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Fault control law of deep-seated gold orebodies in the Jiaodong ore-cluster region: Revealed from three-dimensional geological modeling data

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The Jiaodong Peninsula ranks as the third largest gold ore-cluster region in the world. More than 80% of the gold resources are controlled by three main ore-controlling faults, namely the Sanshandao, the Jiaojia, and the Zhaoping faults. Therefore, the characteristics of faults have always been the focus of gold research. Through three-dimensional geological modeling of three rare super-giant and giant gold deposits, namely the Sanshandao, Jiaojia, and Lingnan-Shuiwangzhuang gold deposits, this study analyzes ore-bearing faults and the three-dimensional morphological characteristics of granites related to gold mineralization, determines the relationships between the deep-seated orebodies' location and the slope dip angle changes of the faults, and discusses the relationships between gold mineralization with faults and magmatic activities. The dip angles of three ore-controlling faults gradually decrease downwards and change alternately between steep and gentle along the fault dip direction, featuring shovel-shaped and stepped morphology. The analysis found the orebodies' grade and thickness increased in the areas of sharp change from steep to gentle of fault dip angles and gentle dip angles. According to the diagram of fault dip angle changing rate superimposed on the grade multiplied by thickness, the orebodies mainly occurred in areas with high changing rate of the fault dip angles. This finding indicated that the stepped change of dip angles of faults is favorable for gold mineralization. Based on this principle, positions with fault dip angles of 20°â€’50° and changing rate of ≥ 0.91 were determined as the deep-seated target areas for prospecting. Further analysis suggests that tectonically, the ore-controlling structures and the granites, and gold mineralization were produced by regional thermo-upwelling extension movements. Strong magmatic activities provided necessary metallogenic and thermal dynamic environment for gold mineralization. Hence, abundant ore-forming materials are provided. In addition, the detachment faults between the Linglong batholith and the Early Precambrian metamorphic rocks provided favorable space for mineralization. The fluctuations of ore-forming fluid pressure caused by sudden changes of the faults' dip angles served as the primary mechanism for the stepped gold mineralization.

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