# DESCRIPTIVE MODEL OF POLYMETALLIC REPLACEMENT DEPOSITS

By Hal T. Morris

APPROXIMATE SYNONYM Manto deposits, many authors.

DESCRIPTION Hydrothermal, epigenetic, Ag, Pb, Zn, Cu minerals in massive lenses, pipes and veins in limestone, dolomite, or other soluble rock near igneous intrusions (see fig. 68).

GENERAL REFERENCE Jensen and Bateman (1981), p. 134-146.

GEOLOGICAL ENVIRONMENT

Rock Types Sedimentary rocks, chiefly limestone, dolomite, and shale, commonly overlain by volcanic rocks and intruded by porphyritic, talc-alkaline plutons.

Textures The textures of the replaced sedimentary rocks are not important; associated plutons typically are porphyritic.

Age Range Not important, but many are late Mesozoic to early Cenozoic.

Depositional Environment Carbonate host rocks that commonly occur in broad sedimentary basins, such as epicratonic miogeosynclines. Replacement by solutions emanating from volcanic centers and epizonal plutons. Calderas may be favorable.

Tectonic Setting(s) Most deposits occur in mobile belts that have undergone moderate deformation and have been intruded by small plutons.

Associated Deposit Types Base metal skarns, and porphyry copper deposits.

DEPOSIT DESCRIPTION

Mineralogy Zonal sequence outward: enargite + sphalerite + argentite + tetrahedrite + digenite ± chalcopyrite, rare bismuthinite; galena + sphalerite + argentite ± tetrahedrite ± proustite ± pyrargyrite, rare jamesonite, jordanite, bournonite, stephanite, and polybasite; outermost sphalerite + rhodochrosite (see fig. 68). Widespread quartz, pyrite, marcasite, barite. Locally, rare gold, sylvanite, and calaverite.

Texture/Structure Ranges from massive to highly vuggy and porous.

Alteration Limestone wallrocks are dolomitized and silicified (to form jasperoid); shale and igneous rocks are chloritized and commonly are argillized; where syngenetic iron oxide minerals are present, rocks are pyritized. Jasperoid near ore is coarser grained and contains traces of barite and pyrite.

Ore Controls Tabular, podlike and pipelike ore bodies are localized by faults or vertical beds; ribbonlike or blanketlike ore bodies are localized by bedding-plane faults, by susceptible beds, or by preexisting solution channels, caverns, or cave rubble.

Weathering Commonly oxidized to ochreous masses containing cerrusite, anglesite, hemimorphite, and cerargyrite.

Geochemical Signature On a district-wide basis ore deposits commonly are zoned outward from a copper-rich central area through a wide lead-silver zone, to a zinc- and manganese-rich fringe. Locally Au, As, Sb, and Bi. Jasperoid related to ore can often be recognized by high Ba and trace Ag content.

Examples

| | |
|---|---|
| East Tintic district, USUT | (Morris and Lovering, 1979) |
| Eureka district, USNV | (Nolan, 1962) |
| Manto deposit, MXCO | (Prescott, 1926) |

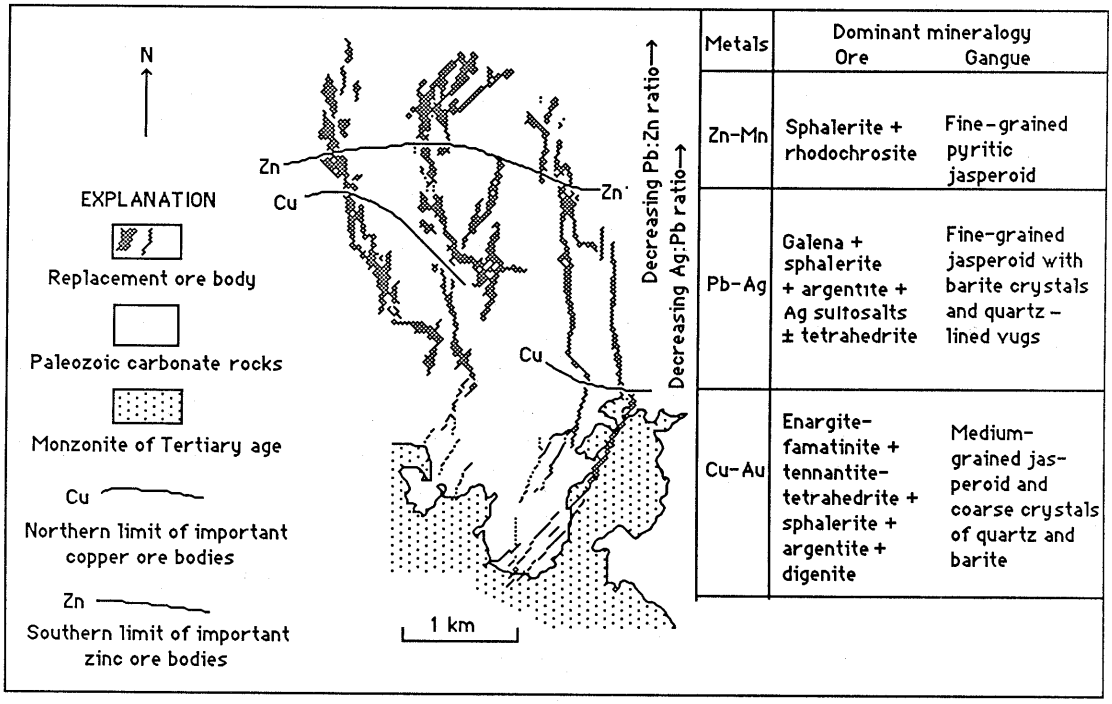


**Figure 68.** Generalized map showing metal and mineral zoning in polymetallic replacement deposits in the Main Tintic district, Utah. Modified from Morris (1968).

# GRADE AND TONNAGE MODEL OF POLYMETALLIC REPLACEMENT DEPOSITS

By Dan L. Mosier, Hal T. Morris, and Donald A. Singer

COMMENTS Carbonate-hosted replacement and transitional vein and other replacement deposits are included. Only districts with combined production and reserves of at least 100,000 tonnes are used. Tonnages for many districts, particularly in the U.S. are biased because only production data were available. The break in slope in the zinc grade plot at about 1 percent may be related to early difficulties of processing zinc oxides, and the consequent underreporting of zinc grades where estimates were based on production. Lead grade is correlated with silver (r = 0.55, n = 45). See figs. 69-74.

DEPOSITS

| Name | Country | Name | Country |
|---|---|---|---|
| American Fork | USUT | Nakatatsu | JAPN |
| Atacocha | PERU | Mitate | JAPN |
| Bell | USNV | Naica | MXCO |
| Big Cottonwood-L.C. | USUT | New Calumet | CNQU |
| Blue Bell | CNBC | Olympias Chalkidiki | GREC |
| Bolkardag | TRKY | Ophir | USUT |
| Bristol (Jack Rabbit) | USNV | Park City | USUT |
| Cerro Gordo | USCA | Plomosas | MXCO |
| Chalchihuites | MXCO | Rush Valley | USUT |
| Charcas | MXCO | San Francisco | USUT |
| Cortez | USNV | Santa Eulalia | MXCO |
| Darwin | USCA | Santander | PERU |
| Drina | YUGO | Saua-Toranica | YUGO |
| East Tintic | USUT | Silva-Aysen | CILE |
| El Porvenir (Milpo) | PERU | Sombrerete | MXCO |
| Eureka | USNV | Spruce Mountain | USNV |
| Hunnan | CINA | Star | USUT |
| La Encantada | MXCO | Sumadisa | YUGO |
| La Reforms | MXCO | Tecopa | USCA |
| Lampazos | MXCO | Tintic | USUT |
| Laurium | GREC | Tombstone | USAZ |
| Liaoning | CINA | Trepca-Kopaonik | YUGO |
| Lone Mountain | USNV | Velardepa | MXCO |
| Magdalena | USNM | White Pine | USNV |
| Maria Christina | CILE | Yellow Pine | USNV |
| Mazapil | MXCO | Zimapan | MXCO |

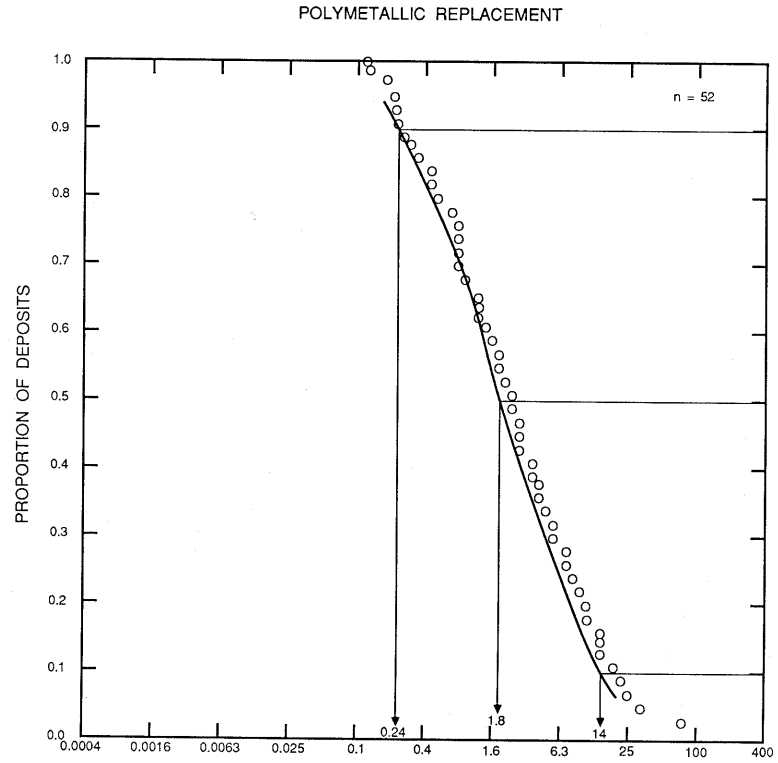


**Figure 69.** Tonnages of polymetallic replacement deposits.

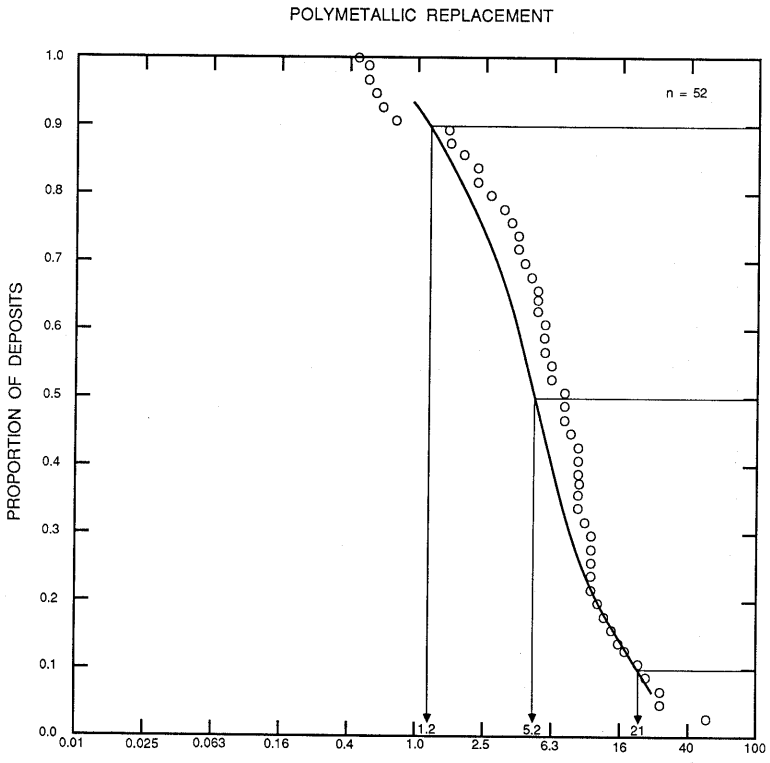


**Figure 70.** Lead grades of polymetallic replacement deposits.

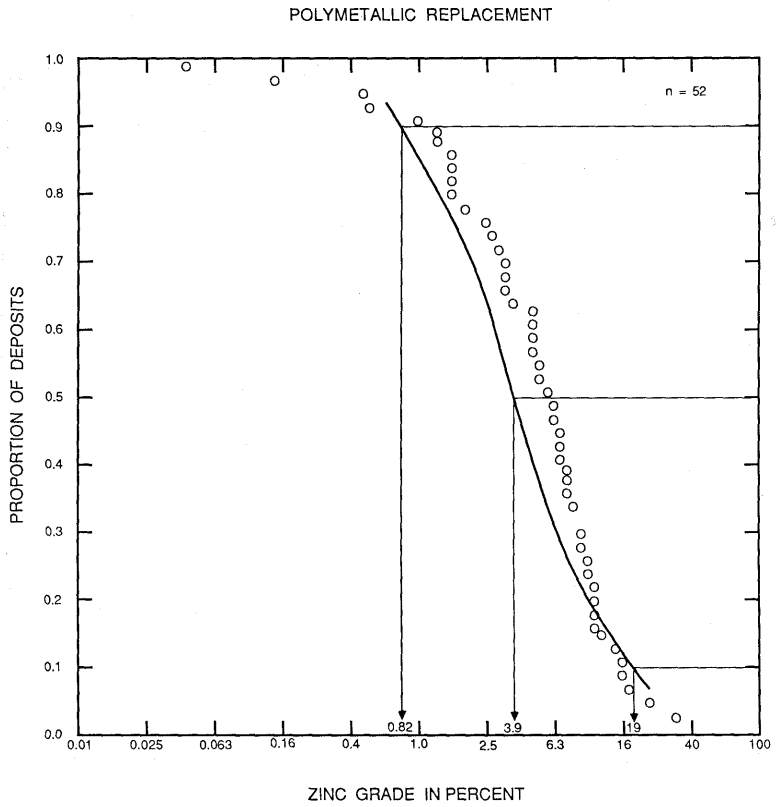


**Figure 71.** Zinc grades of polymetallic replacement deposits.

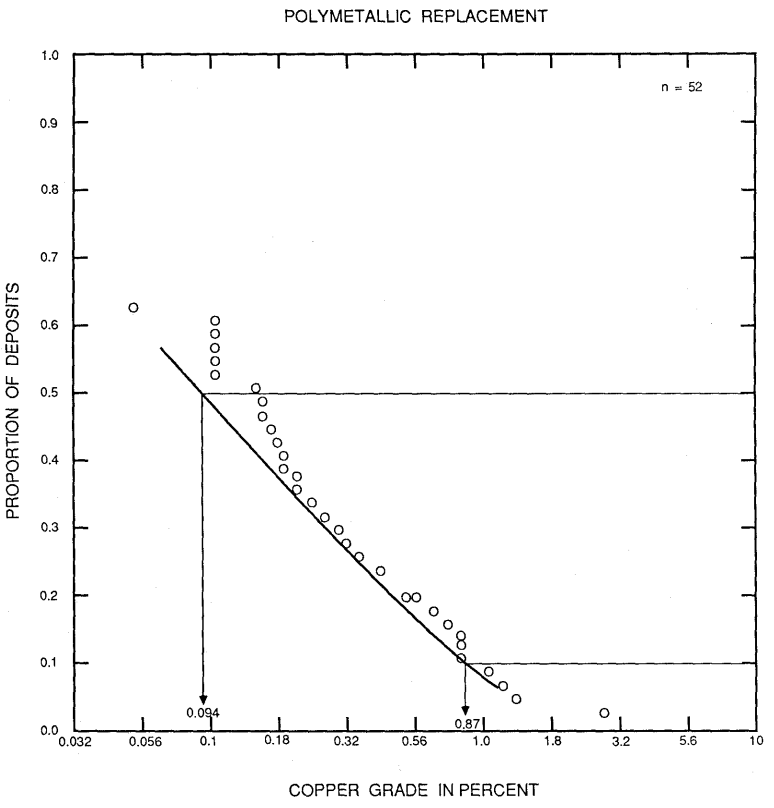


**Figure 72.** Copper grades of polymetallic replacement deposits.

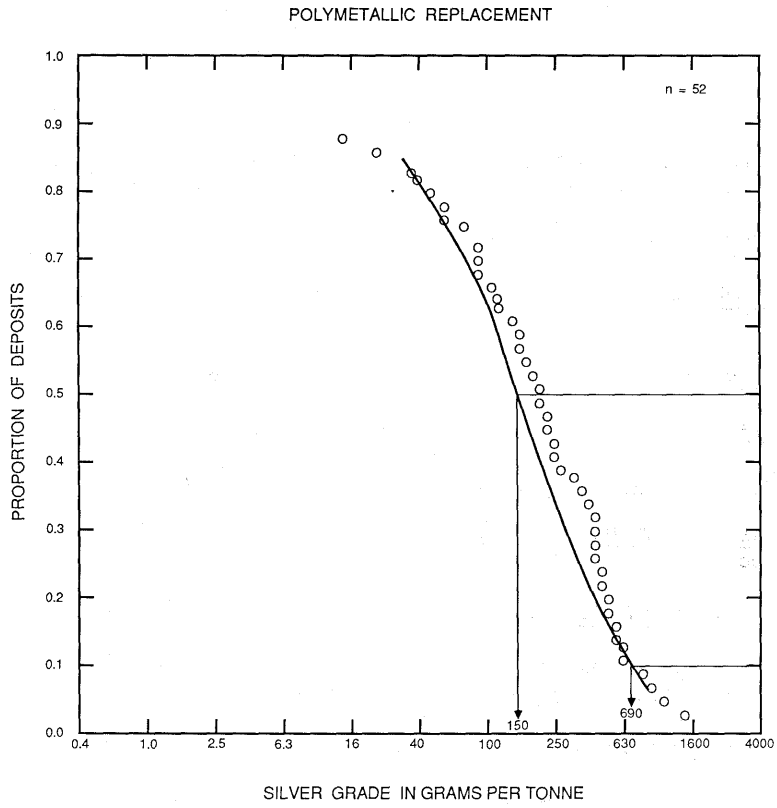


**Figure 73.** Silver grades of polymetallic replacement deposits.

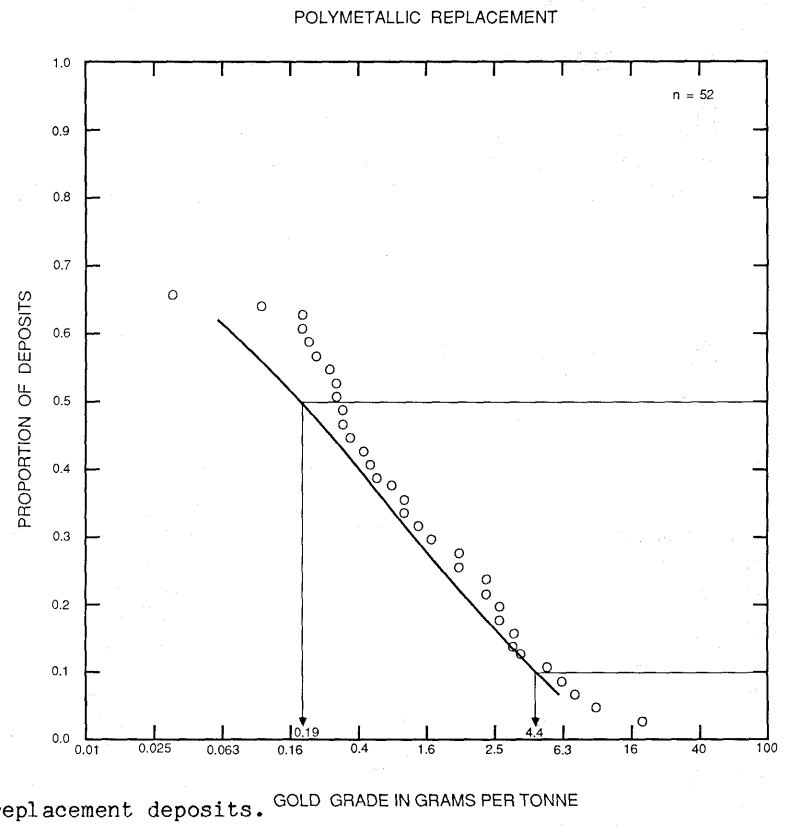


**Figure 74.** Gold grades of polymetallic replacement deposits.