeley, California, 12–13 November 1964. Two years of work since the Tokyo meeting were reviewed.

Japanese scientists working in Japan and the United States reported on the magnetic properties of ferrimagnetic oxides. Akimoto (Tokyo) reported on the system Fe_2TiO_4-FE_3O_4; neutron diffraction clearly shows that titanium remains exclusively in six-coordinated positions at all compositions. Anisotropy and magnetostriction constants at low temperature show remarkable variations with temperature and composition, and generally increase with titanium content. Akimoto thinks that the effect is mostly due to Fe^{2++}; the higher stability and natural remanence of basaltic rock, as compared with granites in which the spinel phase generally contains very little titanium, may be explained in this way.

Ozima (Tokyo) reported on the memory effects associated with the magnetic transition at about 120°K where the signs of the anisotropy coefficients change. He showed that there is very little memory of isothermal remanent megnetization (IRM). However thermal remanent magnetization (TRM) and particularly the partial TRM acquired within 100 degrees of the Curie point, has an extraordinary recovery ratio after cooling below the transition point. This clearly shows that IRM and TRM are acquired by different mechanisms, and suggests, as was proposed by Verhoogen, that TRM depends mainly on magnetostrictive effects. Ozima suggested that the loss of IRM by cooling below 120°K may be used as a simple and practical method for "magnetic cleaning" of rock specimens. Kobayashi and co-workers at Pittsburgh made similar experiments on the magnetite transition and the Morin transition in α-Fe_2O_3; both transitions are completely suppressed in material with an average grain size of 0.1 μ; and in magnetite the memories of saturated remanence acquired below the transition point and at room temperature in the same direction are reciprocal in the sense that they destroy each other. Kobayashi also found that in hematite the reversible susceptibility decreases when the IRM carried by the specimen increases. However, the susceptibility is independent of the magnitude of TRM and anhysteretic remanent magnetization until saturation is reached, showing that TRM is independent of domain configuration. Nagata (Tokyo) reported on the effect of uniaxial pressure on the acquisition of remanence; Kume and Koizumi (Osaka) had studied the acquisition of remanence during the $\alpha \rightarrow \gamma$ and $\gamma - \alpha$ transitions in Fe_2O_3.

Investigations of the direction and intensity of the earth's field in the last

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.