The Yanshanian intermediate-acid rocks are distributed in a NW trend along Xiangcheng in Sichuan to Luoji in Yunnan, and we thus call it Xiangcheng-Luoji Yanshanian granite zone in this paper (Fig. 1). In northern part, the wall rock of intrusions is mainly Lamaya Formation (T3lm), and in southern part, the wall rock is Tumugou Formation (T3t). At present, we have discovered more than 10 outcropped or buried intrusions in various sizes, including Cilincuo batholite, Sandaoqiao stock, Rirongcuo stock, Zhujiding stock, Xiuwacu and Relinlin batholite, Hongshan and Tongchanggou intrusions, from north to south of this intrusive zone. They are largely outcropped at high altitude, and mostly buried or semi-buried at low altitude. Typically disseminated molybdenite is found in granite intrusions, and molybdenite veins and quartz-molybdenite veins are developed along fissures. Chalcopyrite veinlets and nodular molybdenite are found in hornfels near intrusions. In southern part, Honshan and Tongchanggou intrusion (apophyse) host Au, Cu mineralization in addition to Mo mineralization in intrusions.

In past studies, the Geza Indosinian volcano-magmatic arc in the southern section of the Yidun island arc is called Geza island arc, and the associated Cu-Mo, Pb-Zn, and Au-polymetallic ore deposits are characteristics of the porphyry mineralization systems (Li et al., 2013). East of the Yidun island arc, the Ganzi-Litag suture zone hosts Fe, Cr, orogenic Au deposits and occurrences, which are related to ultramafic and mafic rocks in ophiolite-melanges. These deposits represent tectonics-magma-metallogenesis related to closure-oreogenic evolution of Indosinian Ganzi-Litag ocean. Eastward, the Yanyuan-Lijiang continental depression zone along the western margin of Yangzi land block is typified by the occurrences of Cu-Ni sulfide and PGE deposit related with Permian Emeishan basalts, which is thought to have produced from the mantle plume activity, and those deposits represent the Late Variscan magma-metallogenesis. Following the closure of the Ganzi-Litag Tethyan ocean, the tectonic terrains, i.e., the southern section of Yidun island arc, Ganzi-Litag suture zone and Yanyuan-Lijiang continental depression zone of the western Yangtze land block, were matched and succeeded by the collisional and inland orogeny. In Late Yanshanian, the S-type granites in this area were formed from the inland collisional orogeny with partial melting of thickened continental crust. The granodiorite, monzonitic granite outcrops are found in northern part of Xiuwacu and Relin between Yunnan and Sichuan, and southward in Yunnan, the buried porphyries are found mainly in Hongshan, Tongchanggou, where the outcropped granodiorite porphyries (dikes) are associated with porphyry-skarn Mo-Cu polymetallic deposits. Since 65 Ma, the large scale strike-slip, shear and napping are typical for the Sanjiang orogenic belt and the western margin of the Yangzi land block, and as a result, the Himalayan alkaline porphyries were emplaced, which were associated with a number of Au-Cu deposits, such as the large scale Beiya Au (Cu) deposit in Yanyuan-Lijiang continental depression zone, Changan Au deposit in Ailaoshan shear zone and Machangqing Cu-Au deposit. Those deposits are included in the “Jinshajiang alkaline porphyry mineralization belt”. The northern part of Ganzi-Litag suture zone extends from NNW at Muli in Sichuan to south at Luoji area in Yunnan, and then to westward. Chlorite glaucophane schist and ophiolitic mélangé zone are found in Luoji area, along the Geza regional fault at Tuguan in Yunnan, where Yidun island arc belt was matched with Yangtze land block. Yanshanian porphyry Mo-polymetallic deposits and Himalayan alkaline porphyry Au(Cu, Mo) deposits are found in all tectonic units (Fig. 1).

In brief, the Yanshanian intrusive rocks typically vary from monzonitic granite, granodiorite, to granite aplite and granite porphyry, with the assemblage indices σ varying from high to low, and the alkali contents decreasing as well. Their σ values of <3.3 indicate the normal calc-
alkali series, and with one or two exceptions; their
differentiation indices (DI) are similar, slightly lower in
the granite aplite, indicating a good differentiation degree.
Their consolidation indices (SI) vary from low to high,
showing the crystallization sequence of the magma from
monzonitic granite, granodiorite to granite aplite and
granite porphyry. Their alkalinity ratios (AR) generally
decrease; and their Al-alkali indices A/CNK are mostly
close to 1, showing the magma belong to aluminous-weak
peraluminous type. Their H2O contents are also similar, in
2.78-4.55, indicating a water-depleted magma with the
liquidus temperature ranging in 702-913°C.

In general, geological, petrographical and geochemical
characteristics of the Yanshanian granites, the accessory
minerals and Sr initial value of 0.7084 for the samples
from the Relin intrusion, show the transitional feature of I
type and S type. Thus, we believe that the Yanshanian
magmatism was generally in the environment of a
volcano-magmatic arc, not typical of the island arc
environment; however, the Yanshanian granite zone
inherited the characteristics of island arc environment, and
was produced from the crust-mantle mixed material within
a orogenic zone. This is evidenced by the fact that the
Yanshanian granites are typically the weak-peraluminous
granites, similar to the Himalayan “Jinshajiang alkalic
porphyry zone” that occurs cross various paleotectonic
units, possibly resulted from postorogenic extension in a
thickened crust (Fig. 2).

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