Geochemistry characters of Cenozoic Tuoyun alkaline basalts, southwest Tian Shan, northwest China

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Cenozoic Tuoyun alkaline basalt lolcates in Southwest Tian Shan, northwestern China. There are seven volcanoes in Tuoyun basin and form a series of volcanic apparatus included calderas, volcanic necks and cone sheets hosted megacryst of pyroxene, anorthoclase as well as kaersutite, and deep-seated mantle xenoliths such as augite and peridotite [1]. The SHRIMP dating of the sample collected in basaltic cone sheet is 48.1Ma which suggested magma activity in Tuoyun basin are only one stage rather than two periods in previous studying, 100-120Ma and 67-46Ma [2]. Tuoyun volcanic rocks are classified as alkali basalts comprised of tephrite-basanite, phonotephrite, trachybasalt and basalt series. Mg-numbers vary from 52 to 72, and the samples hosted peridotite xenoliths have higher Mg-number.

Strong positive Nb-Ta anomalies for Tuoyun basalts in spider disgram. The characters of LREE enrichment and smoothed REE pattern without Eu anomaly were shown. The samples hosted peridotite xenoliths show higher LREE enrichment $[(La/Yb)_N=16–28]$ than other basaltic samples [(La/Yb)N = 8–16]. Nd isotopic compositions are relatively homogeneous with $^{143}Nd/^{144}Nd$ ratios ranging from 0.512701 to 0.512886. Sr isotopic compositions are relatively wide variation with $^{87}Sr/^{86}Sr$ ratios ranging from 0.703690 to 0.705455. The ratios of $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$ are in the range 18.2402-18.4900, 15.4961-15.6147 and 38.1662-38.5564, respectively.

On the basis of combination on geochemistry characters, complex SHRIMP age sprerum of single zircon [3-4] and the depth range of partial melting in mantle source [5], the formation of Tuoyun basalt is a production of lithosphere delamination, rather than small mantle plume [2].

[1] Liang *et al*. (2005) Xinjiang *Geology* **23**, 105–110. [2] Edward & Nicolas (2000) *Lithos* **50**, 191–215. [3] Liang *et al*. (2007) *Acta Petrogica Sinica* **23**, 1381–1391. [4]-Liang *et al*. (2010) *Earth Science Frontier* **17**, 24–48. [5] Liang *et al*. (2008) *Acta Petrogica Sinica* **24**, 2820–2838

Grain growth and dissolution during crystal-melt interaction

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Grain growth or dissolution arises in a crystal-melt aggregrate when there is a difference in chemical potential between the crystals and the melt. The kinetics of grain growth and dissolution in 1-D and 2-D mono-mineralic and bio-mineralic systems is examined using numerical methods. Diffusion equations for the independent components in the melt and crystals were solved numerically in using finite difference and finite element methods. The input parameters are the liquidi and solidi of the crystals, initial crystal and melt proportions and distributions, and diffusion coefficients of the components in the melt and crystals.

The kinetics of crystal-melt interaction in 1-D setup is relatively well understood. It is characterized by dissolution and reprecipitation [1]. Dissolution-reprecipitation arises because the rate of diffusion in the melt is much faster than that in the solid. If the melt is initially under-saturated with respect to the crystals, the crystals dissolve and the bulk melt composition quickly evolves to the local liquidus or liquidi of the dissolving crystals. Since the interiors of the crystals are still over-saturated with respect to the melt, dissolution reverses to precipitation that is rate-limited by diffusion in the crystal. Under 2-D settings, the size and distribution of the crystals are also important in re-distributing the dissolved materials between the melt and the solid. Smaller crystals may be completely consumed by the melting or dissolution reaction on a diffusion-in-melt limited time scale, whereas larger crystals are preferentially preserved. Reprecipation happens primarily around undissolved larger crystals. The averaging size of the dissolving crystal (s) therefore may increase (rather than decrease) during crystal-melt interaction. Depending on deformation mechanism, the presence of a stress field may hinder grain growth during melt-rock interaction, though the relationship between diffusion-limited grain growth and deformation is still not well understood.

An important consequence of dissolution-reprecipitation is the acceleration of crystal-melt re-equilibration in partially molten silicates, though selective preservation of large grains may lead to exceptions. Animations showing the effects of dissolution-reprecipitation on element distribution during partial melting and crystal-melt interaction under 1-D and 2-D settings will be presented.

[1] Liang Y. (2003) G3, doi, 10.1029/2002GC000375.