

Cotta speaks also of deposits of *débris*—placers—which occur on high plateaus and mountain slopes, and consist of products of weathering which are not rounded pebbles or sand and slime accumulated by water-currents. A. G. Lock speaks of surface-deposits being “a result of the disintegration of the rocks *in situ*,” and says: “The gold it contains is quite angular, hackly, or crystalline, and is derived from auriferous quartz reefs or leaders existing in the immediate vicinity.

Similar conditions obtain very significantly in the Kackar district, to be hereinafter more fully described.

*Theory of the Sinking of Heavier Constituents.*—But the great agent in the transportation and redeposition of the metallic portions of original deposits has unquestionably been flowing water; and this is an equal factor in the removal of the rock-detritus of erosion, which it is constantly striving to carry to the ocean. River sediments are notoriously unstable. What is deposited this year is carried further down stream in the years next following, and so on, until it comes to comparative rest in the sea. The original deposits, furnishing the material thus transported over great distances and areas by water, are well called by the Russians *korennyje mestorozdenyje*, or root-like deposits—that is, as it were, the roots of the scattered hystoromorphous deposits.

The attempt has been made to explain the concentration, especially of heavy metals like gold and platinum, in certain paying layers of the detritus, by a sort of natural concentration process. The circumstance that the richest gold-deposits most frequently lie in the lowest stratum of the detritus, immediately on the bed-rock, yet that several such horizons occur one over the other, is difficult to explain in this way; for Cotta's assumed separate periods of formation are scarcely satisfactory, involving as they do either periodic transportation or periodic deposition, neither of which is probable.

In the Ural gold-placers a much more probable explanation is found, based on the principle that the specifically heavier elements of a loose mass are able, with the aid of water, to work their way down through the lighter portions. At the Przibram concentrating-works, it is found that if the pulp is left standing for a considerable period, the galena will accumulate at the bottom. In gold- and platinum-concentrating establishments, it may be often observed that these heavy metals find their way into the floor and woodwork of the mill, from out of which they are from time to time recovered by working up these materials. Why should this happen in artificial operations only, and not also under natural conditions, where the descent of the heavier portions is essentially aided by the percolation of atmospheric waters through the loose covering-material?

This view is supported by the features of all gold-placers, especially those of the detritus of weathering in place, where the agency of running water cannot be adduced, and the accumulations of gold at the contact of the loose and the solid material must be explained by its sinking through the former.

*Stream Detritus.*—The detrital deposits produced by running water are generally characterized by the predominance of permeable material, such as sand, gravel, &c. Under this covering mass lies the solid, impermeable “bed-rock” or “rim-rock” of the Americans, the *plotik* or *posva* of the Russians; and in all the goldfields of the world the richest pay-deposits are found, as a rule, at the border between the cover and the bed-rock. If the latter is decomposed, fissured, or otherwise loosened, the fine gold will sink into it, making it sometimes rich enough to be mined and concentrated; and this occurs without regard to the petrographic character of the rock. Thus, in the Ural, Palæozoic schists, limestone, and eruptive rocks indifferently are charged with gold. This circumstance indicates also the error of the assumption that these bed-rocks originally carried gold.

But layers of impermeable material sometimes occur in the cover, as, for instance, lava-beds in Australia and California, or, in general, solid conglomerates and clays. In such cases there is often a concentration of gold on the more solid layer, called in America the “false bottom,” and in the Ural *loznyj plotik*—that is, a material erroneously taken for the bed-rock. There are often in the detrital cover two or more such gold-bearing layers, which are easily explained on the theory above suggested. The hypothesis of a natural concentration in running water is embarrassed by the fact that the material of gold-placers shows no arrangement according to size, but consists, as a rule, of elements of all sizes.

The movement of the elements of a loose mass has been already pointed out by W. C. Kerr, who admits the possibility, according to A. G. Lock, of the sinking of the heavier particles, though this is only in a passing remark, and without indication of its far-reaching importance. He says, “The superior weight of the precious atoms would cause them to sink through the moist surrounding matters, till a hard layer was met with. The occurrence of this process would constantly add to the deposits, the gold always gravitating to the bottom, quickly or slowly, according to circumstances.”

It seems to me that this idea must have impressed itself upon other impartial observers also; and I can only wonder that it has not been more frequently expressed.

R. Helmhacker has recently communicated some observations on the Altai region of Siberia, such as the sinking of heavy metallic objects in the loose wash, which confirm the above views. Among other things, he identified grains of metallic lead formed in the gold-placers, as shot, scattered in hunting, which had sunk into the earth.

As is well known, auriferous detritus occurs not only in present but also in ancient river-beds, long since dry; and since, in the latter, the remains of diluvial animals, such as the mammoth, &c., have been found, a distinction has been made between alluvial and diluvial gold-deposits. But discoveries of yet older organic remains have shown that such gold-deposits were formed in still more ancient periods. The old river-beds of California cross the present streams, and the auriferous detritus of the former is covered with thick lava-beds—a feature which may be observed in Australia also. During the deposition of the gold, therefore, conditions very different from those of the present day must have obtained.