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Fluid Inclusions Studies And Geological Significance In The Xuebaoding W-Sn-Be Deposit, Sichuan

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1 Geological Settings

The Xuebaoding deposit is located at Songpan-Garze orogenic belt of the northwest margins of Yangtze plate. It is controlled by the secondary Ziboshan dome structure which is located in the core of Moziping-Nacai overturned synclinorium. The exposure strata was Triassic Zhuwo Formation (T_3zh). It is the main ore-bearing strata of Xuebaoding mining area which is made up slate, schist and marble. The granite body was intruded in the Triassic system at Late Indosinian as stock and dike, the lithology is muscovite monzogranite and muscovite granodiorite.

2 The Fluid Inclusions Characteristics

Fluid inclusions in beryl and scheelite are mainly star bulk distributed, while some of them are star point, groups and zonation distributed, they are mainly elliptical, strip, negative crystal form and irregular, the length-diameter of fluid inclusions are 3-150 μm, the most are 5-30 μm. At room temperature (10℃), according to the characteristics of the fluid inclusions' composition and phase state, the fluid inclusions can be divided into three categories. H_2O inclusions, CO_2 inclusions and CO_2-H_2O inclusions. The CO_2-H_2O inclusions can be also divided into H_2O-rich CO_2-H_2O inclusions and CO_2-rich CO_2-H_2O inclusions. These types of inclusions coexisted in the same sight under the microscope, and it may be caused by fluid immiscibility.

3 The microthermometry Characteristics of the Fluid Inclusions

This paper conducted the microthermometry study to the CO_2-H_2O inclusions of Xuebaoding deposit. Frozen the CO_2-H_2O inclusions until the CO_2 solid phase's presence , and then heated, the CO_2 solid phase's finally melted temperature was -57~-59.1℃, and the CO_2 hydrate's finally melted temperature was 8.3~9.9℃, then we calculated the H_2O phase's salinity was 0.2%~3.38%. In the CO_2-H_2O inclusions, the CO_2 gas-liquid phase's partial homogenization temperature was 16~28℃, and the homogenization way was the CO_2 gas phase's volume was gradually becoming small until homogenized to CO_2 liquid phase. For the H_2O-rich CO_2-H_2O inclusions, when heated, the CO2 phase's volume gradually become small, homogenized to liquid H_2O phase, the total homogenization temperatures was 231.4-286.1℃, while the average temperature () was 255.1℃; the total homogenization pressures was 1218.9-1776.5bar which was calculated by Liubin's formulas(Liu Bin, 1999), the average pressure(P1) was 1424.8bar. For the CO_2-rich CO_2-H_2O inclusions, when heated, the CO_2 phase's volume gradually become big untill homogenized to gas CO_2 phase, the total homogenization temperatures was 233.5-274.5℃, while the average temperature () was 253.1℃ and the total homogenization pressures was 1240.5-1712.9bar, while the average pressure(P2) was 1526.1bar. It was proved that the total homogenization temperatures of the H_2O-rich CO_2-H_2O inclusions was agree with the CO_2-rich CO_2-H_2O inclusions, and so do the total homogenization pressures. The deviation of the two types of inclusions' total homogenization temperatures was $\delta_{th}=|t_{h1}-t_{h2}|/t_{h1}=0.008<0.1$, and the total homogenization pressures' was $\delta p=|p1-P2|/P1=0.07<0.2$.It can be proved that the H_2O-rich CO_2-H_2O inclusions and the CO_2-rich CO_2-H_2O inclusions were inclusions assemblages that were trapped in CO_2-low salinity water immiscible fluid at the same time.

4 Discussion

The ore-forming fluid came from magmatic hydrothermal, mixed with the crust source bittern in the late, and it was rich CO_2, middle temperature and low salinity. Rgon isotope study indicated that the mineralization age was 186.1~191.1Ma which belongs to

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the Early Yanshanian. The study area is located at Songpan-Ganzi orogenic belt of the northwest margins of Yangtze block, the collision event between Yangtze Plate and North China Plate happened at the Early Yanshanian. The strong tectonic movement and magmatic activity was happened in this area and the ore-forming fluid was rising along the joints and fissures, when it into the intrusive contact zones of granite body and the surrounding rock, the pressure was reduced, led to the ore-forming fluid CO_2 solubility decrease and the CO_2-H_2O immiscibility.

ROEDDER (1992) defined the immiscibility, at equilibrium, the existence of two or more non-crystalline polycomponent solutions (fluids), differing in properties and generally in composition. CHI (1991) thought that the immiscibility generally occurred in the W-Sn deposits that related to intrusions(Chi Guoxiang, et al. 1991). Higgins (1980) thinks that, W in rich-CO_2 ore-forming fluid was transported by carbonate and bicarbonate[2], but WOOD (2000) believed that, W was transported mainly in the form of simple tungstic acid ($H_2WO_4^-$, WO_4^{2-}) and alkaline tungstate ion pairs($NaHWO_4$, KWO_4^-, $NaWO_4^-$) (Wood et al., 2000) . Although the role of CO_2 in W ore-forming fluid has not settled yet, a large number of researches show that the high content of CO_2 in the solution is favourable to WO_4^{2-}, Fe^{2+}, Mn^{2+} and Ca^{2+} transported together. Most of the CO_2 escape from the ore-forming fluid because of the CO_2-H_2O immiscibility, the ore-forming fluid's PH and redox conditions changed, caused the complex in the ore-forming fluid resolve, and due to a lot of CO_2 escape, the ore-forming fluid's concentration increased and supersaturated, caused WO_4^{2-} bond with Fe^{2+}, Mn^{2+} and other metal cation, at last the ore was formed.

5 Conclusions

The H_2O inclusions, CO_2 inclusions, H_2O-rich CO_2-H_2O inclusions and CO_2-rich CO_2-H_2O inclusions coexist in the same sight under the microscope, and it may be caused by fluid immiscibility.

The inclusion temperature shows that, the H_2O-rich CO_2-H_2O inclusions homogenized to liquid H_2O phase, and the CO_2-rich CO_2-H_2O inclusions homogenized to gas CO_2 phase, their total homogenization temperatures and total homogenization pressures are agreed, it can be proved that they were inclusions assemblage which were trapped in CO_2-low salinity water immiscible fluid at the same time.

Because of the CO_2-H_2O immiscibility, the ore-forming fluid PH and redox conditions changed, caused the complex in the ore-forming fluid resolve, the ore-forming fluid concentration increased and supersaturated, caused WO_4^{2-} bond with Fe^{2+}, Mn^{2+} and other metal cation, at last the ore was formed.

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