Book Reviews

Learning across Cultures. A study of Germans visiting America. Jeanne Watson and Ronald Lippitt. Institute for Social Research, Univ. of Michigan, Ann Arbor, 1955. x + 205 pp. $3.

A concomitant of the rapid expansion of international exchange programs in the decade since World War II—more than 40,000 foreign nationals now annually visit the United States for broadly educational purposes—has been an upsurge of interest on the part of both administrators and social scientists in assessing the effects of cross-cultural educational experience. Understandably, administrators of exchange programs (and the donors of the funds that support them) have been concerned with evaluating their success. Social scientists, in addressing themselves to this practical question, have, for their part, tapped a challenging area of inquiry that lies at the grassroots level of research on international relations. That this can be a happy marriage of interests is abundantly demonstrated in the volume under review.

The present study reports the results of intensive research on the experiences of 29 young German men and women brought to this country in three separate groups during the period 1949 to 1951 under the auspices of the U.S. State Department. Their visits, which lasted either 6 or 12 months, were based at the University of Michigan and provided a combination of academic training, internship experience, and field trips. Although their sample is thus restricted, the author's aim is to go beyond the limitations of the particular population studied to a more general understanding of cross-cultural education. They are notably successful in fulfilling their intent.

The research focuses on the study of stability and change in the attitudes and general point of view of the visitors and on the analysis of the process whereby learning occurs across cultures. The primary data relevant to these two major topics were derived from a series of three lengthy structured interviews with each subject, the first shortly after his arrival, the second just prior to his departure, and the third six months after his return to Germany. Supplementary information was obtained from sentence completion tests and from the observations of the American participants in the training and research program. As a check, comparable data were also obtained from two matched American control groups.

As distinguished from many similar studies, the approach is analytic and interpretive rather than simply descriptive. Herein lies the book's greatest value for social scientist and practitioner alike. The insights gained from the research are applicable to a broad range of exchange programs and will be welcomed by all who are responsible for the administration of cross-cultural education. Nor do the authors display the social scientist's usual coyness about making practical suggestions; recommendations are liberally scattered throughout the text, and a separate section is devoted to "Directions of program improvement." Moreover, in examining the psychological dynamics underlying the reactions of the sojourner in a strange and sometimes hostile environment, the book contributes as well to the main stream of social-science research. The authors both draw from and add significantly to such areas as the psychology of the self and learning and reference group theory.

Finally, one notes that the book is well designed for its intended dual audience. The technical apparatus, including examples of instruments used in the research and an array of statistical tables, is included in an appendix, and the unencumbered text is written in a fluent and eminently readable style. Thus, with respect to both form and substance, here is a book that deserves to be widely read.

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The Meaning of Relativity. Albert Einstein. Princeton University Press, Princeton, ed. 5, 1955. 166 pp. + index. $3.75.

Five years after the appearance of his comprehensive paper on general relativity, in May 1921, Albert Einstein delivered a set of four lectures at Princeton University, which were subsequently published under the title *The Meaning of Relativity*. Except for a few reprintings, no new edition came forth until 1945, when Einstein added an appendix concerned with the cosmological problem. For the third edition, 1950, he added an "Appendix II," "Generalization of gravitation theory," which was brought up to date for the fourth edition, dated 1953, through the addition of the concept of the "lambda transformation" and by the discussion of what Einstein called the "strength" of equation systems. The present, fifth edition carries Appendix II in a completely revised form, under the title "Relativistic theory of the non-symmetric field"; a very brief prefatory note by Einstein is dated December 1954.

Except for a paper that also appeared posthumously, together with Bruria Kaufman, the fifth edition of *The Meaning of Relativity* is Einstein's last work. Aside from Appendix II, it appears to to be an unchanged reproduction of the earlier editions, including the discussion concerning the embarrassing youth of the universe (which, at the time of the writing of the second edition, appeared to be less than the age of the oldest known rock formations on Earth). This discussion has now become unnecessary because of the upward revision of the age of the universe in recent years made by the astronomers.

It is not necessary to praise at length Einstein's mastery of clear exposition, which is known to anyone who has read some of his scientific writings. Inevitably, some of the brilliance of his style is lost in translation, in spite of the excellent work of Adams (for the original lectures), Straus (for the first appendix), and S. Bargmann (for the second appendix). I should like to comment briefly on some technical points.

To deprive the symmetric character of an affine connection of its invariant character and thereby meet one of the most persistent criticisms of the nonsymmetric theory, Einstein had devised a new invariant transformation group, the so-called λ-transformation, which was already described in the fourth edition. Originally, this additional transformation of the affine connection depended on an arbitrary vector field. Later, Einstein modified the group by restricting this vector field to be a gradient field, and that is how the λ-transformation appears in the fifth edition. The new transformation group is isomorphic with the gage group of electrodynamics. As a result, the identification of charge-current density and electromagnetic field strength in the nonsymmetric theory is unique.

For choosing the variational principle from which the field equations of the nonsymmetric theory are to be derived, Einstein establishes three requirements,

(i) that the theory be invariant with respect to coordinate and λ-transformations, (ii) that it be transposition-invariant (that is, that the equations read from right to left are equivalent to those read from left to right), and (iii) that the equations have the greatest possible "strength." The "strength" of a system of equations is a new concept introduced by Einstein, which measures the extent to which the equations determine the field variables. In contrast to the concept of a Cauchy problem, which requires the singling out of a direction of continuation, the definition of strength treats all four coordinates on the same footing.

We do not yet know whether Einstein's nonsymmetric field theory, or any other "unified field theory" proposed so far, will have a place in the physical theories of the future. Very possibly the time is not ripe for progress in this field. But anyone who sincerely believes in the organic unity of nature will be impressed by the program of unified field theory as an important approach toward the recognition and understanding of that unity. The last book by Albert Einstein represents an extremely significant contribution to this quest.

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L'Evolution de la Lithosphere. I, Pétrogenèse. Henri Termier and Genevieve Termier. Masson, Paris, 1956. 654 pp. Illus. Cloth, F. 8800; paper, F. 8000.

This is the second volume of the *Traité de Géologie* by these authors. The first part was published in 1952, and two more volumes are promised. Petrogenesis is divided into two parts: "Generalities," of 9 chapters (264 pp.), and "Problems of petrogenesis," 13 chapters (335 pp.)

Starting with a brief resumé on the constitution of matter (including a periodic table), the authors consider the gaseous material from which solids are supposed to have condensed. Here the tectites, iron, stone-iron, and lastly the stone meteorites are discussed. The ideas of Urey on the origin of the earth, the build-up of the primitive atmosphere, the birth of water and the accumulation of the oceans, and the beginning of life, are also discussed. These first three chapters are a sort of introductory containing mostly theory. In chapter 4 the lithosphere is introduced, and the authors consider the effect on the crust of cosmic and ultraviolet rays and how photosynthesis and oxygen reduction produce energy. Terrestrial magnetism and gravitation lead naturally to a discussion of isostasity with stable and unstable areas, buckling and orogenies. These, along with thermodynamics, give us regional metamorphism, volcanism, and the formation of granite.

Starting with Laue's work in 1912, the internal structure of crystals has been under investigation, giving us more and more insight into molecules and atoms. The authors state that the "tetra coordinates of silicon is one of the fundamental characteristics of the Lithosphere," and that the silica and aluminum make up the upper part of the lithosphere, the sial of E. Suess. The classification of Green of (i) metals or conductors, (ii) the sulfurs or nonconductors, (iii) the OH groups, (iv) the hydrogene, (v) the silicates, and (vi) natural gases, is given. In chapter 6 the displacement and diffusion of matter in the lithosphere by various means, along with the various imperfections of crystals, are considered.

Chapter 7 deals with minerals from the glasses to the rare earths. Chapter 8 discusses geochemistry and considers the organic as well as the usual inorganic side of earth chemistry. Carbon comes in for careful consideration, especially the isotopes C^{12}, C^{13} and C^{11}, as well as C^{14}. Chapter 9 gives the age of the universe as about 6000 million years and the age of the earth as about 3500 million years, considered from some nine different radioactive approaches.

Under "Problems of petrogenesis," chapter 1 gives us the interinfluence of the terrestrial and meteoritic processes of the geologic evolution of the crust. The zones of weakness, both parallel and at angles to the directions of orogenesis (chapter 2), are followed (in chapter 3) by a synopsis giving succession of the phenomena with the tectonic phases and geosynclinal phases following through stages of deformation, sedimentary deposits, volcanism, metasomatism, petrogenesis, and occurrence. These chapters serve to localize the rocks in time and space.

After reviewing the mode of occurrence (chapter 4), the chemical classification, mineralogical occurrence, chemical-mineralogical classification, the C.I.P.W. classification as modified by Lacroix, Niggle's classification, and statistical methods, the authors give a simplified genetic classification of (i) rocks supersaturated with silica, (ii) rocks saturated with silica, (iii) rocks not saturated with silica, but with feldspathoids, (iv) ultrabasis rocks, and (v) charnockites, anorthosites and lamprophyres. Chapter 5 examines the magmas from various points of view and includes a table showing a series of continuous and a series of discontinuous changes supposed to go on in the liquid material. Next, in chapter 6, volatile, fluid parts, gases, waters, and mineralizing fractions lead naturally to volcanism. In chapter 7 some seven types of volcanic activity are listed. The contribution of geosynclines to the sima occupy chapter 8.

Chapter 9 is a long one and deals with metamorphism, pneumatolytic metasomatism, and hydrothermal metasomatism, running the gauntlet from granite pegmatites to evaporates. Here are introduced the authors' idea of "fronts," sorts of zones of combat between different materials in the crust. The numerous ideas are documented by numerous examples largely from the authors' experiences, but the vast literature is drawn on to bolster their ideas. The problems of granite fill chapters 10 and 11. Finally, chapter 12 discusses convergent rocks (in the biologic sense of convergent), and the last chapter tells of the aberrant rocks.

Throughout the book, the authors consider the importance of the atomic structure of the minerals and the crystal fabric. The influence of gravitation on crustal material is pointed out, and the authors consider metasomatism of the first order in identification and transformation of petrographic types. They favor the progressive differentiation of the sial at the expense of the sima and feel that some petrographic types have a plural or convergent origin.

In all, it is a very detailed study; each chapter, and even some subdivisions, has its own bibliography, sometimes running well over 100 titles. The amount of material covered makes it slow reading, but the book is well worth the effort. The figures and tables are clear and effective. The plates are well chosen and are placed at appropriate places in the text. The style is more literary than that of most geologic textbooks, and it is clear and very much to the point. Certainly all petrographers, mineralogists, and geologists should study it, for there is much to be derived from it, and it is a fitting volume of *Traité de Géologie.*

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Geometrical Optics. L. C. Martin. Philosophical Library, New York, 1956. 215 pp. $7.50.

This is an interesting and well-written treatise covering the elementary problems of geometrical optics, with the addition of some short chapters on diffraction and photometry.

In the first chapter, "The laws of geometrical optics," the author discusses the refraction and reflection laws and basic concepts, such as tangential and sagittal focus, real and virtual images, and the Smith-Helmholtz relation coordinating transverse and angular magnification.

The second chapter covers the first-