Geochemistry and petrogenesis of a nested granite intrusion – the Sedmihoří composite Stock (Bohemian Massif)

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Better understanding of how zoned plutons are constructed and for how long the upper crustal magma chambers remain active is crucial to constrain a range of lithospheric processes, including igneous petrogenesis, ore formation, crustal rheology/deformation and volcanism.

The shallow-level Sedmihoří Stock in the southwestern Teplá–Barrandian Unit, Bohemian Massif, provides an excellent case example of a zoned post-tectonic granitic intrusion. It is roughly circular in plan-view and formed by nested intrusions of three magma pulses within a single conduit: (i) less evolved outer porphyritic Bt monzogranite (326.2 ± 1.2 Ma (2σ), LA ICP-MS Zrn), (ii) more fractionated inner Bt–Mu monzogranite (326.6 ± 1.2 Ma), and (iii) innermost minor Mu leucogranite with Tur. All the varieties are siliceous (SiO_2 > 71 wt. %) and moderately peraluminous. While major-element contents do not vary greatly, trace elements display significant differences between the pulses (e.g., La_N/Sm_N = 4.24–4.45 outer; 3.38–3.44 inner; 2.95–4.43 innermost). Still, each of them preserves its remarkable homogeneity.

Field observations, fabric patterns and geochemistry suggest that each pulse represents a single batch of magma with its own geochemical characteristics and potentially also petrogenesis. This rules out a shallow-level fractionation or contamination by the country-rock metasediments, and points to processes deeper in crust or differences in source materials.

The trace-element compositions with evolved crust-like Sr–Nd isotopic signatures show that the granite pulses were derived by anatexis of immature metasediments (Neoproterozoic metasediments of the Teplá–Barrandian Unit; shown by the presence of inherited components in Zrn 2 and 0.6 Ga old). The higher proportion of pelite within the source of the inner Bt–Mu monzogranite is shown by higher Rb/Sr ratios (9–15) as well as more evolved Sr ($^{87}Sr/^{86}Sr_{326}$ = 0.7098–0.7154) and less radiogenic Nd ($\varepsilon^{Nd}{}_{326}$ = -3.7) than in the outer facies ($^{87}Sr/^{86}Sr_{326}$ = 0.7067–0.7076; $\varepsilon^{Nd}{}_{326}$ = -2.5 to -2.7). Research funding: Czech Science Foundation (GAČR) P210/11/1168.

Using laser-based technology to quantify carbon-13 ratios and fugitive emission CH_4 flux rates quickly and easily

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The United States is home to what is estimated to be the largest known shale gas reserves in the world. Often referred to as the "bridge fuel" that will aid in the country's energy transition from coal to renewable sources like wind and solar, natural gas production is growing at the fastest pace in U.S. history. This expansion involves the introduction of hundreds of thousands of new natural gas wells and processing facilities all across the U.S. Of primary concern is the potentially damaging impact of natural gas drilling on human health due to increase pollution exposure.

Picarro has developed a new instrument (plume scanner) which uses laser-based technology to measure natural gas fugitive emission flux rates from natural gas facilities quickly and easily. As the plume scanner vehicle drives through the plume at the speed of traffic, the air is sampled at 4 different heights along the axis of the vehicle. These gas samples are continuously stored in the vehicle along with wind and vehicle velocity information. When a plume is detected, the stored gas samples are redirected into the inlet of a cavity ringdown spectrometer where concentration and or carbon-13 CH_4 ratio measurements are recorded, synchronized, and/or processed to produce an intensity map or a so-called "scanned" plume image. In this way, fugitive emission flux rates and isotopic measurements of highly localized sources such as natural gas facilities can be made quickly and easily providing greater transparency to stakeholders.

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