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Sedimentary source for the Nibao sediment-hosted gold deposit in southwestern Guizhou Province, China

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The Nibao deposit is a sediment-hosted gold deposit with more than 60 tons contained gold at an average grade of 2.26 g/t. Like many other sedimentary rock-hosted gold deposits in southwestern Guizhou Province, China, the Nibao deposit is generally classified as a Carlin-type gold deposit by most researchers. However, the source of gold and other trace elements in the deposit has long been debated in the literature. In this study, the textures and trace element contents of pyrite and other sulfides from the Nibao deposit have been investigated to make inferences about the potential gold source for the deposit.

Four pyrite types were identified, based on texture and trace element content: framboidal pyrite (Py1), euhedral to subhedral coarser pyrite overgrowing framboidal pyrite (Py2), 'spongy' pyrite containing abundant inclusions of silicate and carbonate minerals (Py3), and narrow pyrite rims overgrowing the sponge-textured Py3 (Py4). The concentration of trace elements in these pyrite types varied due to the changing physicochemical conditions as the basin system evolved. In particular, Py1 and Py2 are rich in As (median 8, 029 ppm for Py1 and 6, 976 ppm for Py2) and contain relatively higher Au contents (median 0.13 ppm for Py1 and 0.17 ppm for Py2) than that of Py3 (median 0.08ppm). Py4 contains most diverse trace element suite of all pyrite types, including Cu, Se, Ag, Sb, Hg, Tl, Pb, and Bi along with As (median 28, 096ppm) and Au (median 31.1ppm). Both the average Co/Ni ratios and Mo content of Py1 and Py2 suggest these early-stage pyrites were deposited in an organic matter-rich and anoxic to euxinic environment. Furthermore, the hydrothermal fluid presumably responsible for the deposition of Py3 and Py4 was apparently rich in trace elements, including trace elements commonly found in pyrite from Carlin-type deposits in Nevada, USA (e.g., Au, As, Sb, Hg, Tl). The trace element contents of different pyrite types and their relationships in this study, and a comparison with worldwide sedimentary pyrite ranging from the Archean to the present suggest the carbonaceous sedimentary source-rock model is valid for the Nibao deposit. In this scenario, Au and As would have been sourced from the broader Youjiang basin and locally pre-concentrated in Py1 and Py2, along with a suite of other trace elements, including Co, Ni, Cu, Se, Sb, Tl, Hg, and Pb. During the main ore-forming hydrothermal event, Au and As would have been remobilized from Py1 and Py2 by hydrothermal fluids in the deep basin, and then transported by these fluids to favourable trap sites where they were precipitated in Py3 and Py4.