geneity, quite apart from strict controls or evaluation of stress and temperature. The only parameter which can be measured with the same degree of certainty on both sides is time.

It would not be unfair to say that nothing new came out of this conference in the scientific sense, but in the correlation of creep data with service life, a considerable step forward must result from the additional evidence supplied here.

C. R. TOTTLE

ROCK MAGNETISM TO-DAY

Rock Magnetism

By Prof. Takesi Nagata. Revised edition. Pp. viii + 350. (Tokyo: Maruzen Company, Ltd.; New York: Plenum Press, 1961.) 9.50 dollars.

ROCK magnetism is that branch of geophysics that deals with the origin of magnetization in rocks and its stability. Workers in rock magnetism are also interested in the phenomenon of self-reversal, that is, a rock acquiring a magnetic moment exactly opposed to the ambient magnetic field. It is necessary to point out that almost all the minerals that cause rocks to be magnetic are also electric insulators and often of very high coercivity. This makes them of interest to solid-state physicists as possible permanent magnet materials. It was the work on rock magnetism that first drew Néel's attention to the possible existence of spontaneous reversal of magnetic moments in ferrites. Again, it was the work on the highly unstable red rocks containing haematite (α-Fe_2O_3) that led Néel to the idea of 'Superantiferromagnetism'. In spite of these occasions, when rock magnetism has been responsible for fundamental advances in pure magnetism, it has mostly lagged behind the advancing front of our knowledge of the magnetism of solids. An example of this can be found in the statement that if, when dropped or struck, bar magnets can lose their magnetization, how can rocks retain their remanent magnetization over geological time-scales? To pose this question is to display ignorance of the concept of magnetocrystalline and shape anisotropy in solid-state physics. *Rock Magnetism* is admirable in this and other respects.

This new edition includes references to almost all the new theories and discoveries in the field of magnetism of solids. Even though these references must, of necessity, be brief, they are there to guide the interested and enthusiastic reader. It appears that, compared with the previous edition, the present one has been increased in volume by only a third. This, however, is not the case. There are twelve chapters now instead of the six in the previous edition. Also, some old chapters have doubled or more than trebled in size. This is the case for the chapter on "Outline of Ferromagnetism" and that on "The Natural Remanent Magnetism of Sedimentary Rocks". This is a direct result of the increased application of the new techniques of solid-state physics to rock magnetism, and this trend will continue. Because it is such a fruitful and controversial field of research, many will query some statements made in Chapter 6 on chemical remanent magnetization. The phrase 'chemical remanence' is in itself a misnomer, because, as has been shown by the excellent work done in Prof. Nagata's own laboratory, the new remanence in minerals undergoing a chemical change is produced not as a direct result of the chemical action or ionic migration but due to the growth of new crystallites through critical sizes. To describe it as 'crystallization remanence' would be more appropriate. On page 213 it is claimed that "there is no magnetite in any normal red sandstone". On the contrary, the very extensive work of Van Houten on the sedimentary petrology of these rocks shows the unambiguous presence of magnetite in red beds. Van Houten also shows a curious correlation between the Triassic and post-Triassic rocks, and the abundance of magnetite.

For the benefit of the uninitiated reader it must be mentioned that it can no longer 'safely' be said that all haematite in red beds "has been produced *in situ* by post depositional chemical changes". Similar criticisms also apply to misdirected use of the word 'titanomaghemite'. If this is to be taken to mean, by analogy with titanohaematites, maghemite containing variable amounts of titanium, the titanium reducing the ferric ions but leaving the vacancies alone, it is one thing. But if it is also claimed that titanium fills the vacancies and stabilizes the metastable maghemite, the end-member of such a solid solution of titanomaghemites is a titanomagnetite! If expressed as a solid solution (x Fe_2TiO_4 $(1-x)$ Fe_3O_4) the previously mentioned end-member of the titanomaghemite series will have $x = 0{\cdot}33$. There are also a few minor errors and omissions. On page 64, electromagnets are said to be used to produce strong alternating magnetic fields, and on page 272, Stacey's main conclusion from compression experiments is omitted. This was that as long as the rock has no pronounced anisotropy to begin with, thermoremanence cannot be deflected by pressure applied during geological time.

Such criticisms apart, the volume is sure to prove a valuable source-book of information for geophysicists, geologists and physicists in that order. There are two very satisfactory chapters which deal with the application of rock magnetism to geology, pure and applied. The final chapter, on the history of rock magnetism, is bound to be of great help to future historians of science. In short, this book brings rock magnetism up from the level of a 'stamp collecting' science to the present day. It is up to the geophysicists and physicists to-day to proceed further, to a complete 'take-over' by solid-state physics of rock magnetism. This, indeed, would be an admirable thing.

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PHYSICAL GEOGRAPHY OF THE OCEANS

The Physical Geography of the Oceans

By Charles H. Cotter. Pp. 317. (London: Hollis and Carter, 1965.) 35*s*. net.

THE publication of *The Physical Geography of the Oceans* is a welcome sign of the increasing awareness of oceanography as an important branch of study, from many points of view. It aims at providing a course in the physical geography of the oceans for students in the sixth forms of schools or in the first year at university. A good deal of basic physical oceanography is covered as well as a more detailed treatment of some aspects of particular interest to the geographer.

The first chapter starts off by taking a global view, describing the distribution of oceans and continents, and going on to give a general account of the bottom topography of the oceans. This is done clearly and adequately for the most part, but it is rather surprising to see that the chart given of the Arctic Basin shows no sign of the Lomonosov Ridge, which divides this region into two distinct sub-basins. The origin of the continents and ocean basins is treated in the next chapter, which leads on from a historical approach to more recent ideas on this subject. There are several points, however, in which the treatment has not been brought up to date. One diagram, for example, shows the earth's crust as being thicker under the ocean than under the continent, contrary to the view now accepted. The boundary regions of the oceans: the coastlines and shores, islands and the ocean bed, including its deposits, are dealt with in several chapters. A separate chapter is devoted to coral reefs and islands, the origin of which provided one of the famous scientific disputes of the nineteenth century and which is a subject of renewed interest to-day.