Favorable Locations and Indicators For Exploring For Shuiyindong Carlin-type Gold Deposit in Southwest Guizhou, China

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1 Introduction

Southwest Guizhou Province, at the border of the Yunnan province, Guizhou province, and Guangxi autonomous region, is an important region in which many Carlin-type gold deposits are distributed. In this paper, a representative cross section across the Shuiyindong Carlin-type gold deposit was established as the subject of research. The main objectives were to determine the deposit-scale spatial distribution of gold and other trace elements and carbon oxygen isotopes of calcites, and then to discover the clues or indicators for Shuiyindong Carlin-type gold deposits in southwest Guizhou, China.

2 Geology of the Shuiyindong Gold Deposit

The Shuiyindong gold deposit, which is approximately 20 km northwest of the town of Zhenfeng in southwestern Guizhou, China, lies on the eastern limb of the Huijiabao anticline, which hosts a cluster of gold deposits. Sedimentary strata in the mining area are dominated by Middle and Upper Permian and Lower Triassic strata. The Middle Permian Maokou Formation is a massive bioclastic limestone conformably overlain by the Upper Permian Longtan, Changxing, and Dalong formations and the Lower Triassic Yelang and Yongningzhen formations. The Middle–Upper Permian unconformity surface is a strongly silicified brecciated limestone–argillite zone at the Shuiyindong gold deposit. Lower grade orebodies are hosted in the unconformity surface (xia et al, 2009).

The strata of the mining area were deformed into the nearly E–W-trending Huijiabao anticline. The limbs of the anticline are cut by reverse faults F101 and F105, which strike E–W and dip steeply to the north and south, respectively (su et al, 2009).

Wall-rock alteration types observed at the Shuiyindong deposit include decarbonation, silicification, sulfidation, and dolomitization.

3 Spatial Distribution of Gold and Other Trace Elements

For our study, a representative N–S cross section across the Shuiyindong gold deposit was selected. In total, 350 samples were collected from 8 drill holes. All samples were analyzed for contents of Au, As, Sb, Hg, Tl, and other trace elements. Elements considered related to the mineralization include S, As, Sb, Hg, and Tl, which were accompanied by ore-forming hydrothermal components that might have included Mo and U; Li and Na were depleted by the ore-forming process in the orebodies. The spatial distributions of Au, As, Sb, Hg, and Tl in a representative cross section show that these elements appear zoned from bottom to top in the order Sb–Tl–As–Hg–Au–Hg–As.

The spatial distributions of Au, As, Sb, Hg, and Tl are roughly consistent and are arranged along the Middle–Upper Permian unconformity surface, anticlinal axis, and fault zones at the flank of the anticline. The distributions of ore-forming elements might signify the process of ore-forming fluids ascending from the deep to shallow crust. The spatial distributions of gold and related elements in the representative cross section show that the ore-forming fluids migrated along the Middle–Upper Permian unconformity surface, anticlinal axis, and fault zones at the flank of the anticline. The distributions of ore-forming elements might signify the process of ore-forming fluids ascending from the deep to shallow crust. The spatial distributions of gold and related elements in the representative cross section show that the ore-forming fluids migrated along the Middle–Upper Permian unconformity surface, anticlinal axis, and fault zones at the flank of the anticline. The distributions of ore-forming elements might signify the process of ore-forming fluids ascending from the deep to shallow crust. The spatial distributions of gold and related elements in the representative cross section show that the ore-forming fluids migrated along the Middle–Upper Permian unconformity surface, anticlinal axis, and fault zones at the flank of the anticline. The distributions of ore-forming elements might signify the process of ore-forming fluids ascending from the deep to shallow crust.

The thick-bedded argillite of the first unit of Longtan
Formation at the anticlinal flanks served as an impermeable barrier and had a converging effect, allowing the ore-forming fluids laterally along the Middle–Upper Permian unconformity surface until they converged at the high position of the anticline.

The interbedding of impermeable argillite and porous bioclastic limestone in the second and third units of Longtan Formation contributed to the ore-forming fluids to laterally migrate and to interact with the bioclastic limestone layers, and thus orebodies extended substantial distances to the anticlinal flanks along the bioclastic limestone layers.

4 Spatial Distribution of Carbon and Oxygen Isotopes

We compared the carbon and oxygen isotopic values between the two kinds of calcite, and one is located in ore bodies of Shuiyindong gold deposit and another unrelated to mineralization is far away from the mining area. The results indicated that the range of the carbon and oxygen isotopic values of calcite veins in the ore bodies roughly is 0~9‰, 15~25‰, respectively, and those of far away from mining area roughly is 3~0‰, 5~20‰, respectively. According to the obvious difference of carbon and oxygen isotopes between these two kinds of calcite, calcite can be used as an indicator for Shuiyindong Carlin-type gold deposits in southwest Guizhou, China.

To observe the spatial distribution of carbon and oxygen isotopes of calcite veins and the relationship with the ore bodies, a representative N–S cross section across the Shuiyindong gold deposit was selected. In total, 42 samples were collected from 8 drill holes. All samples were analyzed for values of the carbon and oxygen isotopes.

The carbon and oxygen isotopic values of calcite can determine the scope of it is related to mineralization or not. The results show that the distribution of calcite related to mineralization is more widespread than the distribution of ore bodies. Calcites associated with mineralization are often distributed in the orebodies and fractures surrounding the ore bodies. Calcites unrelated to mineralization often appear far away from the ore bodies. If a fault cut around the orebodies, calcites related to mineralization may appear in the fault zone.

Through sampling the calcites in exposed fault zone at the surface, and analyzing its carbon and oxygen isotopic values, we may predict whether there are possibility of gold orebodies exist at the deep underground or not.

5 Prospecting Significance

The Middle–Upper Permian unconformity surface is a clue for prospecting, and its overlying of anticlinal high position and fault zones at the flank of the anticline reveal favorable locations for exploring for Shuiyindong Carlin-type gold deposit. The anomalies of Au, As, Sb, Hg, and Tl at the surface, especially in the exposed fault zone and the carbon and oxygen isotopic values of calcites in the exposed fault zone are indicators for Shuiyindong Carlin-type gold deposit.

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