

Contribution of continental collisional magmatism to crustal growth

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Continental growth is generally assumed to be dominated by arc magmatism as arc environments are the sites of greatest rock production of the continental crust. However, crustal destruction rates in these settings result in net crustal production rates close to zero. Here, we test the hypothesis that continental collision magmatism may play a significant role in crustal growth in the Phanerozoic. While rates of magmatism in such settings are lower than those in arc settings, preservation potentials are significantly higher. To test this hypothesis, we have studied rocks formed during collision to post-collision magmatism in Eastern and Central Anatolia.

An important issue in quantifying crustal growth rates is distinguishing between the recycling of pre-existing continental rocks and the juvenile inputs from the mantle. Traditionally, this question has been investigated using the record preserved in zircons (e.g., ages, Hf and O isotopes), but many post-collisional rocks are considered undersaturated regarding their zircon content, so these are not represented in zircon-based records of crustal growth.

In this study, we compare Nd isotope-based approaches used to determine crustal recycling and juvenile inputs (Condie et al., 2017) versus major element composition-based approaches (Reimink et al., 2023). To compare tectonic environments, we first apply the methods to a range of modern arc settings (Izu-Bonin, Antilles and Central Andes). The Nd isotope approach yields results which are generally consistent with accepted interpretations. In comparison, the major element approaches give more variable results. The test results and comparison with Central and Eastern Anatolia will be discussed at the meeting.

By combining digital geologic map data with a comprehensive geochronological database, we estimate crustal growth rates in this area over the past 7 Myrs to be approximately four times greater than previously assumed for tectonic settings (Scholl & von Huene, 2009).

Coupling the high potential preservation rate potential with the dominant juvenile fraction, it is apparent that crustal collision magmatism may play a greater role in current rates of crustal growth than generally assumed.