

cutting, but the crumbling of banks to a large extent is caused by the dissolving-power of water. Loam, clay, and silt as a rule largely constitute the banks of rivers. Water coming into contact with loam at a point *e* will destroy its cohesion, and carry it away. The water falling from level (*e d*) to *a b* eats into the bank as far as *f*, and the whole body (*f e g*), deprived of its support, will tumble down into the river as soon as it is sufficiently heavy to overcome the cohesion along *g f*; this irrespective of any sediment being mixed with the water, as pure water will destroy the cohesion of those materials in exactly the same way as water loaded with sediment.

The same effect is produced by frost. If bank-material saturated with water freezes up, its cohesion is destroyed. The spring freshets will carry it away.

Another instance of this kind is a bank consisting of layers resting on an inclined clay seam. When for some reason the seam becomes exposed to water, this will moisten its surface and transform it into a slippery mass, thus causing the overlying strata to slide into the river.

Therefore, suppose the head waters of all the tributaries of the Mississippi to furnish an entirely clear supply of water. It enters the river-channel. Immediately it picks up such sediment as its velocity enables it to carry. More sediment is added by the causes presented,—the old condition!

There are other remedies of long-established repute, which, if not by the same constructions, in principle certainly, will be just as practical here as anywhere else.

"The prime end to be sought," so Major Powell correctly puts it, "in order to prevent destructive floods, is to prevent the choking of the channel;" and again, "The real problem is to relieve the river of its excess of sediment." In these views engineers will fully concur. The latter touches upon one of these remedies: "Much of a coarser sediment is left to add to the geological growth of the region, while vast quantities pass on to the sea." The end to be sought, then, is to reverse this condition, and make the vast quantities add to the geological growth of the region. This can be accomplished by fixing, protecting, and in that way solidifying, large deposits which are now in constant migration, and preventing their being transformed again into floating sediment. To this end force the river into a channel, which removes the deposits from the current.

The sediment contributed by the tributaries now is only a trifle as compared with the amount centuries have accumulated in the beds of the Missouri and Mississippi. To make these enormous quantities *terra firma* is more effective than to clean the mountain waters, because the effect will be felt right there where the work is done, and at once.

Another means of making the sediment add to the geological growth of the region is this: Create a strip of 'dead' water on both banks all along the entire extent of the rivers in open and direct connection with the current. There will be a constant exchange of water between the current, where the water is loaded with sediment, and these bodies of standing water; and whatever water from the current gets into this strip will deposit its sediment. Then it returns into the river, is reloaded with detritus, and re-enters the strip of standing water. Thus a destructive agency will be turned into a useful tool, carrying along sediment to add to the geological growth of the region. In course of time this strip will be completely filled, and then the water will not only flow in a concentrated channel, but there will also have been formed a terrace at the foot of the old bank, which protects it. This is the really effective settling-basin, and the thousands of miles of river-banks are the places where they must be constructed, because they do the work right on the spot where it is needed.

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Chalchihuitl: A Note on the Jadeite Discussion.

THE jadeite discussion is evidently not yet terminated. In the *American Anthropologist* for July, 1888, Dr. A. B. Meyer of Dresden maintains his position "that the nephrite (jadeite) question is not an ethnologic problem," the mineral occurring wherever the *artefacts* from it are found; while at the recent meeting of the

American Association for the Advancement of Science, August, 1888, Prof. F. W. Putnam of Cambridge reiterated his belief, already expressed in the reports of the Peabody Museum, that the specimens of jadeite from Mexico and Central America were originally brought from Asia.

Jade first became known to modern Europeans by the specimens brought from Mexico, as the origin of the name attests (Spanish, *pieдра de ijada*, so called from its supposed virtues in colic, *mal de ijada*), and therefore the references to it in the early writers on Mexico merit special attention. These have been partly collated by E. G. Squier, in his 'Observations on a Collection of Chalchihuitls' (*Annals of the Lyceum of Natural History*, New York, 1869), and later by Professor Fischer in his well-known volume 'Nephrit und Jadeit.' In verifying these quotations, I find that some important authorities have been altogether omitted, and others only partially reported. No direct reference is made to the Codex Mendoza; and Squier omits some of the most important observations of Sahagun, to wit, those referring to the *provenance* of these minerals,—the very point which, in the present stage of the question, we wish light upon. The practical bearing of this point will be readily appreciated when I add that the statement was made at the meeting of the American Association in August, that last winter an expert was sent to Mexico at considerable expense for the sole purpose of discovering the locality of the jadeite, but his search was vain.

The Nahuatl (Mexican) name for jadeite is *chalchihuitl*. This appears to have been applied to any greenish, partially transparent stone capable of receiving a handsome polish. All such were highly esteemed. Specific distinctions were established between such precious minerals by descriptive adjectives, as follows:—

Iztac chalchihuitl, white chalchihuitl; of a fine green, quite transparent, without stripes or stains.

Quetzal chalchihuitl, precious chalchihuitl; white, much transparency, with a slight greenish tinge, somewhat like a jasper.

Tilayotic, literally, 'of a blackish watery color;' with mingled shades of green and black, partially transparent (chlormelanite?).

Tolteca-iztli, literally 'Toltec knife,' or 'Toltec obsidian;' of a clear, translucent green, and 'very beautiful.'

These are the descriptions of Bernardino de Sahagun (*Historia de la Nueva España*, Lib. XI. cap. 8), probably the source of all other writers upon this subject. He is not very exact as to the localities in which they were found by the natives. The first-mentioned, however, the white chalchihuitl, he states was obtained from quarries in the vicinity of Tecalco. This town, which I do not find on late maps, was in the state of Puebla, and it may be the modern Tecali mentioned by Orozco y Berra in that state (*Geografía de las Lenguas Indígenas de México*, p. 211). It would be worth while searching in that vicinity.

With reference to the last-mentioned variety, the Toltec stone, Sahagun makes a noteworthy remark, not quoted by Squier, which, so far as it goes, is certainly in favor of the view that this valued variety was not from any deposit known to the natives. This beautiful species of chalchihuitl, he says, did at one time exist in this country (New Spain), "and does yet, as is proved by the pieces obtained from the ancient edifices." In other words, no deposit was known to the natives of his day, and such fragments as they possessed were exhumed from the ruins of the ancient cities.

The Codex Mendoza is a copy of the tribute-roll of the ancient Mexican Empire (published in LORD KINGSBOROUGH'S *Mexican Antiquities*). It defines the tax from each district, naming the cities. Strings of chalchihuitl are mentioned as part of the tribute from a number of localities, and refer evidently to small rounded pieces used as beads, and obtained from the sands of streams. Only from one district are large pieces of chalchihuitl demanded. These, three in number each year, were required from Tototepec, Chinantlan, and other towns situate in the present state of Oaxaca, and principally in the department of Vilalta (Zoochila). Mühlendorff describes this region as mountainous and wild, inhabited by the Mixe Indians and the Chinantecas (*Schilderung der Republik México*, Bd. II. s. 213, 214). This is the spot to which the explorer should penetrate if he would discover the locality of the large pieces of Mexican jadeite.

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