Gold-Bearing Skarns

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Abstract

In recent years, a significant proportion of the mining industry's interest has been centered on discovery of gold deposits; this includes discovery of additional deposits where gold occurs in skarn, such as at Fortitude, Nevada, and at Red Dome, Australia. Under the classification of Au-bearing skarns, we have modeled these and similar gold-rich deposits that have a gold grade of at least 1 g/t and exhibit distinctive skarn mineralogy. Two subtypes, Au-skarns and byproduct Au-skarns, can be recognized on the basis of gold, silver, and base-metal grades, although many other geologic factors apparently are still undistinguishable largely because of a lack of detailed studies of the Au-skarns. Median grades and tonnage for 40 Au-skarn deposits are 8.6 g/t Au, 5.0 g/t Ag, and 213,000 t. Median grades and tonnage for 50 byproduct Au-skarn deposits are 3.7 g/t Au, 37 g/t Ag, and 330,000 t. Gold-bearing skarns are generally calcic exoskarns associated with intense retrograde hydrosilicate alteration. These skarns may contain economic amounts of numerous other commodities (Cu, Fe, Pb, Zn, As, Bi, W, Sb, Co, Cd, and S) as well as gold and silver. Most Au-bearing skarns are found in Paleozoic and Cenozoic orogenic-belt and island-arc settings and are associated with felsic to intermediate intrusive rocks of Paleozoic to Tertiary age. Native gold, electrum, pyrite, pyrrhotite, chalcopyrite, arsenopyrite, sphalerite, galena, bismuth minerals, and magnetite or hematite are the most common opaque minerals. Gangue minerals typically include garnet (andradite-grossular), pyroxene (diopside-hedenbergite), wollastonite, chlorite, epidote, quartz, actinolite-tremolite, and (or) calcite.

INTRODUCTION

Gold exploration efforts of the mining industry in the last few years have centered on discovery of skarn deposits, such as Battle Mountain Gold Company's Fortitude deposit in Nevada, and Elders Resources' Red Dome deposit in Queensland, Australia, as well as on discovery of disseminated, carbonate-hosted, or Carlin-type deposits. Carbonate-hosted gold deposits are generally much larger deposits than skarns but are of much lower grade. Bagby and others (1987) report median tonnage and grade values of 5.1 million tonnes and 2.5 g/t Au, respectively, for 35 Carlin-type deposits. Median tonnage and grade values for the 90 skarn deposits we report in this study are 0.279 million tonnes and 5.7 g/t Au, respectively. Some major gold skarns, such as the Lower Fortitude deposit, Nevada (5.1 million tonne, 10.45 g/t Au), and the deposit at Bau, Malaysia (2.4 million tonnes), however, contain more gold than many of the large, disseminated-type deposits and are thus extremely attractive as exploration targets. The geologic characteristics of gold-bearing skarn deposits have only recently been addressed (Meinert, 1988a,b, 1989). This paper presents descriptive and grade-tonnage information obtained from more than 90 deposits that have been referred to in the literature as "Au-bearing skarns," "Au-rich skarn," or "Au-skarn," in a format somewhat similar to models in Cox and Singer (1986) but as modified by P.B. Barton (written commun., 1986). These and many other deposits, generally referred to as gold skarns in the literature, are occasionally further differentiated into contact, or proximal, skarns and distal skarns (Sillitoe, 1983, 1987; Bonham, 1985). Special attention has been given to the mineral chemistry of gangue skarn minerals as they have previously proved useful in distinguishing skarn types.

This paper consists of a geologic description of Au-bearing skarns, presented in a form modified from that established previously for Cu-, Zn-Pb-, and Fe-skarn descriptive models (Cox and Singer, 1986) to allow rapid comparison and contrast; grade-tonnage distributions of Au-bearing skarns; and a combination references-bibliography section.

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