In diverse settings involving sedimentary host rocks, orebodies occur as stratabound concentrations in specific stratigraphic units within thick stratigraphic successions. Mineralization systems may range from sedimentary basinal brines to magmatic hydrothermal carbonate replacement and skarn systems. These restricted ore-hosting intervals typically are related to the susceptibility of certain units to post-depositional alteration and porosity enhancement by fluid systems ranging from near-surface to burial diagenesis that commonly are inherited from their depositional framework. Common sedimentary basin examples include stratabound breccia or other porosity zones resulting from differential removal of soluble components that provided permeable zones for subsequent fluid migration, including MVT-mineralizing sedimentary brines as in the Tennessee and Pine Point districts (e.g., Kyle, 1983).

In more dynamic tectonic settings, reactive sedimentary successions adjacent to plutons commonly are host to skarn-type metal deposits, but seldom are these relationships pursued from the context of detailed analysis of unaltered strata that can be correlated with the altered and mineralized intervals. The Ertsberg-Grasberg district in Papua, Indonesia, hosts two giant porphyry and skarn-hosted Cu-Au systems that formed between 3.3 and 2.5 Ma in the Central Range that forms the Highlands of western New Guinea. These Cu-Au systems are associated with two dioritic intrusive centers, the Grasberg Igneous Complex and the Ertsberg Intrusive Complex, that were emplaced into a deformed sedimentary sequence of Cenozoic carbonate and late Mesozoic siliciclastic strata. The lithologic variations allow the assessment of the development of alteration assemblages for specific rock types and their relationship to economic mineral concentration (Fig. 1).

The Ertsberg-related system contains 3.6 Gt grading 0.60% Cu and 0.44 ppm Au (Leys et al., 2012) in four skarn deposits, the Ertsberg, the Ertsberg East Skarn System, the Dom, and the Big Gossan (Mertig et al., 1994). These deposits represent hypogene copper sulfide concentrations with high complementary gold values. The Ertsberg East Skarn System (EESS) is one of the world’s largest skarn-hosted Cu-Au orebodies; economic mineralization is vertically continuous for more than 1,500 m in steeply dipping strata along the flank of the Ertsberg Intrusive Complex. EESS ores are hosted by mixed assemblages of lower Paleogene siliciclastic and dolomitic carbonate strata that have been altered to Mg-rich skarn assemblages. Prograde skarn assemblages in the dolomitic lower Waripi formation and the limestone member of the Ekmai formation are dominated by forsterite and diopside (Rubin & Kyle, 1998). The alteration assemblage of calcareous strata in the younger Faumai and Kais formations is dominated by monticellite and diopside.

Unaltered strata from a stratigraphic interval equivalent to the EESS skarn-hosted ores have been characterized with regard to their petrographic features, major element compositions, and petrophysical properties (Gandler, 2006; Gandler & Kyle, 2008). These stratigraphic units are interpreted to be responsible for the varied skarn lithologies within the EESS. The dominant prograde skarn assemblages are controlled by protolith composition, notably the relative abundance of quartz, dolomite, and calcite. Models based on isochemical metamorphism of mixed assemblages of quartz and dolomite suggest that the formation of forsterite-diopside-dominant skarn assemblages resulted in the greatest amount of porosity increase, which served to host Cu-Au concentrations. (Gandler, 2006; Gandler & Kyle, 2008). Additional variables include pre-alteration porosity and permeability, but those are generally low. Magnetite is a component of prograde alteration, preferentially replacing dolomitic strata and commonly hosting high grade Cu-Au ore. Thus, EESS Cu-Au concentrations were locally controlled by...
host lithology, with structural and lithologic features providing fluid pathways that focused the mineralizing fluids. The Waripi Formation also is the principal host of the Big Gossan and Kucing Liar Cu-Au skarn ore zones (Leys et al., 2012).

Other skarns in the Ertsberg-Grasberg district are hosted in different stratigraphic units and rock types. Whereas alteration of Waripi units generally is texturally destructive, preservation of original fossil-bearing textures in a variety of calc-silicate assemblages (Figs. 2,3) indicates that the Cu-Au ore zones of the Ertsberg and Dom skarns are developed in the lower part of the Oligocene to lower Miocene Kais Formation (Mertig et al., 1994; Fig. 1).

Stratigraphically higher Kais units generally are converted to marbles in a largely unmineralized zone around both intrusive complexes (Leys et al., 2012). Current studies are assessing the stratigraphic inheritance aspects of the Ertsberg and Dom skarns by comparison with unaltered lower Kais strata.

Thus, in settings ranging from shelf-margin carbonate strata modified by diagenetic solutions to strata modified by high temperature magmatic hydrothermal fluids, an analysis of stratigraphic inheritance not only guides the selection of exploration targets, but assists in the challenge of assessing continuity and grade of mineralized zones from drilling information as is necessary for the current requirements of resource definition.

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