8th. World Congress on Computational Mechanics (WCCM8)
5th. European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS 2008)
June 30 – July 5, 2008
Venice, Italy

MECHANICAL CONTROL ON LOCATION OF SKARN ORE BODIES IN TONGLING-ANQING CU DISTRICT，CHINA: EVIDENCES FROM COMPUTATIONAL SIMULATION

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Key Words: *Skarn Ore Formation, Coupled Mechano-Thermo-Hydrological Process, Computational Modeling, Tongling-Anqing District.*

ABSTRACT

The Tongling-Anqing district hosting the largest Chinese copper industry is a typical copper skarn district, where all copper ore bodies are spatially associated with skarn. Although the skarn are products of some special chemical reactions related to magmatic intrusions, the location regularity of ore-bodies can not be explained only by chemical aspects. For understanding the geodynamics of ore-forming processes, two main deposits, the Fenghuangshan and Anqing, are researched by computational simulation. The results demonstrate the important role of mechanical aspects on location of skarn ore bodies.

The Fenghuangshan copper deposit occurs in the west contact zone of the Xingwuli granodiorite intrusion with low Triassic limestone. Along the whole contact zone of the intrusion, five other copper deposits are distributed (Fig.1), but the Fenghuangshan is largest, where the ore bodies are considered being formed during the syn-tectonic cooling of the intrusion[1]. Based on geological research on the Fenghunagshan deposit and its background, a two-dimensional plan model is constructed to replay the coupled mechano-thermo-hydrological processes during the syn-tectonic cooling of the Xingwuli Intrusion. The FLAC (Fast Lagriangian Analysis of Continua)[2], a two-dimensional finite-difference code, is used to perform the computation. The computational results show all the ore bodies being located in the dilation zones, and larger ore bodies in the bigger and stronger dilation zones which is also places where the fluids focusing to.(Fig.2).

The Anqing iron-copper deposits is located in the contact zone between the Yueshan diorite intrusion and dolomite marble of middle Triassic[3]. It is also a typical iron-copper skarn deposit, with measured reserves of 520 kt copper and 21.8 mt iron. The major ore body is spatially associated with the dolomite “tongue” in the diorite (Fig.3). The structural and mineral features of the ores suggest they are results of hydrothermal events related to retro-metasomatism of the Yueshan intrusion in a tensional tectonic setting. By restituting pale topographic-tectonic architecture of the ore-forming system, a two-dimensional section model is constructed to test the coupled mechano-thermo-hydrological processes during the syn-tectonic cooling of the Yueshan Intrusion. The FLAC is used for computation. The results show that the contact zone of the dolomite “tongue” with the diorite is the most dilatant deformation zone and also most favourable for fluids focusing below the present erosion surface (Fig.4).

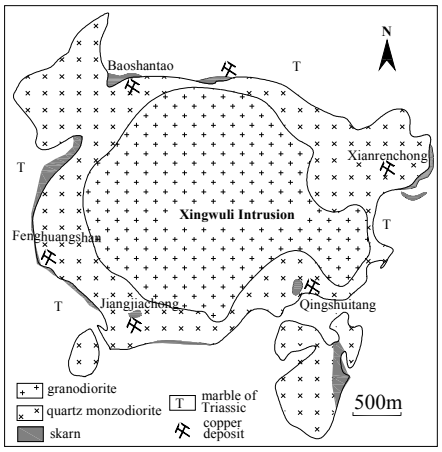


Fig.1

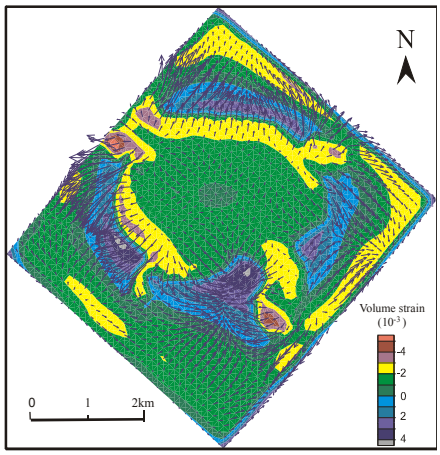


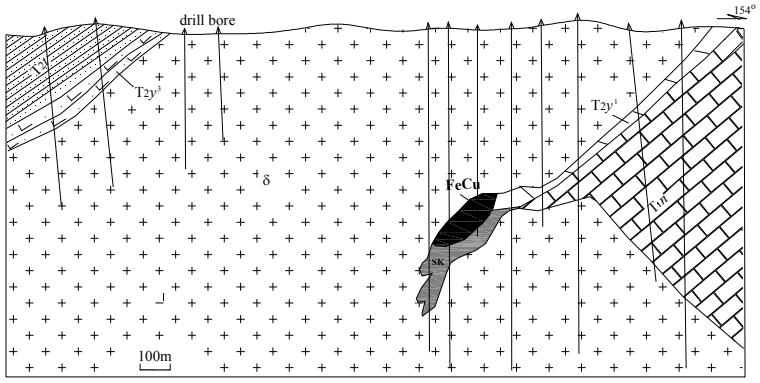
Fig.2

Fig.1 Geological map of Fenghuangshan copper ore field

Fig. 2 Deformation and fluid flow results of modeling, showing Darcy fluid flow velocities (arrows) and total volume strain contour at 7000 year, the maximum fluid flow velocity is 2.61×10^{-11} m/s.

By comparing the computation results with the geological features of the two deposits, it is concluded that, (1) the dilation spaces where fluids flow focus to are the most favorable for the skarn ore bodies being located; (2) the mechanical control on location of skarn ore bodies is result of coupled mechano-thermo-hydrological processes; and (3) the computational simulation is one promising tool for facilitating understanding the skarn ore formation process.

Work presented here is being supported by NSFC grants (40772195) to Prof. L.M. Liu.



T_{2y}: sandstone of mid Triassic; T_{2y^3}: siltstone of mid Triassic; T_{2y^1}: dolomite of mid Triassic; T_{1n}: limestone of low triassic; δ: iorite; SK:skarn; FeCu: iron-copper ore body

Fig.3 A cross section of Anqing iron-copper deposit

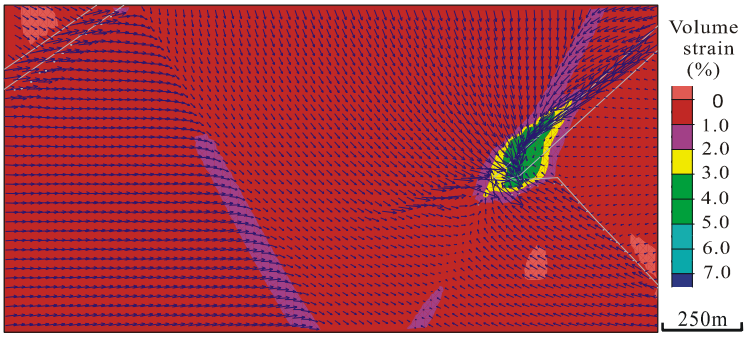


Fig.4 Deformation and fluid flow results of modeling, showing Darcy fluid flow velocities (arrows) and total volume strain contour at 3300 year, the maximum fluid flow velocity is 6.794×10^{-7} m/s. (zoom in the model)

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