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Methane-rich Fluid of Chaihulanzi Gold Deposit

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1 Introdution

Methane-rich fluid has appeared in many deposits, and most of them are base-metal deposits, especially in China, such as Baogutu porphyry Cu deposit (Shen et al., 2010), Huogeqi Cu deposit (Zhong et al., 2013) and skarn near Bayan Obo deposit (Fan et al., 2004). CH_4, as a common volatile in fluid, has a lower solubility in H_2O than CO_2 (Naden and Shepherd, 1989), which can dramatically enlarge the pressure-temperature field immiscibility. This nature plays a vital role in deposition of gold, so methane-rich fluids in gold deposits need to be paid more attention.

Chaihulanzi gold deposit located in western segment of Chifeng-Chaoyang district in the middle part of the northern margin of North China Craton. The orebodies were hosted in the Archean graphite-bearing schist. According to the previous study of ore-forming fluid , We found a lot of CH_4-rich fluid inclusions in quartz and we attempted to elucidate the evolutionary history of methane-rich fluids that was responsible for alteration and mineralization of the Chaihulanzi Au deposit with graphite。

2 Fluid Inclusion Analysis

Fluid inclusion types are indentified based on their phases at room temperature, phase transition upon heating and cooling, and Raman microprobe analysis. Type-1 is a two-phase aqueous inclusion. Based on the mode of total homogenization, type-1 inclusions are subdivided into type-1a, which homogenizes into a liquid phase, and type-1b, which shows critical homogenization. Type-2 is the monophase CH_4 inclusion, which shows two-phase CH_4 (liquid CH_4 +CH_4 vapor) when cooling to ca. − 100℃.

In main-stage ores, the final ice-melting temperature for type-1a inclusions ranges from -10.1℃ to -1.8℃ with an average temperature of -6.1℃. Total homogenization temperature into the liquid phase ranges from 135℃ to 376 ℃ with an an average temperature of 225℃ (Fig. 1). Type-1b inclusions occur only in main-stage ores. The final melting temperature for these inclusions ranges from 397℃ to 403℃ with an average of 400℃. Both of them show critical homogenization.Type-2 inclusions occur only in main-stage ores and gangue. The Th CH_4 ranges from -107.6 to -79℃ with an average of -89.8℃. All of inclusions homogenized into liquid CH_4.

Raman microprobe analysis was carried out to reveal the vapor composition of main-stage fluids. H_2O is the only recognized species in the vapor of type-1 inclusions (Fig.3). In most of type-2 inclusions, CH_4 is the unique component, which is in accordance with microthermometry that most of which are under -82.5℃ (Fig. 2). we can get a conclusion that most of type-2 inclusions are pure CH_4 inclusions.

The type-1 aqueous and type-2 CH4 inclusions in the

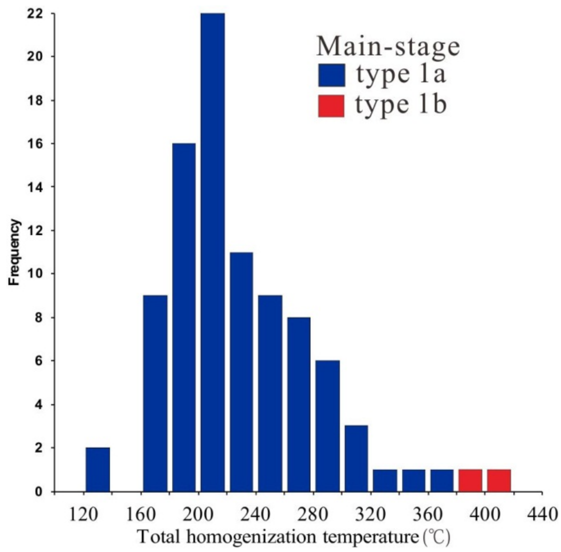

Fig. 1 Total homogenization temperatures of main stage type 1 fluid inclsion.

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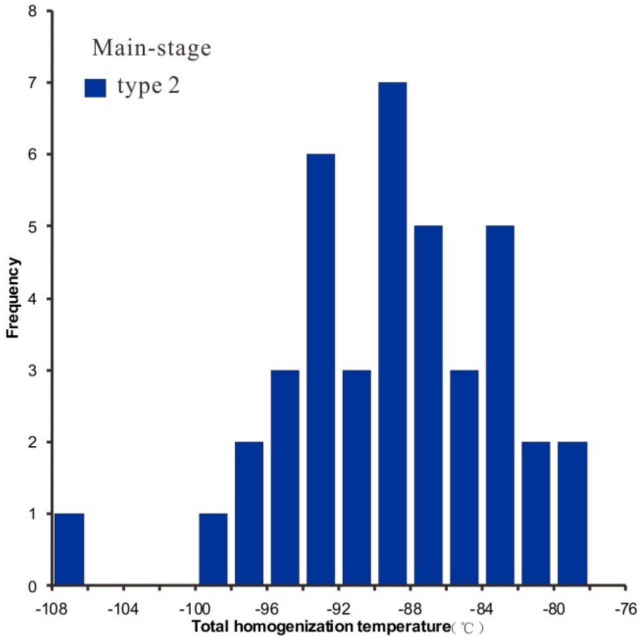

Fig.2 Partial homogenization temperature of CH_4

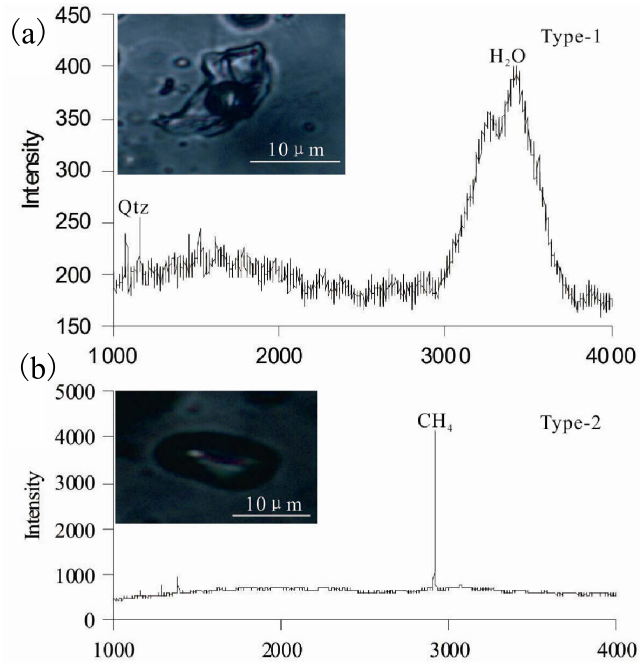

Fig.3 Raman spectra of main stage inclusions

main-stage ores represent two simultaneously trapped immiscible fluids. Therefore, the P-T condition of entrapment can be obtained by the intersection of the intersection of the isochors of the two fluid. The main-stage Au-forming P-T condition is ca. 220-300°C and 0.8-1.2 kbar. The P-T regime constrained by this method may cover a larger area

the actual ore forming conditions because it covers all the potential ore-forming *P-T* regimes of the selected samples. Regarding the overlapping *P-T* area of the two samples, the Au-forming conditions can be more precisely constrained

as 220-260℃ and 1.1-1.2kbar.

3 Possible Origin of the CH_4-rich Fluid

Compared with fluid of classic mesothermal lode gold，the main-stage Au-bearing fluid of the Chaihulanzi deposit is characterized by its high CH_4 content and near absence of CO_2. CH_4-rich fluid was usually found in the base metal ore deposit, but rare in gold deposits, because it can't buffer pH of the fluid like CO_2 (Diamond, 2001; Edward J, 1998; Naden and Shepherd, 1989), so can not transport gold from the deep source area to the proper area. therefore, we can conclude that the CH_4-fluid may not come from the same source with gold, then we can exclude the possibility of degas of mantle. More importantly, there are lots of graphite in the host rock, and almost of gold-bearing vein are restricted to these graphite-bearing schist. After the microscope and field observation, we found that graphite in altered schist was obviously less than those unaltered, so we can conclude that H_2O-CH_4 main-stage Au-bearing fluid is most likely to be an effect of fluid-rock interaction between the graphite-bearing host rocks and deep source magmas water.

References

Diamond, L.W., 2001. Review of the systematics of CO_2–H_2O fluid inclusions. Lithos, 55(1–4): 69-99.

Edward, J. M., 1998. Hydrothermal transport and depositional processes in Archean lode-gold systems: A review. Ore Geology Reviews, 13(1–5): 307-321.

Fan, H.R., Xie, Y.H., Wang, K.Y., Wilde, S.A., 2004. Methane-rich fluid inclusions in skarn near the giant REE-Nb-Fe deposit at Bayan Obo, Northern China. Ore Geology Reviews, 25(3-4): 301-309.

Naden, J., Shepherd, T.J., 1989. role of methane and carbon-dioxide in gold deposition. Nature, 342(6251): 793-795.

Shen, P. et al., 2010. Methane-rich fluid evolution of the Baogutu porphyry Cu-Mo-Au deposit, Xinjiang, NW China. Chemical Geology, 275(1-2): 78-98.

Zhong, R.C., Li, W.B., Chen, Y.J., Yue, D.C., Yang, Y.F., 2013. *P-T-X* conditions, origin, and evolution of Cu-bearing fluids of the shear zone-hosted Huogeqi Cu-(Pb-Zn-Fe) deposit, northern China. Ore Geology Reviews, 50: 83-97