China University of Geosciences (Wuhan) SEG Student Chapter Field Trips

With the passing of the epidemic, our association has conducted four field internships this year. Although we only applied for one place in the past year due to the impact of the epidemic when applying for funds, this year with the support of the Resource College and local mining companies, we have also strived for several more field internship opportunities to better train and cultivate members' geological work abilities, including Huanxiangwa gold deposit, Manaoke Sedimentary rock-hosted gold deposite, Changba Sedex-type Pb-Zn deposit. See below for specific information about the field trips.

Field Trip Ⅰ

Date： 7/10/2023-7/16/2023

Place： Huanxiangwa gold deposit, Xiaoqinling, China.

Trip leader： Dr.Zhao Shaorui

Organizer： CUG SEG Student Chapter

Attendees： Wenshu Wang (members, Ph.D. candidate), Shengren Chang (members, Ph.D. candidate), Jinhao Liu (members, Ph.D. candidate)

Sponsors： SEG Stewart R.Wallace Fund and School of Earth Resources, China University of Geosciences (Wuhan)

North China Craton is the most important metallogenic province in China and one of the important gold producing areas in the world. The Claraton gold deposit in North China is usually divided into several gold mine collection areas, such as Liaodong-Jinan, Jiaodong, Little Qinling-Xionger Mountain, middle section of Taihang Mountain, northern Hebei-eastern Hebei and Chifeng-Chaoyang (Chen Yanjing et al., 1998; Yang et al., 2003). In fact, these gold deposits are mainly distributed along the edge of the eastern land block of north China, roughly forming two east and west metallogenic belts extending near north, north and east. Xiaoqinling-Xiongeshan gold mining area is located in the southern end of the west metallogenic belt, gold reserves are second only to Jiaodong, is the second largest gold mining area in China(Chen et al, 1992; Mao et al, 2002; Li J W et al, 2012a).The gold deposit formed in the early Cretaceous of North China is consistent with the peak period of Craton destruction, and has the characteristics of explosive mineralization. The metallogenic fluid mainly stems from the Craton destruction-related magma or mantle devolatilization, and this type of gold mine was named "Craton destructive gold deposit"（Zhu et al, 2015）.Huanxiangwa Gold Mine is one of the most important gold deposits discovered and explored in this area since the 1990s. More than 30 gold-containing tectonic alteration zones have been found, including 1 deposit. The current estimated gold resource is about 27 t (Zhang xiaowei, 2015).Due to the abundant geological phenomena and favorable observation conditions, the Huanxiangwa deposit, which Luanchuan Luanling Gold Mining Co. LTD is being developed, is a suitable place for economic geology students at any grade to understand orogenic gold deposits better.

Geology background

The Qinling Orogenic Belt (QOB) is located at the central part of the E-W trending Central China Orogen, and its formation involved the closure of the Proto-Tethys Ocean and Paleozoic to Mesozoic multiple subduction-collision-accretion between the North China Craton (NCC) and Yangtze Craton (YC) (Fig. 1a; Dong and Santosh, 2016; Dong et al., 2016; Tang et al., 2016; Li et al., 2016). The QOB consists of four

tectonic units from south to north: the northern margin of the YC, South Qinling Belt, North Qinling Belt and the Huaxiong Block representing the reactivated southern margin of the NCC. They are separated by the Longmenshan Fault, Mianlue Suture, Shangdan Suture, Luanchuan Fault, and San-bao Fault, respectively (Fig. 1b; Chen and Santosh, 2014). The Huaxiong Block is mainly composed of the Late Neoarchean to Paleoproterozoic Taihua Group (crystalline basement), the lowest cover of the Mesoproterozoic Xiong'er Group, and the Meso- to Neoproterozoic Guandaokou and Luanchuan Groups (Fig. 1c; Cao et al., 2015; Wang et al., 2016). The Neoarchean to Paleoproterozoic Taihua Group comprises graphite-bearing gneiss, marble, banded iron formation (BIF) and amphibolite in the upper unit, and tonalite-trondhjemite-granodiorite (TTG) gneiss and amphibolite in the lower unit (Tang et al., 2015; Zhang et al., 2018). The Xiong’er Group unconformably overlies the Taihua Group and is mainly preserved as a weakly metamorphosed volcanic sequence composed of andesites, basaltic andesites, dacites and rhyolites which were erupted at 1.83–1.74 Ga (Zhao et al., 2004; Wang et al., 2019). The Guandaokou and Luanchuan Groups unconformably cover the Xiong’er Group and are mainly composed of carbonate rocks and clastic sedimentary rocks (Yang et al., 2017a,b, 2019).

The Xiong'ershan area is located at the south part of the NCC (Fig.1a). It is bounded by the Luoning fault to the north and the Machaoying fault to the south. The Machaoying fault zone is the main geologic structure in the Xiong'ershan area, extending ~200 km WNW, and is a north-dipping thrust zone formed during a Mesozoic continental collision (Fig.1b). Numerous NE-striking secondary faults are widespread and serve as the controlling structure of gold deposits (Fig.1b). In the Xiong’ershan area, Triassic and Late Jurassic to Early Cretaceous granitoids are widely distributed in the northern and southern parts, without any volcanic equivalents. These granitoids mainly consist of large-scale granitic plutons, ore-bearing porphyries, and explosive breccias, which intrude into the Taihua Group and Xiong'er Group (Fig. 1c). For example, the Mogou pluton, which is exposed as several elliptical syenite stocks, represents Triassic alkaline magmatism derived from

partial melting of Archean to Paleoproterozoic crust together with mantle input (Tang et al., 2019). The Late Mesozoic granitic rocks, such as the Wuzhangshan, Huashan, Heyu, Leimengou plutons, show emplacement ages of 158 – 131 Ma (Mao et al., 2010; Deng et al., 2013). Extensive polymetallic mineralization occurred in the Xiong'ershan area, including orogenic gold lode deposits (Mao et al., 2002; Chen et al., 2008), porphyry, quartz-vein and carbonatite- vein Mo deposits (Mao et al., 2011; Hu et al., 2019), breccia pipe hosted gold deposits (Fan et al., 2011; Tian et al., 2017), and hydrothermal vein-type Au and Ag-Pb-Zn deposits (Li et al., 2013, 2016) (Fig. 1c). These deposits are mainly related to three tectonomagmatic- metallogenic events including Paleoproterozoic, Triassic and Late Mesozoic along the southern margin of the NCC and the QOB (Deng et al., 2013; Li et al., 2013; Cao et al., 2017; Zhao et al., 2019).

Huanxiangwa gold Mine is located in the middle of Xiongershan mining area, southwest of Wuzhangshan rock mass. The ore body type is mainly eroded rock type and quartz vein type, mainly distributed along the F985 fault. According to the extension. The large magma rock exposed in the mining area is the Wuzhangshan rock mass. The main exposed strata in Huanxiangwa mining area are the volcanic rocks of Xushan Formation and Jidanping Formation in the Middle Proterozoic area. The fault structure of the mining area is relatively developed, with complex fault shape, and different scale and mechanical properties, which together constitute the main structural structure of the mining area.Wuzhangshan rock mass is south-east-north-west in the north-east side of the mining area, and invades into the volcanic rock of Xiong ear group. The lithology is mainly speckled granite. At the same time, the mining area also developed a fine crystalline rock vein.

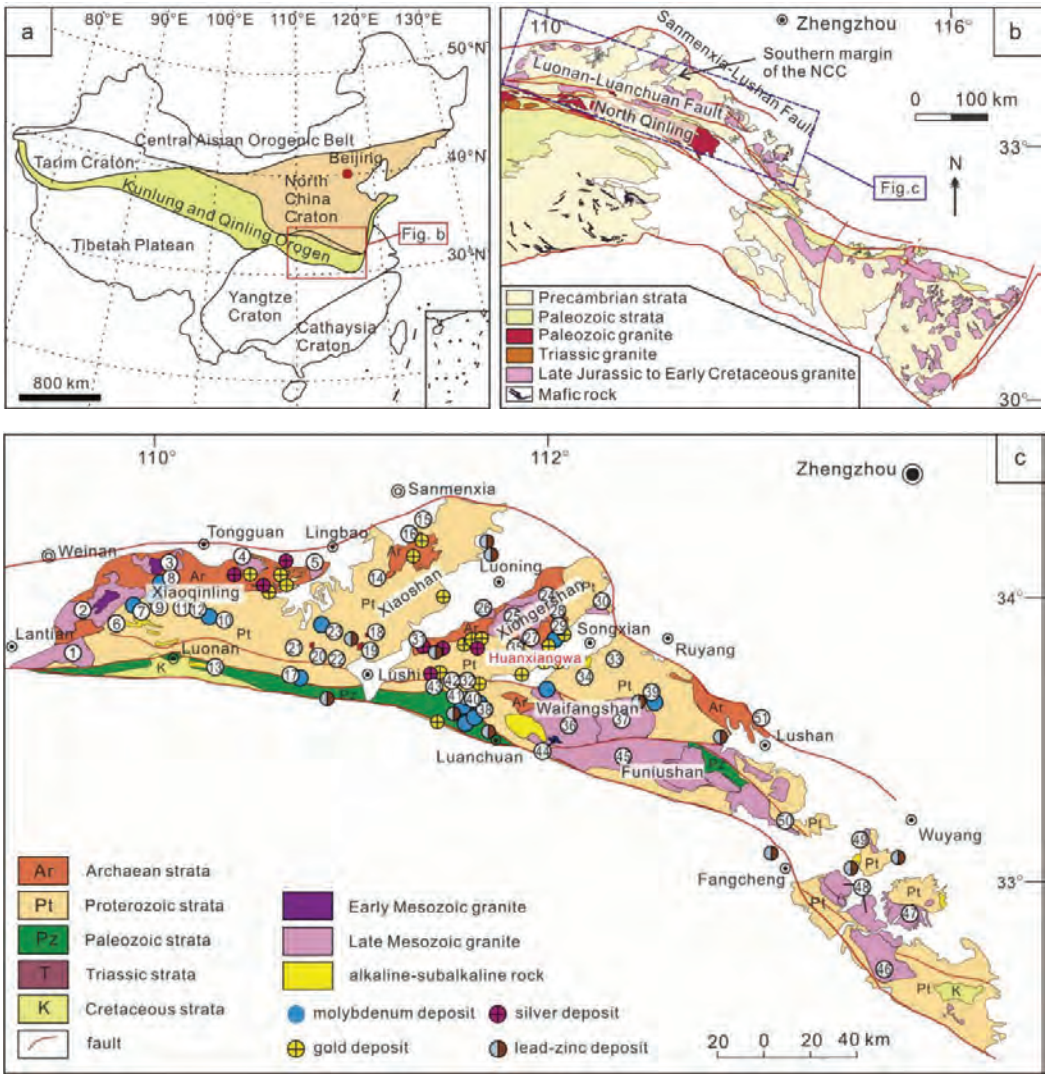

Fig. 1 Distribution of the Mesozoic granitoids and deposits in the southern margin of the North China Craton (NCC). (A) Tectonic outlines of China showing major tectonic units surrounding the NCC and the location of the Qinling Orogen Belt. (B) Geological map of the Qinling Orogen Belt (modified from Zhang et al., 1996). (C)Distribution of the Mesozoic granitoids and deposits in the southern margin of the NCC.(modified from Zhang et al., 1996).

Itinerary

Day 1:

- Attendees went to Luoyang City by high-speed train, then take a car to Songxian town and check in.(Fig. 2).
- Engineers of No. 1 Institute of Geological and Mineral Survey,led the members of the association to explore the mine and introduced the latest exploration progress.
- Observe the surface outside Huanxiangwa gold deposit to learn the wall rock condition.

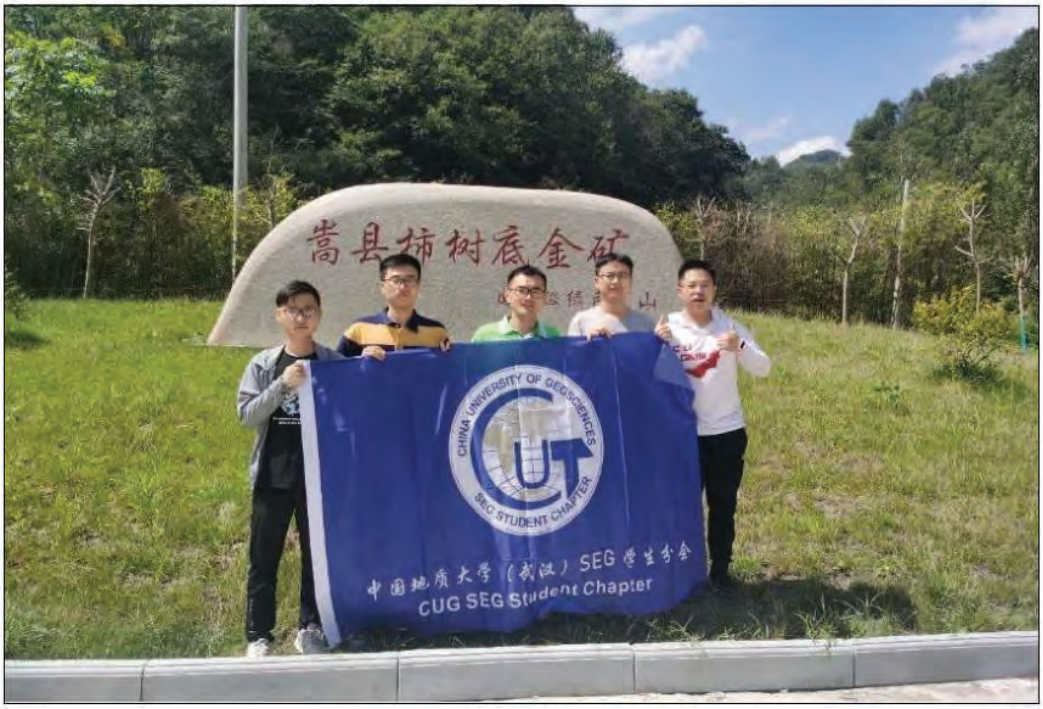

Fig. 2 Field group photo

Day 2~5:

- Search for primary ore bodies and sampling were carried out for different primary ore bodies in the mine. (Fig. 3).

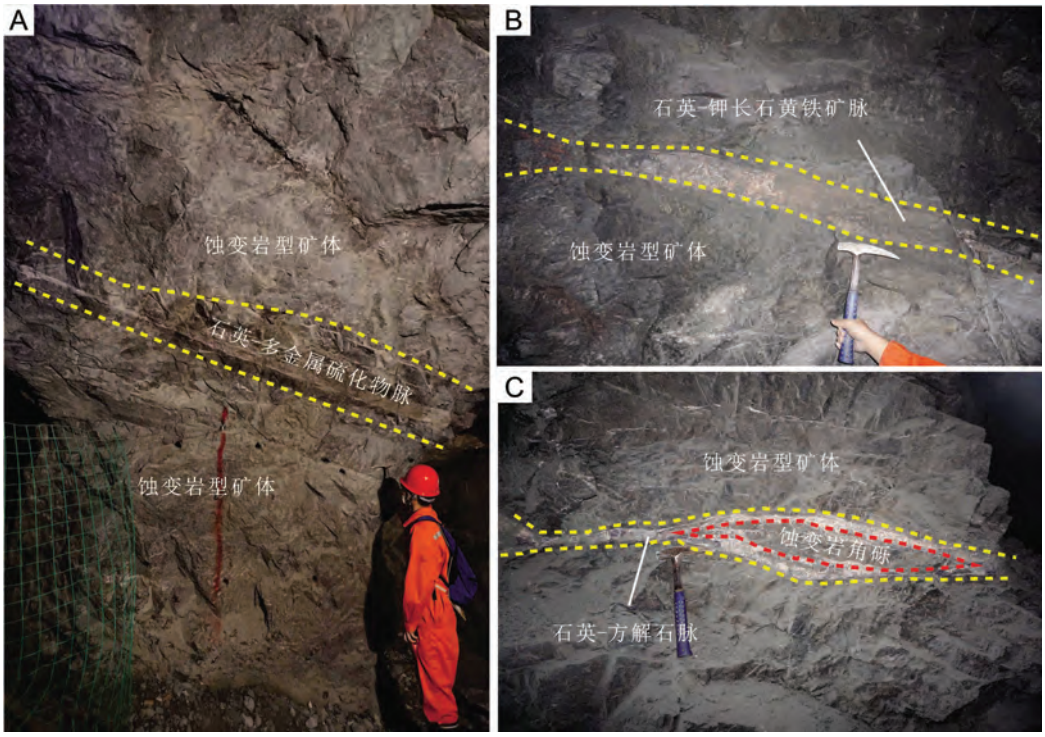

Fig. 3 Observation of field phenomena

Day 6~7:

- Go into the underground mine and observe the rich ore body being mined.
- Get some samples of granite and andesite from the outcrop outside the mine area.

Benefits for students

Through the geological practice in Huanxiangwa Gold mine these days, we have made a detailed observation on the features of ore-bearing strata, ore-controlling structure, ore-body formation, ore structure and surrounding rock alteration in Huanxiangwa gold mine.

Through the interpretation of Shaorui Zhao, Shengren Chang and Wenshu Wang, we understand how to carry out the investigation in the mining area, how to correctly observe and describe the geological phenomena, and as far as possible scientific sampling and collection of information, in order to facilitate the follow-up further work.

During the seven days of field work, Zhao Shaorui led us to observe and sample the strata, structure, wall rock alteration and ore type of the Huanxiangwa gold mine in

detail, so that we can have a more detailed grasp of the field work, and have a more profound understanding of the Huanxiangwa gold mine, laying a foundation for the subsequent scientific research work.