

Research Advances

New Zircon SHRIMP U-Pb Ages of the Langjiu Formation Volcanic Rocks in the Shiquanhe Area, Western Lhasa Terrane and their Implications

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Objective

The potassic and ultrapotassic rocks relating to the India-Eurasia collision and continual plate convergence are widely distributed in the Lhasa terrane. These rocks are very important to understand the deep processes of the India-Eurasia collision and the uplift and evolution of the Tibetan Plateau. Although high-potassic volcanic rocks are also exposed in the western Lhasa terrane, their formation time is still uncertain for the lack of reliable dating. We carried out zircon U-Pb geochronological study on the Langjiu Formation volcanic rocks, which are part of the Early Cretaceous Zenong group volcanic rocks based on 1:250000 scale Shiquanhe regional geological survey report, in the Shiquanhe area of the western Lhasa terrane. These new age data not only offer chronological basis for the regional stratigraphic correlation and classification, but also provide an essential opportunity for revealing signatures of magmatic pulses hidden in the deep crust of the Lhasa terrane.

Methods

Two fresh rhyolite samples (ZN34 and ZN42) were collected from the Langjiu Formation volcanic rocks near Zuozuo village (32°22'N, 80°22'E) located about 45 km southeast of the Shiquanhe town in the western Lhasa terrane. Zircons for SHRIMP U-Pb dating were extracted using heavy liquid and magnetic separation from coarsely crushed samples (60 mesh), and finally selected by hand-picking under a binocular microscope. The selected zircons were mounted onto an epoxy resin disc together with several grains of standard zircon and then ground down and polished to expose their interiors. Cathodoluminescence (CL) images were taken to check

the internal structures of each grain and select potential target domains for subsequent SHRIMP U-Pb dating. Zircon SHRIMP U-Pb dating was conducted at the Beijing SHRIMP Center, Institute of Geology, Chinese Academy of Geological Sciences, Beijing, China. Data were reduced using Squid and Isoplot programs. Uncertainties for each analysis are at 1σ , and the weighted mean age is quoted at 2σ .

Results

The zircon grains are euhedral to subhedral. These features, combined with the regular oscillatory zoning in CL images (Figs. 1a and 1d), show that they are magmatic in origin. Furthermore, except for one zircon grain (Th/U ratio 0.06), all the other zircons have higher Th/U ratios (0.17–1.77) than metamorphic zircons (generally <0.1), which is consistent with the values obtained from magmatic zircons.

The weighted average $^{206}\text{Pb}/^{238}\text{U}$ ages of the youngest age groups are interpreted as the forming time of the volcanic rocks. The results of SHRIMP zircon U-Pb dating for the samples ZN34 ($n = 5$) and ZN42 ($n = 18$) yield a weighted mean $^{206}\text{Pb}/^{238}\text{U}$ age of 22.6 ± 0.9 Ma (MSWD = 0.42) and 24.2 ± 0.4 Ma (MSWD = 0.44), respectively (Figs. 1b, c and 1e, f). These ages indicate that the sampled high-potassic volcanic rocks were erupted during the Late Oligocene to the Early Miocene, rather than during the Early Cretaceous as given by the 1:250000 scale Shiquanhe regional geological survey report.

The concordia age of the sample ZN42 is relatively consistent. However, the inherited zircons of the sample ZN34 show two obvious major populations of 40–68.3 Ma and 138.5–161.8 Ma (Fig. 1b). The inherited zircons of the 40–68.3 Ma is more outstanding, and also match with the reported age (53.9 ± 0.5 Ma) from high-potassic volcanic

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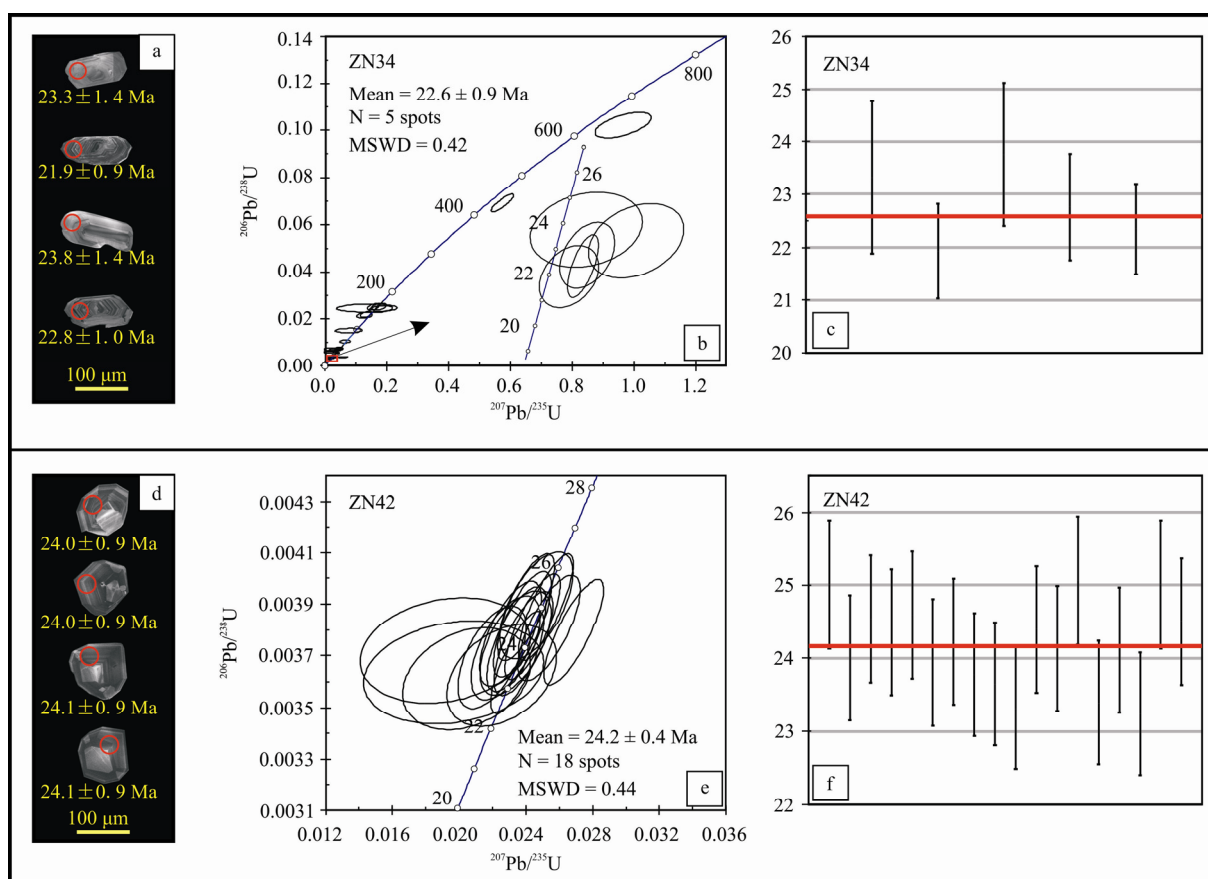


Fig. 1. Cathodoluminescence images (a, d) and concordia diagrams (b, c, e, f) of SHRIMP zircon U-Pb grains for the sampled volcanic rocks in the Shiquanhe area of the western Lhasa terrane.

rocks located about 29 km southeast of our studied area. This age group should be the same magmatic activity of the Linzizong group (43–64 Ma) volcanic rocks that can be best interpreted as reflecting the India-Eurasia collision. Other inherited zircons are dated from 138.5 Ma to 161.8 Ma, which matches well with magmatic records as reflecting the collision between the Lhasa terrane and the Qiangtang terrane.

Conclusions

Our new SHRIMP zircon U-Pb ages show that the two rhyolites sampled from the Shiquanhe area were erupted at 22.6 ± 0.9 Ma and 24.2 ± 0.4 Ma, respectively. Therefore,

they do not belong to the Early Cretaceous Zenong group volcanic series as given by the 1:250000 scale Shiquanhe regional geological survey report, but are the postcollisional products of magmatic activity in the western Lhasa terrane. The inherited zircons show two major age populations of 40–68.3 Ma and 138.5–161.8 Ma, which are well consistent with the two known magmatic records as reflecting of the India-Eurasia and Lhasa-Qiangtang collisions, respectively.

Acknowledgements

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