Research Advances

The Sachakou Deposit in West Kunlun of Xinjiang: A Pb-Zn Polymetallic Deposit Associated with Magmatic Metasomatism of Carbonate Rock

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Objective

The Sachakou Pb-Zn polymetallic deposit is located in Hetian County, Xinjiang (geographical coordinates of E78° 57′ 54.30′′–78° 59′ 53.63′′, N34° 39′ 27.50′′–34° 40′ 57.21″). It belongs to the West Kunlun orogenic belt on the northwest edge of the Qinghai–Tibet Plateau and is connected to the Sanjiang orogenic belt to the south (Spurlin et al., 2005). In recent years, a series of Pb-Zn mineralized spots and deposits have been discovered in this area one after another, which is called the Huoshaoyun ore concentration area. Among them, the Sachakou Pb-Zn deposit has reserves up to140 Mt, which has reached a large scale. However, the study on the genesis of deposits in this area has only just begun. This work studied the genesis ofthis Pb-Zn deposit in order to provide new ideas for the genesis of regional deposits and regional prospecting.

Methods

We performed systematic geological mapping and sampled the surrounding rock and orebody of the Sachakou Pb-Zn deposit. We have selected primary fluid inclusions in quartz and sphalerite at different metallogenic stages for microthermometric measurement. This work was completed at the Institute of Geology, Chinese Academy of Geological Sciences. The tester is a Linkam THMS600 hot and cold stand with a measurement temperature range of −196°C to 600°C. The freezing and uniform temperature test accuracy is ±0.1°C and ±1.0°C, respectively. The H-O isotope testing of quartz was completed at the Beijing Research Institute of Uranium Geology, CNNC. The instrument used for oxygen isotope analysis is MAT_253EM mass spectrometer. The analysis was performed using the traditional BrF_5 method. The oxygen was extracted by reacting BrF_5 with oxygen-containing minerals under vacuum and high temperature conditions, and then converted to CO_2 gas by combustion with a burning resistance graphite rod. The accuracy is ±0.2‰, and the relative standard is V-SMOW.

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Results

(1) The Sachakou Pb-Zn deposit is generally controlled by regional large thrust faults, and the ore bodies as a whole have layered occurrence. It was involved in three mineralization stages. During the ore-forming period, sulphides are mainly galena and sphalerite, with a small amount of pyrite. The gangue minerals are mainly quartz and less calcite; after the mineralization was carbonatation with pure calcite.

(2) The mineralization zone of the Sachakou Pb-Zn deposit spreads nearly east-westwards. The main ore body is nearly 600 m long with an average thickness of 19 m. The oresare mainly composed of veins, husks, and breccia (Figs. 1c, d, e, f). The grade of Zn is 4.04%, and the grade of Pb is 1.26%. The reserves of lead+zinc metal exceed 1.4 Mt, achieving the scale of large lead-zinc deposits.

(3) Microthermometric measurement of fluid inclusions (Fig. 1b; Appendix 1) shows thatthe ore-forming fluid has the characteristics of medium-low salinity, medium-low temperature, and obvious magmatic water and atmospheric water mixed fluids. After the mineralization period, the fluid has the characteristics of medium salinity and low temperature. It has the characteristics of basin brine mixing with atmospheric water. The H-O isotopes of ore-forming fluids show characteristics of magmatic water mixing with atmospheric water (Pei Yingru et al., 2016), which is consistent with the above understanding (Appendix 2).

(4)The Sachakou Pb-Zn deposit, MVT deposits and SEDEX deposits are both epigenetic deposits, and they are very similar in ore structure, mineral composition, and ore-forming elements (Leach et al., 2005; Wang Xiaohu, 2007). However, the most important difference is that the Sachakou Pb-Zn deposit is related to magmatic activity, and that the ore-forming fluid is a mixed hydrotherm of magmatic water and atmospheric water at a temperature of

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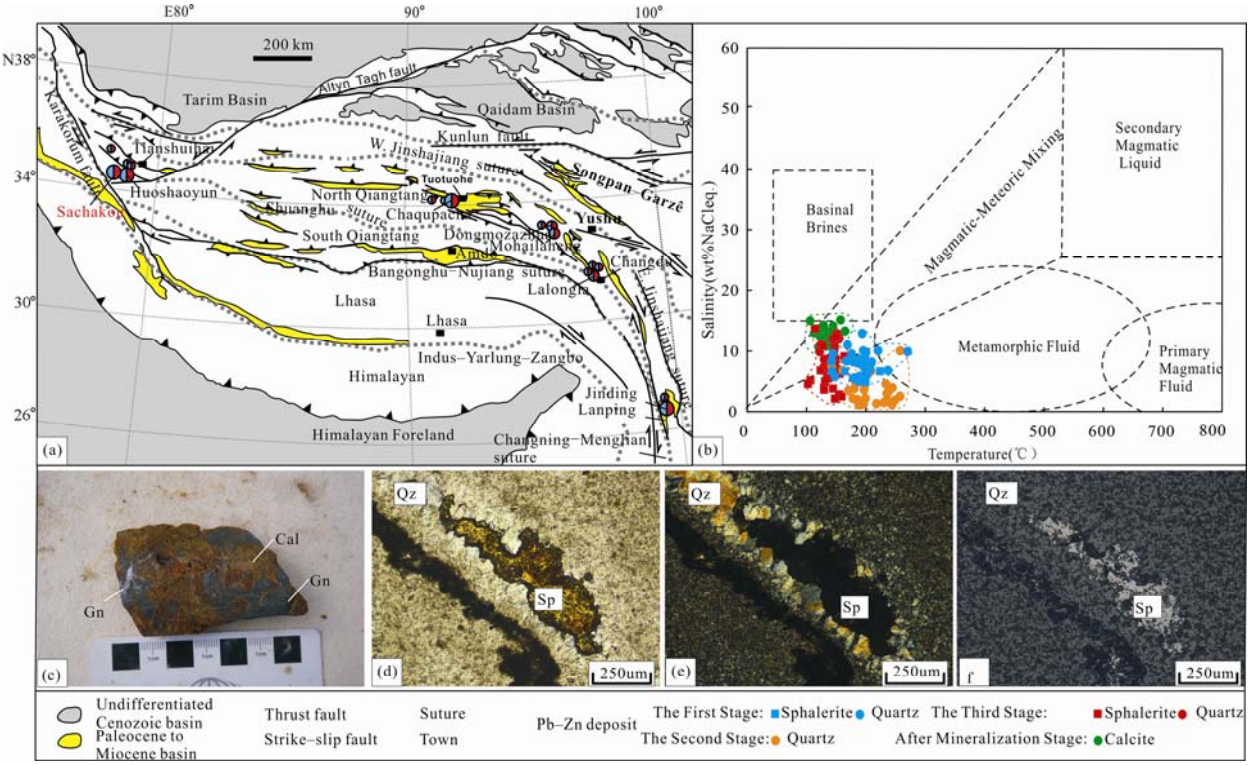


Fig. 1. Features of the Sasaokou Pb-Zn Deposit in West Kunlun of Xinjiang.
(a), Sakoukou Pb-Zn deposit geotectonic location(Spurlin et al.,2005); (b),Temperature-Salinity illustration of fluid inclusions in Sachakou Pb-Zn Deposit; (c), Breccia ore; (d), Quartz sphalerite vein under single polarized light; (e), Quartz sphalerite veinunder orthogonal polarized light; (f), Quartz sphalerite veinunder reflected light; Gn, Galena; Sp, Sphalerite; Qz, Quartz; Cal, Calcite.

100–270°C and a salinity of 1–13wt%NaCleq.

Conclusions

In summary, the ore-forming fluid of the Sayukou Pb-Zn deposit is a mixed fluid of magmatic water and atmospheric water. After the mineralization period, the deposit has undergone transformation of the basin fluids. Different from MVT lead-zinc deposits and SEDEX lead-zinc deposits, this deposit is a Pb-Zn deposit associated withmagmatic metasomatism of carbonate rock, and its formation is closely related to the concealed rock mass and regional structure.

Acknowledgments

Thanks are given to the 8th Geological Brigade of Aksu,Xinjiang, the Institute of Geology of the Chinese Academy of Geological Sciences and the Beijing Research Institute of Uranium Geology,CNNC for their great support.

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Appendix 1 Microthermometric results of fluid inclusions in the Sachakou Pb-Zn deposit

Stage	Mineral	Number	T_m(°C)		$T_{m,ice}$(°C)		T_h(°C)		Salinity(wt% NaCleq.)	
			Range	Mean	Range	Mean	Range	Mean	Range	Mean
1	Quartz	28	−26.5 – −13.3	−22.1	−9.1 – −3.1	−5.3	142.2 – 269.3	198.1	5.1 – 12.9	8.2
	Sphalerite	11	−25.4 – −19.4	−21.9	−5.4 – −3	−4.2	164.5 – 235.6	196.9	4.9 – 8.4	6.7
2	Quartz	30	−25.4 – −16.4	−21.5	−6.7 – 0.7	−2.3	142.3 – 257	206.5	1.1 – 10.1	3.8
3	Sphalerite	21	−26.5 – −15.3	−21.5	−8.6 – −1.3	−3.9	102.6 – 163.6	139.1	2.2 – 12.3	6.2
	Quartz	20	−28.5 – −19.4	−23.4	−9.9 – −3.4	−6.4	115.4 – 154.2	139.2	5.5 – 13.8	9.7
After mineralization	Calcite	25	−57.8 – −45.4	−52.1	−11.3 – −6.9	−9.0	106.3 – 164.9	133.1	10.3~15.27	12.8