The Jinchuan Ni-Cu sulfide deposit is ranked as the third largest magmatic sulfide deposit in the world, which contains 558 million metric tons of Ni resource and 354 million metric tons of Cu resource at Ni and Cu grades of 1.06% and 0.75%, respectively (Tang and Li, 1995). The Jinchuan ultramafic intrusion is only 1.34 km² in outcrop, but the mineralized percentage of Ni and Cu is approximately 50%, which make it to be a representative style of "small intrusion to form large deposits" (Tang, 1990). The unique geological feature, huge economical values and significant prospecting potential of the Jinchuan Ni-Cu sulfide deposit have attracted many geologists (Tang, 1990; Chai and Naldrett, 1992a, b; Li and Ripley, 2011; Ripley et al., 2005; Song et al., 2006, 2009, 2012; Chen et al., 2013). More recently, according to the systematical studies of petrography, mineralogy, mining structures and PGE geochemistry of the Jinchuan deposit, Song et al. (2006, 2009, 2012) and Chen et al. (2013) proposed that the Jinchuan intrusion is originally comprised of two individual intrusions, as referenced to the Western intrusion and the Eastern intrusion, and the present appearance of Jinchuan intrusion is the consequence of post tectonic compression.

2 Geology of Jinchuan Deposit

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2 Geology of Jinchuan Deposit

The Jinchuan Ni-Cu deposit, dated at ~830Ma (Li et al., 2005; Zhang et al., 2010), is hosted in mafic-ultramafic intrusion which is located in Longshoushan Terrane at the south-western margin of Alashan block, western part of North China Craton (Tang and Li, 1995). The Jinchuan intrusion, with a length of 6.5km, a width of 20~527m and the largest vertical depth of more than 1100m, is intruded into mica-quartz schist, biotite-plagioclase gneiss and dolomitic marble of the Baijiazuizi formation. It strikes NW50º, dips SW(50º~80º) and is divided by a series of NE-trending strike-slip faults (F 8, F 16-1, F 23) into four segments (III, I, II, IV) from west to east. There are three main ore bodies in Jinchuan deposit, such as the No.24 ore body which is hosted in segment I and the No.1 and No.2 ore body are hosted in the segment II. The Jinchuan intrusion mainly consists of dunite, lherzolite, olivine websterite, pyroxenite and minor plagioclase-bearing lherzolite locally.

The eastern Jinchuan intrusion is about 3000m in length, 530m in the most width near F 15 fault, the western portion of it has a core of medium-to coarse-grained net-textured sulfide-dunite surrounded by medium- to coarse-grained lherzolite bearing disseminated sulfide, which comprise the No.1 ore body. The contact between dunite and lherzolite is transitional (Tang and Li, 1995; Song et al., 2009). In the eastern portion of it, the fine-grained dunite (~80% olivine, 0.5~3mm in diameter) overlies medium- to coarse-grained lherzolite (50~75% olivine) with sharp contact relationship each other in the middle. The medium-coarse grained sulfide lherzolite is situated in the lower and base of the intrusion, which comprise the No.2 ore body.

3 The Geochemistry of PGE in No.2 Ore Body

The sulfide ores in this study are sampled from the middle (exploration line of No.41) and eastern
(exploration line of No.52), underground, which are collected from the north to the south in each exploration line. The sulfide ore are divided into disseminated sulfide ores (S<5%) and net-textured sulfide ores (S>5%), the data published in Song et al. (2009) are also cited. The contents of Ni, Cu, ∑PGE in 41 exploration line are 0.7% ~2.4% , 0.4% ~2.5% , 20.5ppb~355.5ppb respectively, which is much higher than those in 52 exploration line containing 0.03% ~0.9% Ni, 0.01% ~0.8% Cu, 3.5~27.04ppb ∑PGE. In 41 exploration line, from the north (base) to the south (upper), the contents of Ni, Cu, PGE generally gradually decrease from 2.4% , 2.1%, 148.3ppb to 0.8%, 0.5%, 20.5ppb respectively, but the content of Cu show somewhat fluctuation.

4 Discuss and Conclusions

The S have a positive correlation with Ni, Cu, and PGE, and the Pd/Ir (2.7~31.6) is lower. These observations imply that these elements have not been affected significantly by post thermal fluids. The positive correlation between Ir100 with Ru100, Rh100, Pd100 in all samples indicate that the fractional crystallization of sulfide melts is non-significant. Thus the variation of PGE in different portion of No.2 ore body can be explained by in different R factor (mass ratio of silicate magma to sulfide melt) during the segregation of sulfide droplets from silicate magma.

On the basis of 100% sulfide, the Cu, Ni contents of these sulfides ores is not obviously changed from the western to the eastern part of No.2 ore body, 2.9%~9.44% Ni, 2.3%~7.77%Cu. However, the ∑PGE contents show a decreasing tendency from 1885 ppb in exploration line No. 36 (Song et al., 2009) to 652 ppb in exploration line No. 41 to 162.9 ppb in exploration line No. 52. The Cu/Pd value show an increasing tendency from the west to the east, such as from 15.7×10³ to 384.5×10³ in exploration line No. 36, from 83.8×10³ to 408.5×10³ in exploration line No. 41, and from 350×10³ to 570.6×10³ in exploration line No. 52. The higher PGE content can be caused in higher R factor, that is, the sulfide reacted with larger amount of the new parent magma. This implies that the ore-forming magma flowed from the west to the east in the No.2 ore body. The decrease of ∑PGE from the north (base) to the south (upper) in exploration line No.41 may be as the consequence of reduction of flow velocity lead to the concentration of sulfides.

References