MINERALS ABSTRACTS

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Modern Sea-Floor Hydrothermal Deposits: Their Relationship to Preserved Deposits

Four types of massive sulfide (VMS) deposits are in active spreading ridges. (1) The smallest (a few tonnes in zinc-rich isolated chimneys and small mounds), in moderately volcanically active ridge crests, are confined to the centers of axial valley(s). (2) Larger deposits (1 million MT of eupriferous pyrite) occur on marginal faults to axial valleys, in volcanically active rifts. (3) Large deposits (2 million MT of cupriferous pyrite) occur on faulted off-axis seamounts. (4) Very large deposits in sediment-filled failed-rift valleys form mounds up to 1 km in diameter, beneath a thin pelite cap.

Studies of these deposits clarify numerous characteristics of VMS deposits. (1) Deposits "grow" and are compositionally refined by highly efficient precipitation within the mound through mixing of cold seawater with hot metalliferous fluid. (2) The amount of associated alteration is partly related to the volume of cold seawater refluxing through the immediate footwall. (3) Alteration composition is controlled by the amount of refluxing cold seawater and the degree of phase separation in the hydrothermal fluid. At low pressure, the footwall is carbonated by a carbon dioxide–rich phase that separates and moves ahead of the metalliferous residual fluid. (4) Generation of a 400°C fluid within the substratum induces a broad semiconformable alteration.

A subvolcanic intrusion, sufficiently large to sustain a hydrothermal system, is a necessary heat source; the size and abundance of deposits are functions of the size and shape of this intrusion. Also, faults that penetrate to near the magma zone, and substrata that are relatively impermeable are necessary.