THE NAIRNE SULFIDE DEPOSIT

NAIRNE, SOUTH AUSTRALIA

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by

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C O N T E N T S

A B S T R A C T

The sulfide deposit, which is the Nairne Pyritic Formation, contains at least five varieties of FeS_2, three of which are of secondary origin. The main bulk of the FeS_2 occurs as small grains distributed parallel with the bedding. Some of the FeS_2 occurs as pyrite in relatively large veins containing a suite of Ag-Sb minerals.

Two varieties of secondary FeS_2 are the result of pyrrhotite alteration. The concentric FeS_2 consists of pyrite, marcasite, or pyrite and marcasite. It is characterized by a porous concentric structure, and is extremely fine grained, thus presenting problems in flotation. The zoned pyrite may be either a direct replacement of the pyrrhotite, or a replacement of the concentric FeS_2. The third variety of secondary FeS_2 occurs with zeolite, siderite, and limonite and is definitely a product of weathering.

A detailed study of characteristics of syngenetic pyrite deposits shows that the Nairne formation is of sedimentary origin. The redeposition theory of Skinner (1958) and the hydrothermal theory of Edwards and Carlos (1954) are found untenable.

The sulfide veins containing the Ag-Sb minerals are described in detail. The observed relationships are compatible with either a magmatic or metamorphic origin.

A comparison of the Nairne deposit with similar deposits shows that it has all the characteristics of a syngenetic deposit. Ag-Sb veins in pyrite deposits are more ubiquitous than commonly thought, and in most instances these have been ascribed to metamorphic processes. The author feels that a metamorphic theory of origin for the Ag-Sb vein system at Nairne is the most realistic.

I N T R O D U C T I O N

In September, 1957, the author became interested in the sulfide mineralization at Nairne, South Australia, because of the poor recovery of pyrite in flotation during that period. The following analysis of flotation concentrate and tailing from Grassfire Hill ore clearly demonstrates that concentric pyrite is the non-floatable pyrite, and that it significantly affects the pyrite recovery:

	Flotation Concentrate	Flotation Tailing
% wt. superpanner con.	48	7
% vol. clear pyrite	85	16
% vol. concentric pyrite	13	74
% vol. pyrrhotite	2	trace
% vol. sphalerite	trace	trace
% vol. chalcopyrite	trace	-
% vol. limonite etc.	trace	10

Because of the economic significance of the concentric pyrite, an investigation was initiated to ascertain the nature of the material, and the depth to which it persists. The work of the past eighteen months has coped with this problem, and has led to a number of interesting discoveries pertaining to the mineralogy at Nairne. The author has made numerous visits to Nairne, and has examined in detail three drill cores from Grassfire Hill (D.D. 10, 14, 21) and two from an area south of Shephards Hill (D.D. 12, 13), as well as many surface specimens. The story of the Nairne sulfide deposit is not a simple one and a large part of this thesis has been devoted to a discussion

relating to the significance of the observed information.

A C K N O W L E D G E M E N T S

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