3D geological and geochemical modeling for gold exploration targets in Dashui Gold deposit, China

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The Dashui gold deposit is one of the super-large gold deposits in the world-class West Qinling orogenic gold belt (China). The metallogenesis of this deposit is under debate because only a small amount of fine particles of sulfur can be found, the chronology of orebodies is difficult to constrain, and it is hard to extract ore-forming temperature from fluid inclusions in calcite from the deposit. In this paper, 3D deposit-scale geological and geochemical modeling was used to derive exploration targets in Dashui deposit. The methodology consists of the following steps:

(1) Gold-bearing geological objects in 3D space were observed and surveyed. The datasets include a 1:10,000 scale geological map, 27 cross-sections, 110 boreholes (with total log length of 25,466.61 m, and the longest borehole is 781 m), and lithogeochemical data from 433 samples from four level plans in the Dashui gold deposit.

(2) 3D geological objects modeling in GoCAD software using the mentioned datasets, involving 3D intrusion modeling, 3D orebody modeling, and 3D fracture modeling.

(3) 3D grade modeling of orebodies (#Au2, #Au7, #Au20) using discrete smooth interpolation (DSI) and ordinary kriging.

(4) Exploration targets extraction based on comparison of the 3D ore-forming fracture model and intrusion model with the 3D grade and orebody models.

The results show that: (1) the 'front' halo of Dashui gold deposit is characterized by a Au×Ag×Pb×Cu multi-element association, and its 'tail' halo by W×Bi×Sn×Mo; (2) Cu/Pb ratios correlate with the ore-forming temperatures in the deposit; and (3) the kriging interpolation of gold assays shows that #Au2 orebody has potential extension target from 3500 to 3000 m level and it inclines southwest in the western part of study area, and the #Au7 and #Au20 orebodies incline south from 3450 to 3000 m level in the eastern part of study area.