DESCRIPTIVE MODEL OF SEDIMENTARY EXHALATIVE Zn-Pb

By Joseph A. Briskey

APPROXIMATE SYNONYMS Shale-hosted Zn-Pb; sediment-hosted massive sulfide Zn-Pb.

DESCRIPTION Stratiform basinal accumulations of sulfide and sulfate minerals interbedded with euxinic marine sediments form sheet- or lens-like tabular ore bodies up to a few tens of meters thick, and may be distributed through a stratigraphic interval over 1,000 m (see fig. 158).

GENERAL REFERENCES Large (1980, 1981, 1983).

GEOLOGICAL ENVIRONMENT

Rock Types Euxinic marine sedimentary rocks including: black (dark) shale, siltstone, sandstone, chert, dolostone, micritic limestone, and turbidites. Local evaporitic sections in contemporaneous shelf facies. Volcanic rocks, commonly of bimodal composition, are present locally in the sedimentary basin. Tuffites are the most common. Slump breccias, fan conglomerates, and similar deposits, as well as facies and thickness changes, are commonly associated with synsedimentary faults.

Textures Contrasting sedimentary thicknesses and facies changes across hinge zones. Slump breccias and conglomerates near synsedimentary faults.

Age Range Known deposits are Middle Proterozoic (1,700-1,400 m.y.); Cambrian to Carboniferous (530-300 m.y.).

Depositional Environment Marine epicratonic embayments and intracratonic basins, with smaller local restricted basins (second- and third-order basins).

Tectonic Setting(s) Epicratonic embayments and intracratonic basins are associated with hinge zones controlled by synsedimentary faults, typically forming half-grabens. Within these grabens (first-order basins), penecontemporaneous vertical tectonism forms smaller basins (second-order basins) and associated rises. Smaller third-order basins (tens of kilometers) within the second-order basins (10^{2}-10^{5} km) are the morphological traps from the stratiform sulfides.

Associated Deposit Types Bedded barite deposits.

DEPOSIT DESCRIPTION

Mineralogy Pyrite, pyrhotite, sphalerite, galena, sporadic barite and chalcopyrite, and minor to trace amounts of marcasite, arsenopyrite, bismuthinite, molybdenite, enargite, millerite, freibergite, cobaltite, cassiterite, valleriite, and melnikovite.

Texture/Structure Finely crystalline and disseminated, monomineralic sulfide laminae are typical. Metamorphosed examples are coarsely crystalline and massive.

Alteration Stockwork and disseminated sulfide and alteration (silicification, tourmalization, carbonate depletion, albitization, chloritization, dolomitization) minerals possibly representing the feeder zone of these deposits commonly present beneath or adjacent to the stratiform deposits. Some deposits have no reported alteration. Celsian, Ba-muscovite, and ammonium clay minerals may be present.

Ore Controls Within larger fault-controlled basins, small local basins form the morphological traps that contain the stratiform sulfide and sulfate minerals. The faults are synsedimentary and serve as feeders for the stratiform deposits. Euxinic facies.

Weathering Surface oxidation may form large gossans containing abundant carbonates, sulfates, and silicates of lead, zinc, and copper.

Geochemical Signature Metal zoning includes lateral Cu-Pb-Zn-Ba sequence extending outward from feeder zone; or a vertical Cu-Zn-Pb-Ba sequence extending upward. NH_3 anomalies may be present. Exhalative chert interbedded with stratiform sulfide and sulfate minerals; peripheral hematite-

chert formations. Local (within 2 km) Zn, Pb, and Mn haloes. Highest expected background in black shales: Pb = 500 ppm; Zn = 1,300 ppm; Cu = 750 ppm; Ba = 1,300 ppm; in carbonates: Pb = 9 ppm; Zn = 20; Cu = 4 prom; Ba = 10.

EXAMPLES

Sullivan mine, CNBC	(Hamilton and others, 1982)
Meggen mine, GRMY	(Krebs, 1981)
Navan, Silvermines, Tynagh, IRLD	(Boyce and others, 1983; Taylor, 1984)

GRADE AND TONNAGE MODEL OF SEDIMENTARY EXHALATIVE Zn-Pb

By W. David Menzie and Dan L. Mosier

COMMENTS Deposits in this model include most commonly identified deposits of this type. Nevertheless, examination of the distribution of silver grade suggests the presence of two subtypes. Lead grades are significantly correlated with silver grades (r = 0.77, n = 39). See figs. 159-163.

DEPOSITS

Name	Country	Name	Country
Balmat	USNY	McArthur	AUNT
Baroi	INDA	Meggen	GRMY
Big Syncline	SAFR	Mineral King	CNBC
Black Mtn.	SAFR	Mount Isa	AUQL
Broken Hill	SAFR	Navan	IRLD
Broken Hill	AUNT	Rajpura-Daiba	INDA
Cirque	CNBC	Rammelsberg	GRMY
Dugald River	AUQL	Rampura-Agucha	INDA
Duncan Lake	CNBC	Red Dog	USAK
Dy	CNYT	Reeves MacDonald	CNBC
Faro	CNYT	Rosh Pinah	NAMB
Fx	CNBC	Silvermines	IRLD
Grum	CNYT	Squirrel Hills	AUQL
HB	CNBC	Sullivan	CNBC
Hilton	AUQL	Swim Lake	CNYT
Homestake	CNBC	Tom	CNYT
Howards Pass	CNYT	Tynagh	IRLD
Jersey Emerald	CNBC	Vangorda	CNYT
King Fissure	CNBC	Woodcutters	AUNT
Lady Loretta	AUQL	Wigwam	CNBC
MacMillan	CNYT	Zawar	INDA
Matt Berry	CNYT	Zawarmala	INDA

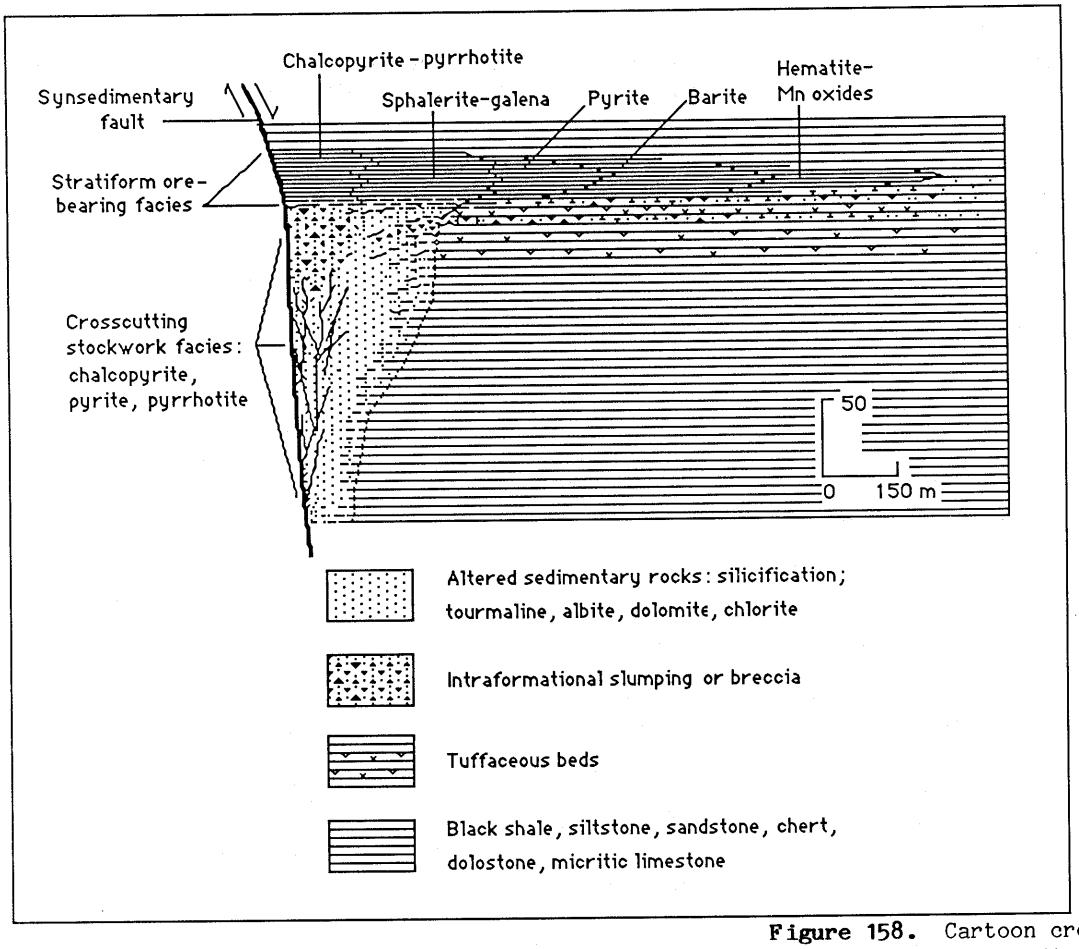

Figure 158. Cartoon cross section showing mineral zoning in sedimentary exhalative Zn-Pb deposits (modified from Large, 1980).

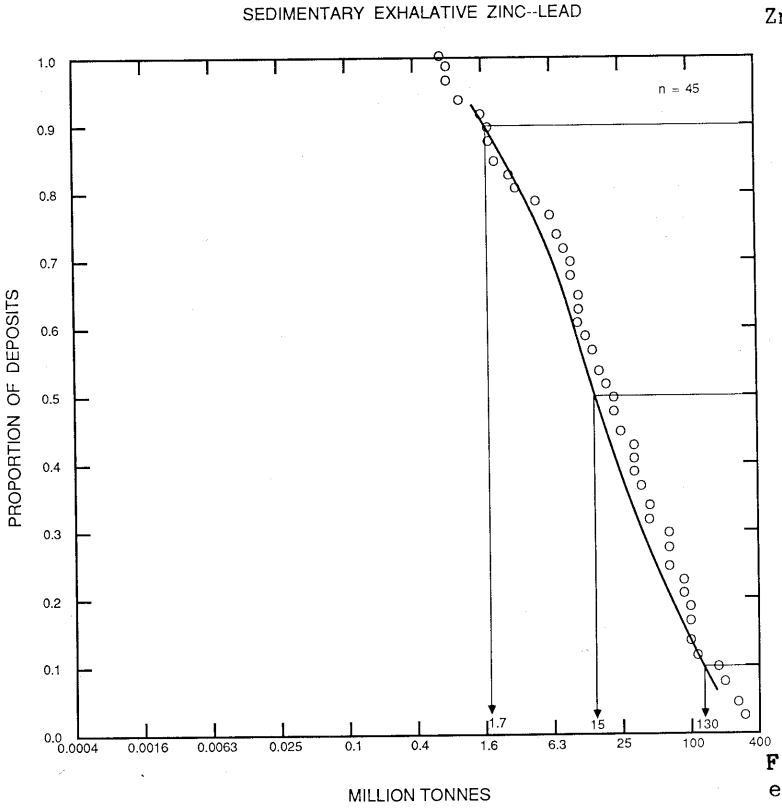

Figure 159. Tonnages of sedimentary exhalative Zn-Pb deposits.

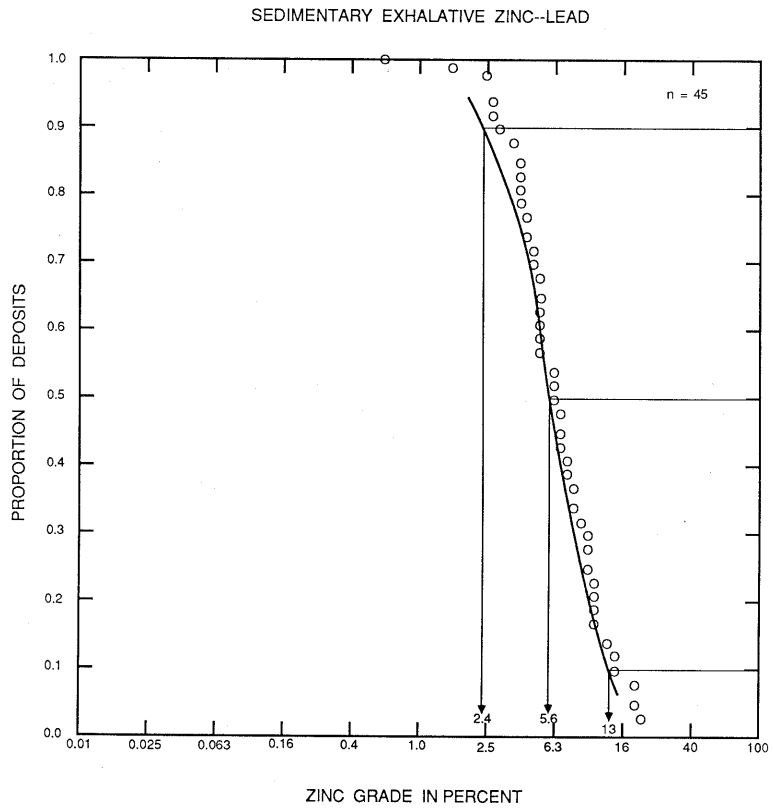

Figure 160. Zinc grades of sedimentary exhalative Zn-Pb deposits.

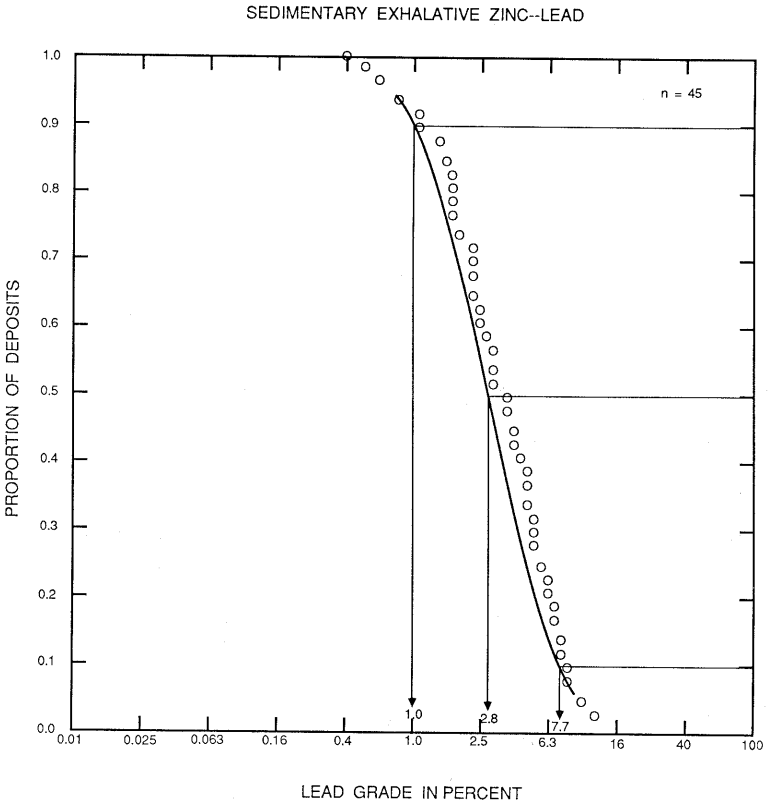

Figure 161. Lead grades of sedimentary exhalative Zn-Pb deposits.

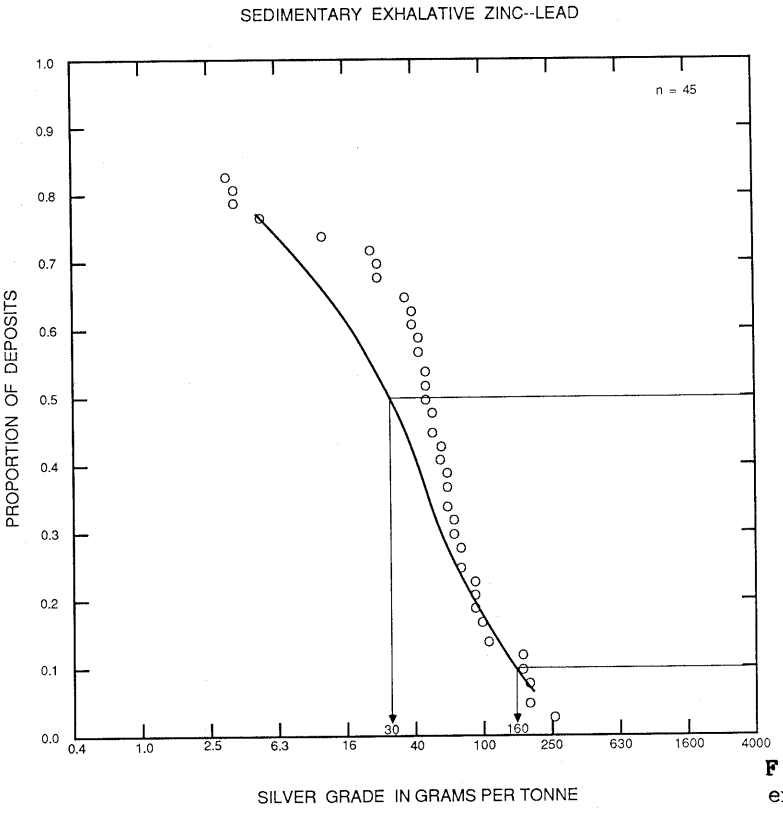

Figure 162. Silver grades of sedimentary exhalative Zn-Pb deposits.

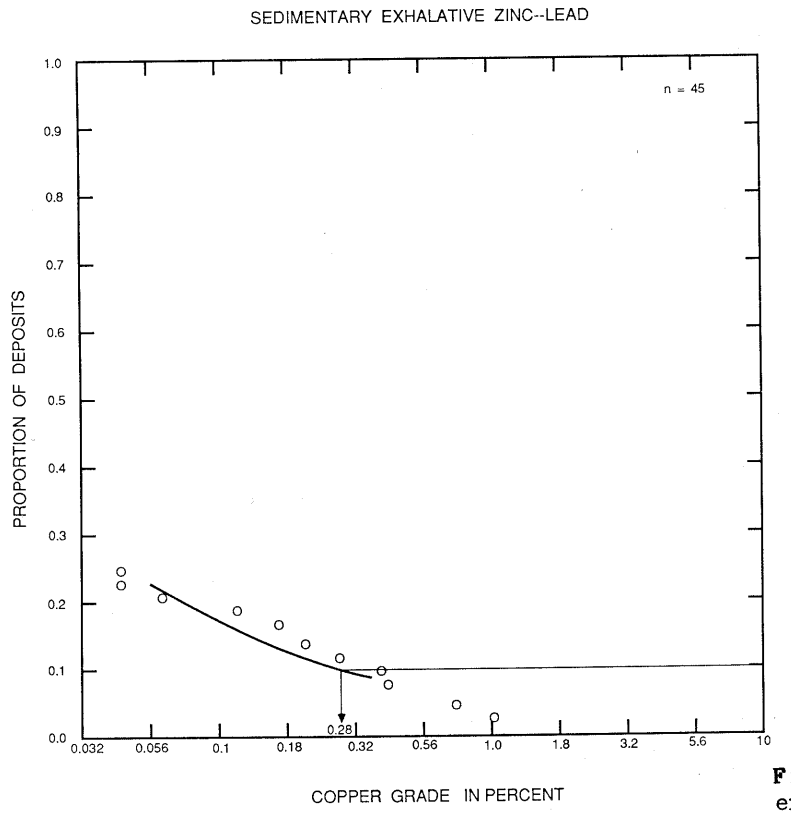

Figure 163. Copper grades of sedimentary exhalative Zn-Pb deposits.