1 Worldwide

1.4 Models of Grades and Tonnages of Some Lode Tin Deposits

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Abstract

Descriptive and grade/tonnage models have recently been built for many types of deposits. Such models consist of descriptions of mineralogy, host rocks, ore textures, controls, alteration, geochemical signatures, age, and tectonic settings, together with statistical models of grades, tonnages, and contained metal of deposits of each type. The models are used to identify areas that may contain undiscovered deposits of given types, to convey to non-geologists an idea of the importance of such deposits, and to test and refine classifications of mineral deposits.

Descriptive and grade/tonnage models have recently been built for five types of primary tin deposits: rhyolite-hosted such as in Mexico; hydrothermal lodes such as in Cornwall, England, and the Herberton district, Queensland; replacement (or exhalative?) such as Renison Bell, Tasmania; skarn such as at Lost River, Alaska; and greisen such as in the Erzgebirge. Analyses of frequency distributions of tonnage, contained metal, tin grades and the relationships between these variables show that the deposits fall into four well-defined domains that have definite geological characteristics. Rhyolite-hosted, or Mexican, deposits contain a median of 4 t of tin and have a median grade of 0.4% Sn. Hydrothermal lode deposits have the highest grades. Half of such deposits have grades over 1.0% Sn, and the majority contain more than 1,000 t Sn. Large hydrothermal vein deposits contain more than 50,000 t Sn. Replacement (or exhalative?) deposits contain the largest amount of tin (median = 40,000 t). They are only of slightly lower grade (median = 0.80% Sn) than the hydrothermal lodes. Greisen or stockwork deposits have larger tonnages than replacement deposits, but contain less tin (median = 25,000 t). They are also of much lower grade (median = 0.3% Sn). Though grades and tonnages are available for only four skarn deposits, they appear to be more like greisen deposits than replacement deposits when compared using grades, tonnage and contained tin.

Although these individual models of primary tin deposits must be regarded as preliminary because of the relatively small number of deposits upon which they are built, they clearly demonstrate differences among types and provide basic information that can be useful in making decisions about exploration strategy, land classification, and tin supply.

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Introduction

Descriptive and grade/tonnage models have recently been built for many types of ore deposit (Cox, 1983, a, b, and Singer and Mosier, 1983 a, b). Such models consist of descriptions of the mineralogy, host rocks, ore textures, controls, alteration, geochemical signatures, ages and tectonic settings, together with associated statistical models of grades and tonnages. While some data on the grades and tonnages of tin deposits have been published (Taylor, 1979), descriptive and grade/tonnage models have not been built. This paper presents preliminary grade/tonnage models of five types of primary tin deposits: rhyolite-hosted, greisen, hydrothermal, skarn, and carbonate replacement (exhalative?). Descriptive and grade tonnage models are useful for evaluating exploration strategies, estimating future supplies of resources, assessing undiscovered resources and for testing and refining classifications of ore deposits.

Building Grade/Tonnage Models

The first step in constructing a grade/tonnage model is to identify a set of well-explored deposits of the type one wishes to model. A correct classification of the deposits is important because differences in the grades and tonnages of different types usually will be apparent. For example, Figures 1 and 2 show tonnages and grades of fluorine-rich Climax type, and fluorine-deficient porphyry molybdenum deposits (Singer et al., 1983; Menzie and Theodore, 1983). These plots show that the fluorine rich granite-hosted porphyry molybdenum deposits have larger tonnages and higher average grades than the low-fluorine quartz monzonite-hosted deposits. The process of building grade/tonnage models is usually iterative and during the course of building