of the Madras province left blank as if it had never been surveyed (whereas the old Madras revenue surveys furnish excellent material for any 1-inch reproduction), and a fairly wide area of Baluchistan territory near Quetta, which has been most carefully surveyed on the scale of 2 inches to the mile and has stood the test of a whole series of military manœuvres most successfully, classed as "geographical reconnaissance"—which it certainly is not, nor is the mass of ½-inch work which has been completed in that country.

The fact is that, for the completion of the 1-inch topographical map of all India, only a small portion of the Rajputana desert really requires first survey. There must, however, be an enormous amount of revision necessary.

During the year under review, 34,000 square miles of detail survey were completed, and (according to the general summary) about 24,000 square miles of geographical reconnaissance. Elsewhere we find records of 15,000 square miles of Seistan geography, no less than 58,000 square miles in Tibet, and the invaluable work of Colonel Wahab in South Arabia (of which we have heard so little and would like to know so much), amounting to 6000 square miles. Presumably the 24,000 square miles with which the summary deals is independent of these special outturns. The chief interest of the report lies in the appendix dealing with these special performances, and we cordially welcome a return to even this partial recognition of the absorbing interest which is to be found in the story of Indian surveying. The kernel of the report was extracted when the "narratives" went out of it. Even here we do not find the story of the death of that gallant native geographer and explorer Sheikh Mohiudin, whose determined (reckless, for a surveyor) search after information in Seistan led to his being found at last, dead, with his horse dead beside him—dead of thirst in that thirsty country; whilst his plane-table sheets had been stripped from the board and wound round the body of one of his native assistants, who was finally rescued by a friendly Afghan out of a far-away pool of water in which he was lying insensible. Such little incidents as this, or the death of Colonel Wahab's native surveyor, who was shot at his work in Arabia, excite little public comment in India.

In the scientific branches of the department there is much good work to record. The great arc of principal triangulation which terminates with the Dehra Dun base has been extended into the Himalayas, and connected with the peaks of the Snowy Range. Valuable results have been obtained from the comparison of geodetic with astronomic determinations for latitude, the tendency of them being to prove that large northerly deflections of the plumb-line continue to prevail in the heart of the Himalayas. Pendulum observations to determine the force of gravity have been resumed, and magnetic work has also been a feature of the scientific branch of the department supervised by Lieut.-Colonel Burrard, R.E., F.R.S. That officer has also added a useful chapter to the report on the value of principal triangulation and scientific surveying. All this is most valuable work, and should go a long way to satisfy financial critics that the Government of India gets its money's worth out of the scientific investigations of the Survey Department.

The official report of the observations made by Captain Wood, R.E., in Nepal to determine the position of the Everest peak relatively to the Gaurisankar group is included in this volume. It is hardly necessary to refer again to the conclusions which have been formed on a subject which has already been discussed in the pages of NATURE. A most useful map of part of Nepal, and the panoramic views which accompany Captain Wood's report should be convincing evidence of the isolated position of the highest peak in the world, if any further evidence were needed. A re-perusal of the exact conditions under which these observations were made is most interesting, and fully confirms the opinion expressed by Colonel Gore (the late Surveyor-General) that "those who trust to their appreciation of characteristic forms and their mountaineering instincts, as a means for identifying peaks from widely different points of view, are apt to be frequently misled."

THE IRON AND STEEL INSTITUTE.

THE annual meeting of the Iron and Steel Institute was held in London on May 10 and 11, Mr. R. A. Hadfield, the president, in the chair. The president referred to the loss the institute had suffered by the deaths of Sir David Dale and Mr. J. T. Smith, past-presidents, and votes of sympathy were accorded. The report of the council, read by the secretary, Mr. Bennett H. Brough, showed that the membership amounted to 2033, and that in 1905 the income was 6271*l.* and the expenditure 5257*l.* The Bessemer medal was awarded to Mr. F. Osmond, the eminent French metallurgist. Carnegie research scholarships of 100*l.* were awarded to Dr. C. A. F. Benedicks (Sweden), Mr. O. Stutzer (Germany), Mr. E. Hess (United States), and Mr. E. F. Law (London). Grants were also made to Mr. H. C. Boynton (United States), Dr. L. Guillet (France), Mr. W. H. Hatfield (Sheffield), Mr. E. G. L. Roberts (London), Mr. W. Rosenhain (Birmingham), Mr. E. A. Wraight (London), and Mr. A. Campion (Glasgow). The Carnegie gold medal for research was awarded to Dr. L. Guillet, and the silver medal to Mr. W. Rosenhain.

In the first paper read Mr. A. J. Capron (Sheffield) described a new method of compressing steel ingots in the mould which has been successfully adopted in Sheffield. The ingot moulds are placed inside the press, the steel being run into the moulds in this position, so that they have not to be transported with the liquid steel in them, and the press practically forms the casting pit.

Prof. T. Turner (Birmingham) gave the results of observations on the volume and temperature changes during the cooling of cast-iron. Apparatus was designed in order to measure the changes of length of a test-bar, whilst cooling curves were taken of the specimens at the same time with a Le Chatelier pyrometer. The curves obtained may be divided into four classes, depending upon the number of arrests observed in the normal rate of contraction of a cooling solid.

Mr. E. Adamson (Seaton Carew) read a paper on the influence of silicon, phosphorus, manganese, and aluminium on chill in cast-iron. The depth of chill is primarily dependent upon the percentage of combined carbon and the temperature of casting. Combined carbon 0·67 per cent. gives 1/16-inch chill, and combined carbon 0·88 per cent. gives ¾-inch and 1-inch, but the latter was cast at a much higher temperature. These figures are taken from the silicon and phosphorus tests. The manganese tests also show an increase in true chill with increasing manganese up to combined carbon 1·60 per cent. The tests described were made from coke irons, and suggest that under proper treatment coke irons are as good as charcoal irons for high mechanical tests and depth of chill.

On May 11 Prof. J. O. Arnold and Mr. F. K. Knowles (Sheffield) read a preliminary note upon the influence of nearly pure metallic manganese alloyed with varying proportions of nearly pure metallic iron. A series of alloys ranging in manganese from 0·3 per cent. to 36 per cent., and in carbon and silicon from 0·05 per cent. to 0·2 per cent. each, was prepared in special crucibles. In the finished bars, each 12 feet long, liquation of a remarkable character took place which rendered the completion of the research difficult. It is possible, but hardly probable, that some of these costly alloys may prove of practical importance.

Mr. C. de Schwarz (Liége) read an interesting paper on the use of oxygen in removing blast-furnace obstructions. The difficulties caused by the tap-hole of a blast furnace becoming closed up by solid iron have been overcome by the application of compressed oxygen. The process has been adopted at several works in England and on the Continent with satisfactory results. At the conclusion of the paper a practical demonstration of the process took place at the works of the Brin Oxygen Co. in Westminster.

Mr. E. F. Law (London) described an extended investigation into the causes which underlie the production of brittle and blistered tin plates. He showed that oxidised steel will give rise to blistered sheets, and that this defect is more liable to occur with Bessemer than with open-hearth steel. Steel high in sulphur and phosphorus will cause brittleness in sheets, especially if the sheets are rolled from

large and slowly-cooled ingots in which the maximum of segregation has taken place.

Mr. P. Eyermann (Benoit, Wisconsin) submitted a lengthy paper on the manufacture of solid rolled steel wheels and tyres. The average life of a cast-iron wheel is 56,000 miles in passenger service, while steel-tyred wheels have a life of 265,000 miles. The author considers it probable that before long the solid rolled steel wheel will replace the existing tyres in Great Britain.

Mr. E. Lelong (Couillet, Belgium) described a new method of manufacturing chains by machinery in which the successive convolutions of spiral links are continuous. Chains made by this process are 20 per cent. stronger than those made by the usual methods.

Mr. C. O. Bannister (London) discussed the relation between type of fracture and microstructure of steel test-pieces, showing that valuable conclusions may be drawn from the examination of the fractured surface.

The effect of copper in steel was discussed by Mr. F. H. Wigham (Wakefield). Copper is very difficult to alloy with steel so as to obtain a homogeneous mass containing more than 2 per cent. even with the addition of aluminium. In steel containing 0·5 per cent. or more of carbon it is not of practical value to use more than 0·6 per cent. of copper. The steel with 0·25 per cent. of copper and alloys up to 0·25 per cent. of copper with high carbon (0·70 per cent.) give, with or without a high percentage of manganese, a good quality of wire. In fact, copper to the extent of 0·25 per cent. is no disadvantage in the manufacture of the best classes of steel wire.

The reports of research work carried out during 1905–6 by holders of Carnegie research scholarships, which were submitted, represented a large amount of work of great interest. An exhaustive study of quaternary steels was submitted by Dr. L. Guillet (Paris). For the research 250 varieties of steel were prepared, including nickel-manganese steels, nickel-chromium steels, nickel-tungsten steels, nickel-molybdenum steels, nickel-vanadium steels, nickel-silicon steels, nickel-aluminium steels, manganese-silicon steels, manganese-chromium steels, and chromium-tungsten steels. The area for the commercial employment of these steels is considerably restricted, and is limited to the nickel-vanadium steels, the nickel-tungsten steels, and the chromium-vanadium steels containing comparatively low proportions of foreign elements.

The report by Mr. W. Rosenhain (Birmingham) on the deformation and fracture of iron and mild steel constitutes a continuation of his previous paper on the plastic yielding of iron and steel. He gives further observations on slip-bands, and deals with the modes of fracture under various conditions. In tensile fractures the break runs almost indifferently through ferrite and pearlite, owing to the fact that the previous extension of the metal has weakened, and in part even ruptured, the pearlite; in shock fractures the pearlite is able to assert its superior strength and is avoided by the fracture, while fissures are formed in the ferrite. The features of bending fractures are found to be of an intermediate character. The results of the examination of these fractures are discussed both from the point of view of the relative behaviour and interaction of ferrite and pearlite under breaking stresses and from the point of view of the general theory of deformation and fracture which is presented in the paper. In conclusion, the author points out the possibilities of practical application which his method of studying fractures opens up. This detailed study of fractures makes it possible to locate accurately the causes of weakness and strength in a given microstructure, and by comparing the behaviour of the constituents when broken in different ways to gain a deeper insight into their mutual interaction; while the study of "mysterious" fractures occurring in service—as rendered possible by this method—should make it easier to trace the causes of fracture—if any—which are present in the metal.

Dr. H. C. Boynton (Harvard, U.S.A.) dealt with the determination of the hardness of the constituents of iron and steel with the aid of Jaggar's microsclerometer. Reduced to a common unit, the hardness of pure ferrite, the average hardness of the constituents was found to be as follows:—

Constituent	Present in	Average Hardness	Ratio
Ferrite	Electrolytic iron	460	1
,,	,, ,, quenched	990	2·15
,,	Average of all unhardened samples	610	1·03
,,	Commercial wrought irons	686–1643	1·5–3·6
Pearlite	Series 0·13–1·52 per cent. carbon	842–4711	1·8–10·3
,,	Series 0·35–0 86 per cent. carbon	1745–2150	3·8–4·2
Sorbite	0·48 and 0 58 per cent. carbon steel	2400–24,650	5·2–53·6
Troostite	Steel, 0·58 per cent. carbon	40,564	88·2
Martensite	Series 0·20–1·52 per cent. carbon	17,896–120,330	38 9–261·6
Austenite	White cast-iron (3·24 per cent. carbon)	47,590	103·4
Cementite	White cast iron (3·24 per cent. carbon)	125,480	272·8

Mr. J. D. Brunton (Musselburgh) submitted an elaborate report on the heat treatment of wire, particularly wire for ropes. He showed that the usual methods of obtaining the best wire by means of torsion and tensile tests are not altogether trustworthy for determining the best point for the wire to perform useful work. Annealing of the rod before the final annealing does not, in any way, produce better material, as it has been thought to do, and is, therefore, not necessary.

The research carried out by Messrs. E. G. L. Roberts and E. A. Wraight (London) comprised a series of 150 experiments and complete analyses, dealing with the constitution of ferromanganese and the efforts made to deprive this alloy of its carbon.

It was announced that the next meeting would be held in London at the end of July, when members of the American Institute of Mining Engineers would be the guests of the institute.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Prof. William Schlich, F.R.S., St. John's College, has been constituted by H.M. Secretary of State for India professor of forestry so long as he shall be continued in his present position and be resident within the University.

The first of two lectures on "The Teaching of Science in Schools" was given by Dr. Bevan Lean, headmaster of Sidcot School, on May 10 at the lecture room of the delegacy for the training of secondary teachers. The second lecture is to be delivered to-day.

CAMBRIDGE.—A Grace authorising the general board of studies to appoint, subject to confirmation by the special board for medicine, Mr. G. H. F. Nuttall, Christ's College, to be reader in hygiene in connection with the special board for medicine, the University lectureship in bacteriology and preventive medicine to terminate on his appointment as reader, will be offered to the Senate to-day.

Mr. W. J. Sell, Christ's College, has been approved by the general board of studies for the degree of Doctor in Science.

A university lectureship in mathematics will be vacant at Michaelmas, 1906, by the resignation of Mr. Whittaker. The general board of studies will shortly proceed to appoint a lecturer to hold office from Michaelmas, 1906, until Michaelmas, 1911. Candidates are requested to send their applications, with statements of the subjects on which they are prepared to lecture, and with testimonials if they think fit, to the Vice-Chancellor on or before May 31.

The Vice-Chancellor has been informed by the clerk to the Worshipful Company of Girdlers that the company is prepared to continue its grant of 100*l.* a year towards the teaching of economics for a second period of three years. The board of economics is of opinion that this offer should be gratefully accepted.

THERE seems every possibility of the Hamburg University being very quickly established. Three million marks have already been voluntarily subscribed, two millions of which have been given by Mr. Alfred Beit. It is proposed that only one-half of the lectures shall be given for direct preparation for any particular profession, while the other half are to be for the further extension of the general education of the inhabitants of the town.