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THE USE OF THE TERMS FLINT AND CHERT

WALDO S. GLOCK

Reference to almost any two text books in geology will show that there are different usages for the terms flint and chert. Perhaps much of the confusion is due to the fact that the origin of these substances is unknown, in which case exact definition at this time would be premature. Whatever the reason it seems advisable to bring out the variability of definition, if for no other purpose than to state a problem without attempting its solution.

Blackwelder & Barrows.—Elements of Geology, 1911, page 39.

Flint is defined as "a very compact, dark grey, siliceous rock." Farther on, chert is said to be "an impure flint, usually of light color;" both occur in limestones.

Chamberlin & Salisbury.—Introductory Geology, 1914, pages 268, 287-289.

"Flints and cherts occur in limestone both as nodules and as distinct beds." Under alterations of rocks it is stated that silica which was primarily deposited as shells is later gathered into nodules or concretions of chert or flint. Concretions of chert (silica) are common in limestone. Preference is given to mode of occurrence, while no distinction is drawn between the two terms.

Chamberlin & Salisbury.—Geology, Advanced course, 1904, Vol. I, page 426.

There is here no essential difference in the use from that in the "Introductory Geology" except that cherts are termed impure flints and that both may occur in limestone and chalk. In a reference list of the more common minerals under which it is admitted that common usage is more or less inconsistent, the definitions are given: chert — "an impure flint, usually of light color and occurring abundantly in concretionary form as nodules in certain limestones;" flint — "a compact dark chalcedonic or lithoid form of quartz." No sharp rules are laid down.

H. F. Cleland.—Geology, Physical and Historical, 1916, page 77.

"Flint and chert are gray to black, translucent to opaque, quartz masses which occur in chalk and limestone."

Grenville A. J. Colc.—Rocks and Their Origin, 1912, pages 38-42, 62-63.

Flint, a form of silica, is described as being the most common substance that replaces calcium carbonate in limestone. For three paragraphs flint is strictly associated with the chalk of the Cretaceous of England. Then comes the information that casts of crinoids are found in the flints of the Carboniferous limestone. "Radiolaria have now been well recognized as flint formers, even in dark 'cherts' of Silurian age." In a discussion of sandstone it is said, "Bands of flint (chert) occur in certain sandstones, — — — —. These are due to the cementing of certain layers of chalcedonic silica." Toward the end the author makes no attempt to conceal the fact that he regards flint and chert as identical.

W. O. Crosby.—Tables for the Determination of the Common Minerals, 1911, page 84.

Flint and chert are described as compact or cryptocrystalline, and not glassy.

J. D. Dana.—Manual of Geology, 1895, pages 83, 480.

Chert is called an impure flinty rock and flint is used in reference to the chalk deposits.

W. E. Ford.—Dana's Manual of Mineralogy, 1912.

Flint is placed under the cryptocrystalline varieties of quartz.

Archibald Geikie.—Textbook of Geology, 1903, page 141.

There is no strict definition. Flint is assigned to chalk but it is held that chert is impure flint most of which occurs in limestone.

A. W. Grabau.—Principles of Stratigraphy, 1913, pages 764-765.

"Flints characterize chalk, and chert layers abound in many limestones. Chert concretions occupy the same relation to limestone that flints do to chalk." Thus flints are assigned absolutely to chalk and cherts to limestone.

A. J. Jukes-Brown.—The Building of the British Isles, 1911.

Throughout scattered pages the term "cherts" is used only in connection with sands and limestones; "flint" is used with chalk.

E. H. Kraus.—Descriptive Mineralogy, 1911, pages 74-75.

Flint,—"Gray, smoky, brown, — — —, nodular variety (of quartz) closely related to chalcedony. It is usually found in chalk beds and limestone." Chert,— "A more or less general term applied to hornstone, impure flints or jaspers." They are thus described as more or less general terms.

Lake & Rastall.—Textbook of Geology, 1910, pages 151-152.

Cherts are said to be chalcedonic silica that occur in limestone, as in the Lower Carboniferous rocks of North Devon. Flint is “nodular and shapeless masses of black or gray chalcedonic silica — — — — in chalk.” The author gives a definite distinction which, of course, would allow a clear usage.

J. Le Conte.—Elements of Geology, 5th Edition, 1903, page 169.

It is specifically stated that flints are siliceous concretions in chalk while in limestone they are called chert.

C. K. Leith.—An article in “Types of Ore Deposits.”

“Chert as defined in the textbooks, is an amorphous and hydrous variety of quartz, but in the field the term has been generally applied to siliceous bands such as those found in limestone, with little regard to their microscopic or chemical characteristics. Some of the so-called cherts in limestones are very fine-grained or amorphous. The cherts of the iron formation are similar in every respect to those of the limestones. They show the same irregularity of texture, interlocking of quartz grains, and often very fine grains. However, it cannot be said that any of the so-called chert in the Lake Superior region has been found to be truly amorphous and hydrous.” Leith probably had in mind the bands of quartz which with their distinct crystalline properties should not be called cherts. Among the various sources, however, flint and chert appear to be regarded more often as cryptocrystalline than amorphous. Evidently the author would base a definition of chert on microscopic and chemical characteristics.

Sir Chas. Lyell.—Principles of Geology, 11th Edition, 1872.

Flints may occur either in chalk or limestone while chert is only impure flint.

H. A. Miers.—Mineralogy, 1902, pages 373-381.

“Under the microscope chalcedony is found to be crystalline, consisting of minute fibers, — — — they are therefore quite distinct from true quartz, and chalcedony is not, as was formerly supposed, merely a massive or micro-crystalline quartz — — — —. ‘Flint’ contains sponge spicules and is of organic origin; it often contains crystallized quartz in its cavities. ‘Hornstone’ and ‘chert’ are names given to compact flinty varieties of chalcedony; the latter is generally also of organic origin.” He evidently distinguished flint and chert on the basis of composition, crystalline properties and origin.

Moses & Parsons.—Mineralogy, Crystallography and Blowpipe Analysis, 1904.

Flint is put under the jasper varieties of quartz. Flint is "smoky-gray to nearly black, translucent nodules, found in chalk beds."

William H. Norton.—Elements of Geology, 1905, pages 18, 375.

Chert is not mentioned. In referring to the limestone of Missouri it is said to contain nodules of flint that are left on the surface by the decay and removal of limestone. Further on it is remarked that flints were formed in the accumulation of the Cretaceous chalk of England and France. Evidently flint is an ordinary feature of both chalk or limestone and is not to be defined on the basis of occurrence alone.

James Park.—Textbook of Geology, 1914.

Flints are said to occur in chalk and cherts in limestone.

A. H. Phillips.—Mineralogy, 1912, page 361.

"When dark in color and associated with limestone in nodules it (chalcedony) forms flint." There is no mention of chert.

Pirsson & Schuchert.—A Textbook of Geology, 1915.

On page 496 an attempt is made to assign separate origins to flint and chert but at the end an appended reservation concedes that they may be formed in either way. The authors state it has been held that flints are of diagenetic origin and the cherts "develop near the surface in the zone of circulating ground waters during the process of weathering." It is probable also that flints are caused by meteoric water. As to definitions. "Flint (p. 274) is a dark gray to black, very hard and compact substance occurring in irregular nodules, or concretions, in chalk. It is composed of silica, SiO_2 , with a little chemically combined water. An impure flint, occurring in a similar way, in limestones, is known as chert — — — —." In the appendix, page 410, flint "is an intimate microscopic mixture of crystallized silica, SiO_2 (quartz), and non-crystalline silica containing some combined water (opal). Its color is dark gray, or black, from organic matter; its hardness is well known and like that of quartz; it cannot be scratched by the knife or by feldspar — — — —. Its occurrence as concretions and masses in chalks and limestones (in the latter often called chert) has been alluded to in this book (page 274)." The quotations speak for themselves. However, the authors do present a possible solution for the lack of a definite term for the great amounts of silica interbedded with iron ore. "Somewhat similar masses

of silica, more or less pure, sometimes white or light gray, and often differently colored by iron (yellow, red, or brown) and other substances, in some cases of similar but often of different or uncertain origin, have been variously termed jasper, jaspilite, hornstone, novaculite, etc. In places like the jaspilites of the Lake Superior region, or the novaculites of Arkansas, they may form beds of considerable importance."

H. Ries.—Economic Geology, 1910.

The author considers flint or chert as a single term and calls them nodules in limestone and chalk. However, he does say that our main supplies of flint come from France, England and Norway where extensive chalk deposits occur.

Tarr & Martin.—College Physiography, 1918, page 20.

The whole matter is dismissed by a sentence: "The minerals opal, chalcedony, agate and jasper are impure varieties of silica, as in the rock flint, or chert."

The Americana Encyclopaedia.

Chert:—"A cryptocrystalline variety of quartz closely related to flint. It is found in limestone and other stratified rocks."

Flint:—"A subvitreous variety of quartz resembling chalcedony somewhat — — — — and occurs chiefly in the chalk of England and France."

Encyclopaedia Britannica.—Eleventh Edition.

Flint:—A dark gray, or dark brown cryptocrystalline substance which has almost a vitreous luster, a splintery, conchoidal fracture and is opaque. Its specific gravity is 2.6. "Flint occurs primarily as concretions, veins and tabular masses in the white chalk in such localities as the south of England. Chert is a coarser and less perfectly homogenous substance of the same nature and composition as flint. It is gray, brown or black, and commonly occurs in limestone in the same way as flint occurs in chalk." Under concretions:—"Another very important series of concretionary structures are the flint nodules which occur in chalk, and the patches and bands of chert which are found in limestone.

— JOHN SMITH FLETT.

CONCLUSION

The question resolves itself into two parts: first the distinction, if any, between the terms, and second the present usage or exact meaning of the two.

Is there a difference between flint and chert? Apparently

siliceous nodules were found in the chalk of England and called flint while later, and elsewhere, siliceous nodules in the limestone were found and called chert. It appears that authorities such as A. W. Grabau, A. J. Jukes-Brown, Lake & Rastall, J. S. Flett in the *Encyclopaedia Britannica*, and Pirsson and Schuchert to a certain extent propose to draw a hard and fast line between the two substances, depending on their occurrence in chalk or in limestone. So far as present knowledge is concerned their origin is professedly uncertain. A. C. Trowbridge and E. W. Shaw in the "Geology and Geography of the Galena and Elizabeth Quadrangles" (Illinois State Geological Survey, Bull. 26, 1916, pp. 80-81) state the case by pointing out that the origin of cherts and chert bands is entirely problematical. Therefore it seems altogether out of place and quite confusing to base, simply for the sake of apparent exactness, a precise distinction on mode of occurrence when, in all possibility, flint and chert may be found subsequently to have identical origins and thereby cause the terms to be synonymous.

In the second place come the physical characteristics of flint and chert, their composition and the limitations to surround the use of the terms. Confusion appears to have arisen by attempting to assign minor differences to each. On the whole the color varies from almost white through gray and brown to black, the hardness is that of quartz or slightly different owing to impurities, and the fracture is conchoidal. As to texture the silica has been described as amorphous, or cryptocrystalline, or coarsely crystalline, or a mixture of the first two. Limitations should be applied here since the use of chert for coarsely crystalline silica will infringe sooner or later on the field of quartz itself and will meet obvious difficulties. Such admittedly is its misuse as intimated in the citation from C. K. Leith. Concensus of opinion, however, tends to restrict the terms to cryptocrystalline and amorphous varieties of silica. Another stumbling block lies in the composition as related to texture which relation is given as impure quartz, or crystalline silica, or amorphous and hydrous silica, or a mixture of crystallized silica and non-crystallized silica with a little chemically combined water. Mineralogists, as Dana, Kraus, Miers, Moses and Parsons, Crosby, and Phillips include both flint and chert under the anhydrous varieties of the oxide of silica.

The entire confusion seems to result solely from the uncertainty, warranted no doubt, that envelops the terms. The fact stands out that they are blanket terms which, in the present state of knowledge

regarding them, should not be circumscribed by hard and fast rules. On this account, however, they should not be made promiscuous "catch-alls" whose latitude may be unwisely increased by including much more than the simple siliceous nodules and bands in chalk and limestones. Until such a time when investigation shall point out the true origin, and the differences if any, or variations, in mode and place of occurrence, form, composition, texture—in other words point out the real nature, limitations and gradations of the terms flint and chert as applied to their field equivalents—it would be well for the sake of truth to forbear an attempt at exact definition. Under the circumstances precision is at the present premature and probably misleading.

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