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York, 1944, p. 68 *UN Bull 39*

# EXAMPLES OF SUPERGENE ENRICHMENT

Supergene enrichment, enrichment through the chemical action of descending surface waters and oxygen, has been an important process in concentrating the metallic content of many Nevada ore deposits. Its influence has been most profound and of greatest economic importance in those ores mined for silver or copper. Its effect on deposits of other metals has been negligible by comparison.

With the dissolving of the soluble constituents in the well-oxidized part of the deposit, the residuum, consisting of the insoluble portion, forms an oxidized zone having a higher content of

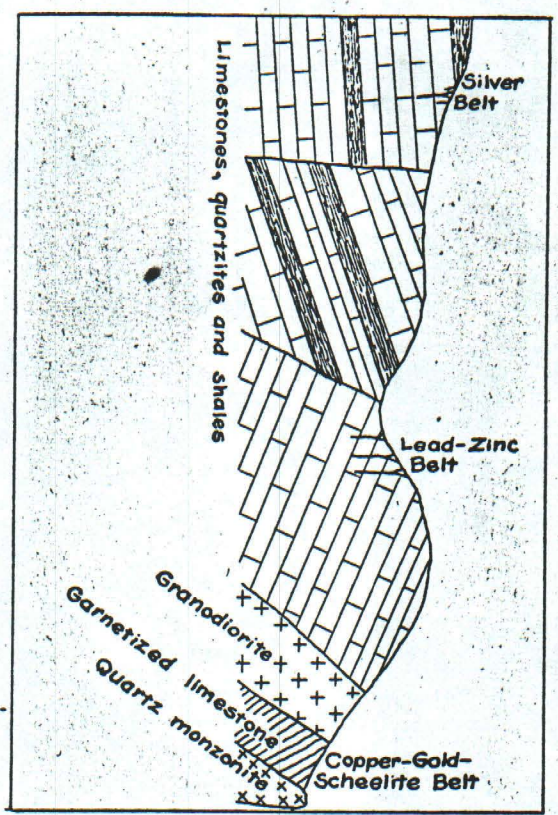


FIGURE 3. East-west section through the White Pine district showing relation of mineral belts to exposed intrusives.\*

insolubles than the original mass, and may be more or less valuable than the original mass. Generally, in the case of gold, silver, and lead ores, this surface ore is richer, while in the case of copper and zinc ores it is poorer.

Free gold and pyritic gold deposits are enriched at the surface because of the accumulation of gold in a siliceous iron-stained mass.

This has been true in almost all cases since the discovery of gold at Gold Hill on the Comstock in 1859 down to the relatively late discovery at the Gatchell mine in Humboldt County.

\* From observations made by the writer in September 1935, and August 1939.

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Esmeralda  
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The presence of horn silver at or near the outcrop of silver-bearing veins in Nevada is very common, and in many cases the enriched oxidized ore is the only ore of sufficient grade to be commercial.

The most striking example is the Treasure Hill mine at Hamilton in White Pine County. Lincoln states "that from a space 70 feet wide and nowhere over 28 feet deep on the Eberhardt mine, 3,200 tons were mined which milled \$1,000 a ton, and one boulder of silver chloride found in this mine weighed six tons." Unfortunately the corollary of this is that the unaltered ore below did not contain enough silver to be commercial ore.

After the main ore bodies had been mined at the Divide mine in Esmeralda County, stringers of pure horn silver were discovered outcropping close to the shaft. There is on exhibit at the Museum of the Mackay School of Mines a large piece of this ore assaying over 17,000 ounces in silver per ton, and illustrating the difficulty of drilling through this waxy mineral.

At several districts in Nevada, notably Pioche in Lincoln County and Tybo in Nye County, the main value at the surface of the lead-zinc-silver veins was almost entirely in horn silver, and was the cause of the early rush to and development of the camps.

At Eureka where the primary ore below water level is argenterous galena, pyrite, arsenopyrite, and sphalerite, the oxidized ore for several hundred feet in depth has been mined mainly because of its lead content as cerussite and anglesite, the carbonate and sulphate, respectively, of lead. The silver remained in the oxidized ore as horn silver, and the iron as iron oxides. The arsenic gave much speiss at the smelters, but the zinc was apparently well leached out of the ore.

Generally the copper and zinc content of ore bodies containing those metals has been leached out of the oxidized zone which accounts for many barren outcrops above bodies of copper and zinc ore; but if the ore contains calcite or is in limestone, the copper and zinc content is precipitated out in great part as the carbonates in the oxidized ore at or near the surface.

The most striking example in Nevada of this enrichment in the case of copper is at the Ludwig mine in Lyon County. Thousands of tons of rich, almost jewelry, ore of malachite and azurite, containing chrysocolla also, were shipped directly to the smelter. Below this ore was rich cuprite and native copper ore, and below

a Lincoln, F. C., op. cit., p. 258.