

by fusion, both by the study of natural and artificial products, with a few apparent exceptions, which receive a special explanation.

By a judicious combination of substances and temperatures, the authors succeeded in obtaining eleven distinct mineral associations, almost exactly reproducing, even in the minutest details of structure, as many natural rock types.

These are as follows: 1°. *Augite (oligoclase) andesite*, 2°. *Augite (labrador) andesite*, 3°. *Augite (anorthite) andesite* (all produced by single fusion at temperature No. 3); time three days. 4°. *Basalt*. Two successive stages of fusion were necessary to produce this rock. Temperature No. 2 produced in forty-eight hours numerous crystals of olivine embedded in a glassy matrix, which was altered into a crystalline mass of labradorite and augite microliths by being again subjected for an equal length of time to temperature No. 4. 5°. *Nephelinite* was produced in forty-eight hours at temperature No. 4. 6°. *Leucitite* was obtained after three days' fusion at temperature No. 2. 7°. *Leucititephrite* produced by double fusion exactly like basalt. 8°. *Lherzolite*, 9°. *Meteorites free from feldspar*, and 10°. *Felspathic meteorites*, though quite successful so far as the mineral associations were concerned, showed certain variations from the natural products in their structure. No synthesis was perhaps so interesting as that of 11°. *Diabase*, with the so-called 'ophitic' structure. This structure consists, as is well known, of irregular masses of pyroxene filling the spaces between the lath-shaped crystals of plagioclase. It was found to be impossible to reproduce this structure with oligoclase or labradorite, on account of their comparatively low fusing-point. By means of a double fusion with anorthite, it was, however, successfully accomplished.

Scarcely less interesting than these positive results are the conclusions derived from the authors' negative experiments. It was found impossible to obtain the acid rocks, i.e., those containing either quartz, albite, orthoclase, muscovite, biotite, or amphibole, by purely igneous fusion. These minerals either produced an amorphous mass, or passed into other combinations giving rise to species already obtained; e.g., hornblende, when melted, crystallized as pyroxene. Thus the very important conclusion is reached, that the acid rocks owe their origin to some other agency than simple fusion.

Under the head of the synthesis of minerals, the authors' experiments in fusing mixtures

of feldspars are worthy of special notice as being directly opposed to the now generally accepted theory of Tschermak, that the triclinic feldspars form an isomorphous series. Fouqué and Lévy found it impossible to obtain crystals of intermediate members, as only well-defined microliths of either oligoclase, labradorite, or anorthite, appeared, varying in their relative proportions with the mixtures fused. Also of especial interest are their artificial production of feldspars with lead, barium, and strontian as bases.

THE GEOLOGY OF NATAL.

Natal. Department of mines. Report upon the coal-fields of Klip River, Weenan, Umvoti, and Victoria counties, together with tabulated statement of results obtained from a series of trials of colonial coal upon the Natal government railways. By F. W. NORTH. London, Harrison, pr., 1881. 1, 66 p., (49) pl., etc. f°.

This report contains two maps, showing the distribution of the coal-fields of the colony of Natal, and a description of 72 sections occurring in them, 70 of which are illustrated by diagrams. There are also two horizontal sections given,—one from Buffalo River to the Drakensberg Mountains, and the other from Buffalo River to Elands Laagte.

Mr. North estimates the actual area of the Natal coal-field, where he has found workable coal-seams at the surface, at about 1,100 □ miles, situated entirely in Klip River county. To this he adds 250 □ miles for the region between the Ingagani River and the Drakensberg Mountains, which he considers the coal measures underlie. The workable seams vary from 4 to 10 feet in thickness, and are of several qualities. Assuming an average thickness of 4 feet, and allowing a deduction of 50 per cent for faults, worthless coal, and barren ground, he estimates the whole at 2,073,000,000 tons, divided into,—

	Tons.
Anthracite, similar to Gladstone . . .	518,400,000
Semi-bituminous, similar to Walmesley, Bituminous, similar to Dundee coal-fields and Lenox sections	518,400,000
Free-burning bituminous coal of the same character as No. 44 Crown lands and Lenoxton, Newcastle .	518,400,000
Total	2,073,600,000

Mr. North considers these coals superior in quality to those of Cape Colony. A number of analyses of them have been made by Dr. Frankland and Dr. Hahn. There are also many beds of iron ore: the one from Prestwick is an intimate mixture of magnetic iron ore and

brown iron ore, and yielded on analysis 63.51 per cent of metallic iron.

Accompanying the report is a "Horizontal geological section on the main road from Durban to Van Reenen's pass, by Dr. P. C. Sutherland." This, in so far as it covers the same ground, differs considerably from that published by C. L. Griesbach in 1871. The Table Mountain sandstone, referred by Griesbach to the carboniferous, is by Sutherland considered Silurian. The mesozoic eruptive rocks are joined together under the name of basaltic, and are apparently represented as dikes, and not as interstratified flows of melaphyr, amygdaloid, and aphanitic diorite, as by Griesbach.

Mr. North gives the following geological order of succession in the rocks of Natal:—

1. Basaltic trap rocks, often penetrating between stratified rocks or shales of the coal-measures, and forming horizontal beds.

2. Triassic horizontal coal-measures, containing coal-seams correlating with the Stormberg coal-field of Cape Colony.

3. Pietermaritzburg shales, probably corresponding with the upper Karroo beds of Cape Colony.

4. Conglomerate or boulder clays, in all probability the Dwyka conglomerate of Cape Colony.

5. Sandstones, horizontal and massive, of the Inanda location, Table Mountains, and Bothas Hill, etc., probably of Silurian age.

6. Primary rocks, — granite, gneiss, marble, etc.

Mr. North seems to have overlooked the cretaceous series, from the lower greensand up to the white chalk described by C. L. Griesbach in south-eastern Natal; and no evidence is given for assigning the Table Mountain sandstone to the Silurian instead of the carboniferous: in fact, no notice whatever is taken of Mr. Griesbach's able work on the geology of Natal.

At the Insiswa Mountains, in the Amaponda territory, the line of demarcation between a vast eruption of igneous rock and the triassic contains various ores of copper containing traces of gold. Mr. Griesbach also mentions the occurrence of copper ores along the line of the eruption of melaphyrs. We have here, in another portion of the world, another instance of the occurrence of cupriferous traps in the trias.

The boulder clay consists of a bluish gray base, so fine that its constituents are not resolvable except under high magnifying power, and then no crystals are disclosed. It appears

to be a very fine indurated mud, containing boulders, pebbles, angular fragments, and grains of a great variety of rocks varying in size from masses weighing over 5 tons to pieces smaller than a pea. In mechanical composition it greatly resembles the great Scandinavian drift. It stretches for hundreds of miles, and has been found 1,200 feet thick. Some of the larger angular boulders seem to have been brought from a distance of at least 70 miles. It seems difficult to account for such a formation otherwise than by glacial action at the close of the dyassic period.

THE BIBLIOGRAPHY OF ANGLING.

Bibliotheca piscatoria. A catalogue of books on angling, the fisheries, and fish-culture, with bibliographical notes and an appendix of citations touching on angling and fishing from old English authors. By T. WESTWOOD and T. SATCHELL. London, Satchell, 1883. 397 p. 8°.

THE possibilities of the future in the formation of libraries on special subjects, at present rates and ratio of increase in book-making, are brought forward in a striking manner by examination of a list like that before us. Here is a work devoted to angling, fisheries, and fish-culture, in which 2,148 distinct publications are registered under 3,158 entries, inclusive of new editions and reprints. Angling occupies 245, fisheries 83, and fish-culture 23 pages. Roughly estimated, nearly ten per cent of the publications, including reprints, etc., have appeared since 1870. Fish-culture alone claims an increase of nearly one-third in the same time. It is hardly to be expected that a work of this character should be entirely exhaustive or complete. The authors deserve great credit for the nearness of their approximation to completeness, for the amount and quality of information given, and for general accuracy.

An example or two will indicate respects in which the book may be improved in future editions.

"*Gesner* (Conrad). *Aqvatilivm animantivm nomina Germanica et Anglica, serie literarum digesta, autore Conrado Gesnero.* [1530?] 8°. Appended to an edition 'P. Ovidii Nasonis *Haliuticon*, etc.' Tigvri apud Gesneros fratres, pp. vi+280, and extending from page 12 to 280. . ."

This should read, —

Gesner (Conrad). *De piscibvs et aqvatilivbvs omnibys libelli III.* Noui. Avthore CONRADO GESNERO Medico et philosophiae naturalis interprete in Schola Tigurina.