GEOLOGY

Rocks of the Fortieth Parallel

"A Classic of Science"

Zirkel Classified American Rocks, Including Dense Black Varieties Grouped Under the Name Basalt

MICROSCOPICAL PETROGRAPHY by Ferdinand Zirkel. Vol. 6 of the Report of the Geological Exploration of the Fortieth Parallel, made by order of the Secretary of War according to Acts of Congress of March 2, 1867, *and March* 3, 1869. *Under the direction of Brig. and Bvt. Major General A. A. Humphreys, Chief of Engineers, by Clarence King, U. S. Geologist. Washington: Government Printing Office,* 1876.

United States Geological
Exploration of the Fortieth
Parallel, October, 1876.

GENERAL: Herewith I have the honor to transmit Volume VI of the report of this Exploration.

While American palaeontologists have materially aided field-geologists by their systematic assignment of fossil remains to proper horizons, the important study of petrography has suffered complete neglect, save by a few exceptional workers.

Believing that the establishment of definite American rock-types could only be satisfactorily accomplished by minute comparisons with those of Europe, and that the refinements of microscopic investigation were essential to success, I naturally turned to Europe for aid.

I am sure American men of science will welcome the present volume, from the distinguished pen of Prof. Ferdinand Zirkel, as one of the most important contributions ever made to our geology, and will give it the cordial intellectual greeting due so eminent a guest as its author.

Very respectfully, your obedient servant,

CLARENCE KING,
Geologist-in-Charge.

Brigadier-General A. A. HUMPHREYS,
Chief of Engineers, U. S. Army.

Leipsic, 1876.

Sir: Sending you herewith my report on the crystalline rocks along the Fortieth Parallel in the Western United States, I cannot fail to gratefully acknowledge how much invaluable assistance I owe to you and to your excellent fellow-workmen, Messrs. S. F. Emmons and Arnold Hague. You well remember that happy time in New York when for many weeks we made together the preliminary examination of that vast collection of rocks you had gathered under such difficulties, but with such eminent geological taste.

You then enabled me to become acquainted with the geological distribution, relative age, and reciprocal connections of the rocks; and if I have been able to study their mineral and chemical constitution from a geological point of view, and to present more than a sterile and dry petrographical description, the merit is originally yours. Since the greater part of this investigation is directed to the microscopical composition and structure of rocks, it has appeared appropriate to offer in the beginning some brief general remarks upon that subject.

You know that when we examined the collection microscopically I entirely agreed with the determination and nomenclature you and your able colleagues had already arrived at in the field. There were only some doubtful occurrences, whose true nature could not at that time be decidedly cleared up. Now, after having carefully studied more than twenty-five hundred thin-sections under the microscope, I have only to testify again that your original designations should almost never be altered or corrected.

May the results of this report as an American contribution to the general science of rocks fulfil the expectation you cherished when you entrusted your classic collections to me.

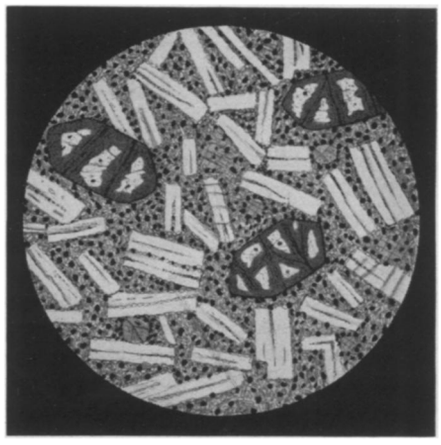
With sincerest respect,

F. ZIRKEL.

TO CLARENCE KING,
United States Geologist.

Basalts

Of the younger Tertiary eruptive masses, the basaltic, in a general sense, are the opposites of the trachytic rocks,



BASALT

This rock, north of American Flat Creek, Washoe, Nevada, is a characteristic type, containing larger microscopic or even macroscopic crystals of feldspar and olivine, both contrasting with an extremely fine-grained crystalline mixture of rounded, drop-like or crippled augite grains of pale color and with black, sharp grains of magnetite.

namely, rhyolite, trachyte, phonolite, and hornblende-andesite. They are characterized by the presence of augite, the total absence, or very small amount, of quartz and sanidin, the frequent occurrence of olivine, an abundance of magnetite, a more basic constitution, a higher specific gravity, and a darker color. It is only in comparatively rare cases that they present their mineralogical constituents in forms visible to the unaided eye.

A great multitude of dark, heavy, basic rocks have been collected for basalts. Their chief mass seemed macroscopically to be homogeneous, and their mineralogical composition gave rise to conjectures and interpretations as untrustworthy as they were numerous, until microscopical study achieved a solution of this much-vexed question.[1] The examinations show that these rocks very similar in their exterior behavior and in their chemical constitution, are not, as was accordingly inferred, made up of the same principal mineral ingredients; but they are clearly divisible into three large groups, possessing dif-

[1] F. Z., Untersuchungen über die mikroskopische Structur und Zusammensetzung der Basaltgesteine, Bonn, 1869.

ferent mineral combinations. The microscopical association of ingredients discovered here are not, as such, however, at all new or strange, but are merely a phanerocrystalline repetition of types which have long been known. As stated above, the basalts may be arranged into three divisions, the behavior of each being quite different from that of the rest; and, accordingly to the principles valid in macroscopical petrography, they are three separate and well characterized types of rock. With respect to the chief silicate, which is free from iron and rich in alumina, that always accompanies the never-wanting augite, which is rich in iron and poor in alumina, there exist the following: *a,* feldspar-basalts, characterized by the presence of plagioclase, usually wanting in leucite, occasionally with some nepheline, which correspond to the more distinctly grained dolerites and anamesites; *b,* nepheline-basalts, occasionally containing some leucite, and, when rich in nepheline, usually free from feldspar, corresponding to the nephelinite, for instance, from the Löbauer Mount, Saxony; *c,* leucite-basalts, which are almost always free from feldspar, but generally contain nepheline in comparative abundance, although less than the leucite. Contrary to the previously entertained opinion, therefore, feldspar is not a principal ingredient of all so called basalts. The members of all the three groups always bear magnetite, almost always olivine, and sometimes titanic iron. Mellilite and haüyne only occur separately, and are limited to the nepheline and leucite-basalts.

The microscope also proves that the separation into three groups not only refers to the massive, proper basalts, but to all the basaltic lavas. These latter are divided into:

Feldspar-basalt-lavas.
Nepheline-basalt-lavas.
Leucite-basalt-lavas.

And not only all the varieties of constituent combinations which are met in the proper basalts, but all the most special relations presented in their microscopical structure, are exactly repeated in the basaltic lavas. Whether a basalt is a feldspar, a nepheline, or a leucite rock must always be decided in each case with the microscope; for the simple black *ensemble,* common to them all, completely hides the difference of their interior mineralogical composition, and even the most careful chemical analyses do not afford material for a rigid determination.

Yet it becomes evident, by a comparative review of the examinations thus far made, that, taken in general, the basaltic occurrences assembled together in one region differ but little in their composition. The stronger contrasts are obtained when rocks from different regions are compared. For example, the German basalts of the Siebengebirge, and the enormous basaltic and anamesitic depositions of Scotland, the Western Islands, the Faeröer, and Iceland, are all feldspar-basalts, and not a particle of leucite has yet been discovered in them. The proper basalts of the Erzgebirge, between Saxony and Bohemia, on the other hand, bear only leucite and nepheline, and are free from feldspars. No lava from the environs of the lake of Laach, Rhenish Prussia, has been examined in which there was not to be observed an abundance of leucite. For aught that is now known to the contrary, leucite is totally wanting in the numerous basalts and lavas of Central France (Auvergne, Velais, Vivrais, Cantal), which bear feldspars, and are free from, or poor in, nepheline.

The nepheline-basalts sometimes contain leucite, and the leucite-basalts usually bear nepheline; so that these two groups appear to be much closer connected with each other than either of them with the feldspar-basalts. Moreover, the nepheline and leucite groups often occur together in one region; for instance, at Erzgebirge, Rhön, in Germany, and Northern Bohemia. And where feldspar-basalts are abundantly developed, there is little probability of finding with them members which are rich in leucite and nepheline, the latter almost always occurring separately.

These rules, deduced from a comparative study of European basaltic regions, are found to hold good of the occurrences along the Fortieth Parallel in Western America. Notwithstanding the enormous number and extent of development of the basaltic eruptions here, the rocks are, with very few exceptions, and those confined to the eastern limit of the examined territory, feldspar-basalts; which, in general, are no doubt the most frequent type in all parts of the globe. If on this account the petrographer finds himself confined to the monotony of one general type of composition, and searches in vain for those interesting mineral combinations exhibited by the leucite and nepheline-basalts, he is amply compensated by the great number of remarkable and charteristic varieties of microscopical structure offered by the numerous feldspar-basalts.

Science News Letter, September 10, 1932

PHYSIOLOGY

Brain Makes Fuel of Alcohol, Yale Researchers Discover

A NEW BRAIN fuel is announced as a result of the recent experimental work of Dr. Harold Himwich and Dr. L. H. Nahum of the Yale Medical School faculty, who have just discovered that the brain can oxidize alcohol. Knowledge of what the brain can burn is exceedingly meager, lactic acid being the only previously known substance which the brain is supposed to oxidize.

But Dr. Himwich and his associates in the physiological laboratories at the Yale Medical School have used the respiratory quotient as an index of what the brain can use for food and have come to the conclusion that it can oxidize alcohol. The respiratory quotient is a ratio between the carbon dioxide produced and the volume of oxygen consumed during the oxidation of any substance. For lactic acid and for normal brain the values are one. But for alcohol and for blood from dogs in alcoholic state and even for brain after it is removed from rats which have previously been given alcohol, all values fall below one.

"We feel," says Dr. Himwich, "that these preliminary experiments, even though few in number, indicate that the brain can oxidize lactic acid and alcohol simultaneously. Some energy may be derived from this oxidization but since the presence of alcohol interferes with the normal functions of the nervous system, the oxidization of alcohol by the body, and particularly by the brain, an organ which usually oxidizes only lactic acid, serves as a protective device to rid the brain of a toxic substance."

Science News Letter, September 10, 1932