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Gold-bearing arsenian pyrite and marcasite and arsenopyrite from Carlin Trend gold deposits and laboratory synthesis

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ABSTRACT

Invisible gold in natural and synthetic arsenian pyrite and marcasite correlates with anomalous As content and Fe deficiency, and high contents of invisible gold in most natural and all synthetic arsenopyrite correlate with excess As and Fe deficiency. As-rich, Fe-deficient arsenopyrite synthesized hydrothermally contains up to 3.0 wt% Au uniformly distributed in growth zones of light backscattered electron contrast. At the Deep Star gold deposit, Carlin Trend, Nevada, the sulfide compositions apparently span the full range of metastability from FeS_2 to near FeAsS (40 at% S); arsenian pyrite contains up to 0.37 wt% Au, but arsenopyrite has excess S and is relatively Au poor. Observed minimum Fe contents are 29.1 at% in arsenian pyrite and marcasite from the Deep Star deposit and 31.3 at% in synthetic arsenopyrite. We suggest that invisible gold in arsenian pyrite and marcasite and arsenopyrite from sediment-hosted gold deposits represents Au removed from ore fluids by chemisorption at As-rich, Fe-deficient surface sites and incorporated into the solids in metastable solid solution. However, the oxidation state of invisible gold (Au^0, Au^{1+}) remains uncertain because the chemisorption process is intrinsically nonsystematic in terms of crystal-chemical parameters and does not result in definitive atomic substitution trends.