The Syrian Arc.

The Syrian Arc is the name proposed by Dr. E. Krenkel for a mountain chain which can be traced around the south and east of the Levant from Tunis to the Taurus. The name is given in a short but important paper (" Der Syrische Bogen," *Centralblatt für Mineralogie*, 1924, No. 9, pp. 274-281, and No. 10, pp. 301-313) which correlates the mountain movements which have determined the position of the south-eastern Mediterranean. According to Dr. Krenkel, this mountain chain begins to the west in Tunisia, where there are two sets of fold mountains. The predominant set belong to the Atlas System and its members trend to the north-east. The set in southern Tunis trends east and west and is obviously a distinct mountain group from the Atlas.

According to Dr. Krenkel, this southern set is the westernmost element of the Syrian Arc. It is cut off by the Great Syrtis from Cyrenaica. Dr. Krenkel, from the writer's work on the geology of Cyrenaica, interprets its plateau as one of the inner members of the Syrian Arc. In Egypt this arc is represented by three fold ranges, those of Abu Roasch, Wadi Araba and Quena. It continues with a trend to the east-north-east, across the deserts of northern Sinai, where it has been determined by Messrs. Moon and Sadek. The Egyptian and Sinaitic members of the Syrian Arc are separated by the Gulf of Suez.

According to one view, the Clysmian valley of Dr. Hume, which includes that gulf, is the direct continuation of the Rift Valley of the Red Sea. According to another view, it is a synclinal. According to Dr. Hume, it is due to a combination of faulting and a series of Erythrean folds. Dr. Krenkel supports the first of these interpretations as the Gulf of Suez lies in a rift valley which has broken across the Syrian Arc nearly at right angles; and the structures which have been interpreted as due to a series of Erythrean folds Dr. Krenkel explains as due " to the tossing and tilting of uniclinal sedimentary blocks which appear on the floor of the rift valley." He denies the existence of Erythrean folds due to pressure in a westerly or easterly direction.

From Sinai the Syrian Arc passes north; it is bounded westward by a series of steps down to the Mediterranean and eastward, according to some accounts, by flexures. Dr. Krenkel represents these flexures as fractures which have broken across preexisting folds. He attributes the topography of this area to a combination of an older folding with the younger rift valley fractures. In Syria, however, where the structure has been represented by Diener and most of his successors as determined by simple block structures, Dr. Krenkel insists on the importance of folds. In middle Syria, the Lebanon on the west is separated by the great valley of the Bakaa from Mt. Hermon and the Anti-lebanon. This valley he attributes to a down-fold lasting from the end of the Cretaceous to the Upper Miocene; but the Bakaa in its present form he describes as a rift valley made by Pliocene fractures. The Damascus Arc is a branch from the Syrian Arc and is marked by the presence of the only overfolding recognised by Dr. Krenkel anywhere along the Syrian Arc; it happened there to a slight extent owing to the pressure of the Damascus Arc against the northern edge of the Arabian Foreland. Farther north the Syrian Arc ends against the cross folds of the Taurus. The line of separation is defined by Dr. Krenkel as the Afrin line which divides the African element from those of Asia Minor.

The Syrian Arc was upraised by folding in three stages: the first movement was in the uppermost Cretaceous (Upper Danian); the second in the Lower Miocene; the third and most important was in the Upper Miocene. The crumpling was due, according to Dr. Krenkel, to pressure from the south and east toward the Mediterranean. It was therefore in the opposite direction to that in the Dinaric-Taurus Arcs, which extend along the eastern side of the Adriatic, through Greece and the Archipelago to the southern chains of Asia Minor. The general course of the Syrian Arc conforms closely to that of the Dinaric and Taurus Mountains; and both of the mountain arcs moved toward the great depression of the Eastern Mediterranean which lies between them.

J. W. Gregory.

Permanent Magnets.

Mr. S. Evershed read an important and valuable paper on permanent magnets to the Institution of Electrical Engineers on March 19. The paper gives the results of many years' research, and ought to prove of immediate value in improving the quality and cheapening the cost of high-grade permanent magnets. In 1616 Barlowe wrote concerning the medieval art and mystery of magnet making—" The compass needle, being the most admirable and useful instrument in the whole world, is so bungerly and absurdly contrived as no other." Although the permanent magnet has become an indispensable adjunct of modern engineering, yet industries rooted in tradition are generally backward, and magnet making is no exception.

The hardening of iron and the making of steel were probably discovered accidentally. Metallurgists have found that ordinary pure iron exists in various allotropic forms depending on the temperature. At ordinary temperature it is called Alpha iron and is the commonest of all metals. Its specific heat at 0° C. is 0·1055 precisely, which is in excellent accord with theory. This specific heat gradually increases until about 750° C. The author calls this the precursor effect, as it indicates that the heat is not all expended in raising the temperature; some of it is doubtless expended in effecting a change of some kind in the structure of the iron. At about 770° C. Alpha iron begins to change into Beta iron, and the transformation is practically complete at 810° C.

Alpha iron is magnetic, Beta iron is entirely non-magnetic. As the molecule of Beta iron must be quite different from that of Alpha iron it is practically a new element. Throughout the narrow zone of temperature of 40° C. Alpha and Beta molecules can exist together, and this explains the loss and recovery of magnetism in iron as shown by experimental curves. At between 918° and 920° C. Beta iron is converted into Gamma iron, and at between 1404° and 1405° C. Gamma iron becomes Delta iron, its specific heat suddenly increasing by 50 per cent. At 1528° C. pure iron melts. Assuming that specific heat is inversely proportional to atomic weight, it would follow that these varieties of iron should have atomic weights of about 56, 37, 41, and 27, which are the atomic weights of iron, chlorine, calcium, and aluminium. The molecules have not changed successively into the molecules of these elements, but they must have done something equally revolutionary.

The carbides used in manufacturing magnet steels dissolve freely in Delta, Gamma, and Beta iron, but these kinds of iron are all non-magnetic. To make a magnet the steel must be magnetic, and consequently in the Alpha state. It is necessary, therefore, to heat the iron until it is in the Beta or Gamma state, dissolve a quantity of carbide in it, and then by plunging it into cold water make it return quickly to the Alpha state.

Nowadays carbon steel is seldom used for permanent magnets. Tungsten magnet steel is made similarly to carbon magnet steel, but half the carbide of iron is replaced by carbide of tungsten, the total content of carbon remaining unchanged. The effect of replacing part of one solute substance by another is to increase the magnetic coercive force from rather less than 50 to slightly more than 70. When cobalt is used instead of tungsten the coercive force is increased to 180. From the point of view of the manufacturer, tungsten steel is generally the most attractive. Carbon steel is 60 per cent. more costly, and cobalt steel costs three or four times as much. Cobalt steel withstands demagnetising forces much more effectively than tungsten steel. If two permanent straight magnets, one of tungsten steel and the other of cobalt steel, were subjected to demagnetising forces equal to 20 per cent. of their coercive force, the tungsten magnet would lose 14 per cent. of its strength, but the cobalt magnet would only lose 3 per cent.

The author has made many experiments on the loss of the coercive force in all kinds of "permanent" magnets. In a cobalt magnet, for example, the initial coercive force was 180, but after 4·4 years it had fallen to 161·8. The continued falling off in the coercive force of hardened magnet steel is attributed to the passage of carbide molecules out of solution. Immediately after the hardening, the coercive force decreases by about 7 per cent. in the course of the first hundred hours, but after a year the rate of decay seems to settle down to a small steady value. The author calculates that the whole of the surplus carbide in cobalt steel might pass out of solution in about seventy years, the steel then being completely softened. He has noticed, however, a seasonal oscillation in the value of the coercive force, the reason of which is still unexplained.

When manufacturing steel containing tungsten or cobalt for use in making permanent magnets, the greatest attention has to be paid to the heat treatment. The experiments described prove conclusively that if tungsten steel be heated to any temperature between 750° C. and 1214° C., and kept at this temperature for an appreciable time before hardening, its magnetic properties are weakened, the weakening increasing with the length of time the steel has been kept at the high temperature. The deterioration of the steel goes on most rapidly when the temperature is 950° C. At 1200° C. the spoiling of the steel goes on very slowly, the coercive force falling only 0·4 units per hour. At 1240° C., however, which is only 26° above the danger zone, restoration of coercive force takes place at the rate of 15 units a minute. It is obvious, therefore, that great attention has to be paid to the temperature to which the steel is heated, before hardening.

This paper is a sequel to one the author read to the Institution in 1920, and together they give a very complete account of the modern theory and practice of magnet making. The results obtained by the British Scientific Instrument Research Association on the possibility of making magnets of complicated shapes by casting them with molten metal and then subjecting them to a suitable heat treatment are described. The method appears to be very promising and already cast magnets are on the market.

University and Educational Intelligence.

CAMBRIDGE.—Particulars are now available of the Pinsent-Darwin Studentship in mental pathology, founded in 1924 by Mrs. Pinsent and Sir Horace and Lady Darwin for promoting research into any problem which may have a bearing on mental defects, diseases or disorders. The Studentship is of the annual value of about 200*l.* and is tenable for three years in the first instance. Candidates may be of either sex, and need not be members of the University of Cambridge. Applications must be sent before May 1 to the Secretary, Pinsent-Darwin Studentship, Psychological Laboratory, Cambridge.

EDINBURGH.—The following are among the honorary degrees to be conferred in July:—LL.D.: Brigadier-General the Hon. Charles Granville Bruce, chief of the Mount Everest Expedition; Prof. A. S. Eddington, Plumian professor of astronomy and experimental philosophy in the University of Cambridge; Prof. Robert Muir, professor of pathology in the University of Glasgow; Principal C. G. Robertson, University of Birmingham; Sir Harold J. Stiles, emeritus professor (clinical surgery) in the University of Edinburgh.

LEEDS.—Mr. J. Gordon has been appointed lecturer in bacteriology in succession to Dr. Ross resigned. An honorary demonstratorship has been instituted in the Department of Zoology, and Mrs. H. W. Swift appointed thereto.

LONDON.—In commemoration of the donation of 105,000*l.* made in 1914 by Sir Hildred Carlile, Bart., to the Endowment Fund of Bedford College, it has been resolved that the University chairs of English literature, Latin, botany, and physics tenable at the College shall henceforth be entitled the "Hildred Carlile" chairs.

The following doctorates have been awarded: *Ph.D.* (*Science*), Mr. K. C. D. Hickman (Imperial College—Royal College of Science) for a thesis entitled "Studies in Adsorption, with special reference to the Washing of Photographic Products," and other papers, and Mr. D. F. Stedman (University College) for a thesis entitled "The Liquid-vapour Equilibrium of the System Glycerine-water"; *D.Sc.* (*Physics*), Mr. F. Simeon (University College) for a thesis entitled "1. The Carbon Arc Spectrum in the Extreme Ultra-violet: 2. Note on the Striking Potential necessary to produce a Persistent Arc in Vacuum," and other papers, and Mr. B. W. Clack (Birkbeck College) for a thesis entitled "On the Study of Diffusion in Liquids by an Optical Method."

ST. ANDREWS.—The Senatus Academicus has resolved to confer the honorary degree of LL.D. on the following, among others: Sir William Bragg, Fullerian professor of chemistry at the Royal Institution, and Director of the Davy-Faraday Research Laboratory; Prof. F. G. Donnan, professor of inorganic and physical chemistry in the University of London; Prof. Etienne Gilson, professor of philosophy of the Middle Ages, Sorbonne, University of Paris; Mr. R. W. T. Gunther, fellow of Magdalen College, Oxford.

A COMPETITIVE examination for two scholarships at the Household and Social Science department of King's College for Women, namely, the Carl Meyer, 80*l.* a year for three years, and the Minor College, 40*l.* a year for three years, will be held on May 21. The latest date for the receipt of entry applications is May 18. They should be sent to the Secretary of the department, Campden Hill Road, W.8.