orientation measurements. A leveled transparent plate with two inscribed lines oriented N-S and E-W in accordance with the compass coordinates of the horizontal circle is placed over the mounted particle, which then is adjusted in its mount so that the lines on the particle coincide with the lines on the inscribed plate when viewed directly from above. Reorientation of particles by this method permits use of either the orientation goniometer for parameter measurements or other methods not requiring a goniometer (*2*). A convenient combination of inexpensive and readily available equipment consists of the inscribed transparent plate mounted on three legs, a large circle drawn on a horizontal surface, and an improvised clinometer or Brunton compass for measuring the parameters of reoriented particles.

Measurement of only two parameters, the long and short axes, precisely determines the attitude of a particle in space and is sufficient for most orientation studies (*3*). However, measurements of other parameters such as faces and surface markings, readily accomplished by the foregoing method, may significantly enlarge the scope and increase the accuracy of conclusions derived from the fabric studies of gravelly sediments.

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Helicopter Support for the Geologist

Geological fieldwork in Greenland has generally been curtailed by the difficulties of transport. Movement across country or along the coast has taken place mostly in spring and fall, when snow and ice conditions were favorable for sledging. However, the snow and ice that favor travel have an adverse effect on geologic observation, for they conceal much of the ground and limit observations to projecting outcrops. In summer, when the snow disappears and the details of the rocks are abundantly displayed, the geologist is faced with the necessity of back-packing across country or boating along the coast. In this season, he either is limited to an area close to his base or his observations are confined to only a few lines of traverse. The use of the helicopter for transport, however, has altered these conditions; and now the geologist can utilize the summer season for his fieldwork without the restrictions formerly imposed by lack of adequate transportation.

During the summer of 1953, several members of the U.S. Geological Survey and geologists from several colleges were requested by the Corps of Engineers and Transportation Corps, U.S. Army, to do fieldwork in northwestern Greenland in the vicinity of Thule. The area of interest was 650 mi^2 of hilly-to-mountainous terrain divided into two segments by a large glacier. The northern segment, consisting of 180 mi^2, was investigated by geologists operating from a single base camp, whereas surveys for the larger southern segment were carried out from a number of field camps as well as from a permanent base. The helicopters used were Bell H-13 Army-type, which proved to be well suited for such fieldwork. With a cruising range of about 140 mi, they were capable of carrying a geologist and pilot and about 400 lb of rock samples, or, for long trips, a corresponding load of additional gasoline.

In the northern part of the area, the helicopters were used primarily to carry the geologist between his base and his area of operations. In the southern segment, the helicopters were used in several ways. After the area close to the base had been covered on foot, the geologists and their equipment were transported to field camps, from which they traversed the surrounding country on foot, as in normal areal geologic mapping. This proved too slow, and as the summer advanced it was apparent that such a method would not permit the completion of the survey before the season drew to a close.

The use of helicopters was increased considerably in order to accomplish the work that remained. Aerial photos were examined and the ground patterns, which in a barren area such as Greenland directly reflect the mappable rock units, were outlined. Flight courses were established in order to cover each discernible unit and to cover the entire area systematically. The flight plans were used for organizing fieldwork and also provided a safety factor; if a helicopter was disabled, a search for it could be made more easily by following its flight pattern for the day.

For fieldwork, the helicopters were quickly flown to the area of interest, and at a height of 1500 to 2000 ft the general features of the terrain were observed. The helicopters then flew at altitudes of 10 to 200 ft above the ground at speeds of 10 to 40 mi/hr. At such low altitudes and slow speeds, it was possible to observe closely the characteristics of the material at the surface. Frequent landings were made at outcrops or where ground or photo patterns indicated a change. At all landings, samples were taken and the necessary geologic observations were made. In this manner, 30 to 60 mi^2 a day could be surveyed in detail equal to that obtained by traverse on foot.

The extreme versatility of the helicopter was demonstrated during periods of ground fog, which often persisted for a week at a time. During such weather, fieldwork with helicopters was possible, even though ground traverses were curtailed because features needed by the geologist to identify his position were obscured. The helicopters were able to rise above the fog and descend through openings in it, allowing the geologist to carry on the fieldwork. In extreme cases, it was practical to fly through fog at very slow speeds and very low altitude, using contact navigation to stay on course.

The cost of helicopter operation is high, about $100 per flying hour or about $400 a day per helicopter. However, where detailed areal geologic mapping is necessary, in an area such as northwestern Greenland, the over-all cost of using helicopters, considering the saving in time and effort, is about 80 percent of the cost of the same work accomplished by ordinary ground traverses.

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Book Reviews

Traité de Paléontologie. Vol. 3, ***Les Formes Ultimes d'Invertébrés; Morphologie et Evolution—Onychophores, Arthropodes, Echinodermes, Stomocordés.*** Jean Piveteau, Ed. Masson, Paris, 1953. 1064 pp. Illus. 9600 fr.; clothbound, 10,320 fr.

Volume 3 of this stately treatise completes coverage of the invertebrates. The remaining four volumes are to deal with the vertebrates. Twelve collaborators (11 French and one Belgian) contributed to this volume, which covers the arthropods, echinoderms, graptolites, and some minor groups. The arthropods take up half the book and the echinoderms a third.

The onychopora, merostomoids, pseudocrustacea, and marrellomorphs are dealt with by Colette Dechaseaux. These minor, but phylogentically important, groups are represented for the most part by Walcott's genera from his fabulous Middle Cambrian locality in British Columbia. The Scandinavian *Xenusion,* reported to be of pre-Cambrian age, is doubtfully referred to the onychopora (*Peripatus* and allies). If it is as old as it is alleged to be, it is perhaps the oldest recognizable form of multicellular animal life.

A chapter of 203 pages on trilobites is the work of Pierre Hupé. Somewhat more than half of it consists of a full and well-illustrated account of morphology, anatomy, development, habits, distribution, and evolution. The treatment of evolution is comprehensive, well-balanced, and restrained. The systematic part, however, gives the impression of having been hastily put together. It includes new superfamilies, many new families, and a great many new subfamilies. Supergeneric categories are diagnosed; genera are listed, with their age and general distribution. Genera are diagnosed in a publication by Hupé issued in 1953, and that publication contains a much more complete bibliography than this treatise.

The arthropleurids (protoarthropods of uncertain affinities), branchiopods, copepods, and crustacea of uncertain affinities are described by Dechaseaux; the ostracodes by Nicolas Grekoff; and the cirripeds by Henri and Geneviève Termier.

Daniel Laurentiaux contributed the chapters on myriapods and insects. The systematic part of his chapter on insects is a comprehensive survey of fossil insects. The chapters on merostomes, including the gigantostracea (a later name for eurypterids), and arachnids—a complete survey—are the work of Gérard Waterlot.

The echinoderms are very unevenly handled; the heterosteles and cystids are discussed by Lucien Cuénot, who died before the book was published. His treatment of the cystids stands out as the best for any of the major echinoderm classes. The blastoids are described by F. M. Bergounioux; edrioasteroids by Jean Piveteau; crinoids, stelleroids, and ophiocistioids by Georges Ubaghs; and echinoids by the Termiers. The systematic part of the chapter on crinoids is disappointingly and inadequately illustrated. It includes a new order, new suborders, and many new superfamilies.

Gérard Waterlot wrote the chapters on pterobranchs and graptolites, which are given class rank under Dawydoff's recently proposed phylum stomocords. The book closes with the Termiers' discussion of groups of uncertain affinities: machaeridians, conularids, hyoliths, and tentaculites.

The omission of any indication of the number of pages in publications cited in bibliographies appears to be a fixed policy of this treatise. The price is even higher than for Volume 1 or Volume 2.

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[1] I am indebted for advice to P. E. Cloud, Jr., and A. R. Palmer.

Chemie Lexikon, Vols. I and II. 3rd ed. Hermann Römpp. Franckh'sche Verlag, Stuttgart, 1952–53. 2108 pp. Illus. Clothbound, DM84—a vol.

To be successful, an encyclopedia must provide adequately detailed information on every topic coming within its survey, and yet remain both manageable in size and reasonable in cost. In a broad field such as chemistry, these aims are usually achieved by limiting the scope of the book to a particular section, and a number of excellent dictionaries and handbooks dealing with such limited areas of information have been produced. However, there is a need for an all-encompassing chemical encyclopedia to which the specialist may turn for information on other branches of his subject, and where the nonchemist may expect to find answers to any questions of a chemical nature. This need is adequately fulfilled by Dr. Römpp's *Chemie Lexikon.*

Special attention has been paid to the requirements of the businessman engaged in the chemical trade and to workers in industry. The scope of the book is so broad, however, that it will prove invaluable to all whose work brings them into contact with any branch