

Wegener's Theory of Continental Drift.

UNDER the joint auspices of the Sections of Geology and Geography, Botany and Zoology, a Symposium on "Wegener's Theory of Continental Drift, with reference to India and Adjacent Countries" was held on 7th January, during the recent session of the Indian Science Congress at Hyderabad. Mr. W. D. West of the Geological Survey of India presided. In opening the proceedings, Mr. West gave a brief account of the theory and reviewed the various evidences for and against the idea of continental drift as conceived by Wegener. He said that this was a subject in which several groups of scientists were deeply interested, and the present symposium gave them an opportunity to meet and discuss this theory on a common platform. He then invited Dr. Sahni to open the discussion.

PROF. B. SAHNI (*Lucknow*) said that from a broad survey of the late Palæozoic floras, two striking facts emerge: (a) some countries with closely allied floras lie on the opposite sides of big oceans; and (b) others with very different floras lie dovetailed with each other. The question to decide was—could we explain these facts without the aid of the drift theory? Regarding the first point, he said that his attempt 10 years ago to compare the southern fossil floras from this point of view proved abortive, because our knowledge of the floras of corresponding points on the opposite coasts was too unequal to admit of a fair comparison; and the position to-day is much the same as it was ten years ago. Regarding the second point, he drew the attention of the house (with the help of maps) to the remarkable case of two very distinct floras which now lay very close to each other near Assam—the *Gigantopteris* flora of China and Sumatra, and the *Glossopteris* flora of India and Australia. These are two climatically distinct floras and their present contiguity obviously suggests a movement of these two floral provinces towards each other. Thus though it is true that we have not yet enough palæobotanical data to prove the drifting apart of the different remnants of Gondwanaland, yet we at least seem compelled to agree that movements of large magnitude elsewhere have brought into juxtaposition continents once separated by a wide ocean. We cannot get away altogether from the idea of continental drift, but the details of Wegener's theory must stand on their merits.

DR. S. L. HORA (*Calcutta*) viewed the theory from the evidence afforded by the Indian fresh-water fish fauna. With the help of a series of lantern slides, he pointed out that the fresh-water fauna of India was derived by successive waves of migration, consequent upon extensive river captures, from east to west. He illustrated this with special reference to the *Schilbeidae*—a group whose first appearance is indicated by some fossils in the Tertiary deposits of the highlands of Pedang in Sumatra—and pointed out that the relationships of these and other genera of fishes can only be explained on the assumption that their ancestral forms migrated from Indo-China, Siam, etc. His studies of the origin and geographical distribution of the Indian fresh-

water fishes negatived the theory of the permanence of oceans and continents, and indicated the existence of a land connection between India and Africa. Whether this connection was in the form of a land bridge between the two continents or the two continents were juxtaposed at some remote period but later drifted apart, it is very difficult to decide.

PROF. S. P. AGHARKAR (*Calcutta*) referred to the Palæo-African Element of the Indian flora, which he said must have reached India towards the end of the Jurassic and the Cretaceous period, when there was a direct land connection between Peninsular India and Africa through Madagascar. After mentioning a number of genera of this element and noting their present distribution, he was of opinion that these facts of observation could be better explained by Wegener's theory of continental drift than by any other hypothesis.

DR. A. K. DEY (*Calcutta*) in the course of his paper (read by Mr. D. N. Wadia in the absence of the author) compared the Jurassic and Cretaceous fossils of a number of areas in India, Africa and Madagascar, and doubted the effectiveness of a land bridge between India and Africa to account for the migration of flora and terrestrial animals. He pointed out that according to Grabau, India was joined to the Arabia-African continent *via* Iran only, throughout most of the Palæozoic time, and during the Mesozoic, they were joined in the Trias and lower Jurassic periods. Subsequently they were separated, and again joined during the Tertiary. During such intervals of land connections, inter-migrations of flora and terrestrial animals took place by this route only. Those who believe in the permanence of land and sea will probably agree with Grabau, and discard the necessity of interposing a purely hypothetical land connection across the Indian Ocean.

J. D. H. WISEMAN AND R. B. SEYMOUR-SEWELL (*Cambridge*) in their communication (read by Dr. S. L. Hora in the absence of the authors) gave a brief account, illustrated with lantern slides, of the floor of the Arabian Sea and the neighbouring areas of the Indian Ocean as mapped by them during the recent John Murray expedition. The region is traversed by several submarine mountain chains of which six were described in some detail. There is a remarkable similarity between the topography of the floor of the Arabian Sea and the region of the great rift-valley in Africa, the one being the mirror image of the other. It seems highly probable that the floor of the north-western part of the Indian Ocean assumed its present form as a result of compression in tertiary times, contemporaneous with the Alpine-Himalayan folding; and that subsequently, in Pliocene or post-Pliocene times, a tract of land occupying this area became faulted down to its present depth. There is little or no indication that any older continental mass or land isthmus such as the hypothetical continent of Gondwanaland or the isthmus of Lemuria, ever existed, except in the granitic mass of the Seychelles

and perhaps the corresponding granites of Sokotra and the Kuria Muria Islands.

MR. P. EVANS (Assam) pointed out that as seen from the detailed mapping of the Assam tertiaries, there had been a very great contraction in that part of the earth's surface since early Pliocene times. The distribution in time and space of the conditions which favoured the formation of oil, has been held to support a theory of continental spreading, but to favour Gutenberg's views rather than Wegener's.

PROF. L. RAMA RAO (Bangalore) said that in discussing the validity of this theory, we must focus our attention on the history of the earth during the late Palaeozoic and early Mesozoic periods, and that any conclusions based entirely on Tertiary and post-Tertiary phenomena will not be helpful. With reference to the evidence in India and adjacent countries, he said that our acceptance of Wegener's theory must largely depend on its bearing on the two important aspects of the late Palaeozoic geology of Gondwanaland—(a) the distribution of *Glossopteris* flora and (b) the Permo-carboniferous glaciation. From both these points of view, the theory has been critically examined during recent years and there is a general agreement to reject it. The theory raises more problems than it proposes to solve. The remarkable case of two originally very distinct floras (the *Glossopteris* flora of India and Australia and the *Gigantopteris* flora of China and Sumatra) now seen in close juxtaposition and even dovetailed with each other, to which Dr. Sahni has drawn

attention, no doubt suggests a movement of these two floral provinces towards each other and thus appears to support the general idea of a continental drift. But in view of the fact that the theory has been tried and found wanting in the solution of the more major problems of geological structure, palaeo-climates, and former distribution of fossil floras, it seems doubtful if we have still to invoke the aid of this theory for explaining this particular occurrence. No other explanation may just now be possible, but in course of time, a more detailed knowledge of these two contrasted floras and a better understanding of the several factors controlling plant distribution may some day enable us to discover an alternative explanation which will be more easily acceptable.

THE PRESIDENT (Mr. W. D. West) in bringing the Proceedings to a close said that they had spent a most useful afternoon in this discussion and thanked the various speakers for their valuable contributions. Whether we ultimately accepted or rejected this theory of Continental Drift, he said that there was no doubt that within the last 25 years, Wegener's theory had served a most useful purpose in stimulating and furthering investigation and research in several branches of science, leading to very valuable results. Likewise, he said, the discussion they had that evening was quite stimulating and enabled workers in different fields to understand one another better in the solution of a common problem.

L. RAMA RAO.

The Teaching of Applied Chemistry in Indian Universities.*

LAST year at the Indore session of the Indian Science Congress the Sectional Committee of Chemistry decided to elicit public opinion regarding the teaching of Technical Chemistry with regard to the following points:—

(1) Whether it is desirable to standardise the teaching of technical chemistry in various universities;

(2) Whether all duplication of teaching in different universities should be avoided;

(3) Whether it is desirable to approach Government departments and industrialists to give facilities to students for practical training in the factories and organisations under their control.

A circular letter on the above lines was sent to the different universities, provincial directors of industries, and prominent industrialists and industrial concerns. The replies received were quite encouraging and the matter was again thoroughly discussed in the Chemistry Section of this year's session of the Indian Science Congress at Hyderabad, Deccan.

PROF. R. B. FORSTER of Bombay University who opened the discussion said that Technology or applied science was based on pure science, and

the latter on a good general education. He suggested that more attention be given to the study of practical English in the schools and that German could, with advantage, be introduced at an early stage. It was in these two languages that the bulk of the chemical literature was to be found. A good working knowledge of a foreign language was easily acquired by the young if taught by the direct method. For students who proposed to study science the matriculation examination in English should be modified so as to test the student's knowledge of the use of the English language rather than his knowledge of set books. Practical mathematics should be given a prominent place in the school curriculum.

It is doubtful whether Chemistry and Physics should be taught in schools, it depended largely whether the school was in a position to maintain adequate laboratories and qualified instructors, the imparting of book knowledge in science was of little value. In this connection he pointed out the great difference between Indian and European schools.

The stage at which applied science should be taught depended upon whether you wished to train the artisan or the technologist. For the training of the technologist, he was in favour of an undergraduate course in pure science up to the B.Sc. standard and a post-graduate course in chemical technology, as this fitted in best with

* Abstract of the discussion on "The Teaching of Chemical Technology," held on Tuesday, Jan. 5, during the Indian Science Congress Session, Hyderabad, 1937.