English abstract

A highly unusual fabric pattern and inferred flow mechanism was discovered in the shallow-level Říčany granite pluton, Bohemian Massif, using an integrated structural and anisotropy of magnetic susceptibility (AMS) study. The pluton consists of outer strongly porphyritic and inner weakly porphyritic biotite granite separated by a wide gradational contact. Both varieties share steep margin-parallel mesoscopic (defined by K-feldspar phenocrysts and biotite) and magnetic (AMS) foliation carried by biotite. The steep foliation bears shallowly-plunging magnetic lineation arranged in a spiral-like way along the pluton margin and steep magnetic lineation in the weakly porphyritic pluton center. A new mechanism of magma flow is proposed, in which the bulk ascent along a steep-sided, cylindrical conduit was partitioned into the high-viscosity, phenocryst-rich outer margin flowing helicoidally while the low-viscosity, phenocryst-poor center flowed vertically. This interpretation is supported quantitatively by a simple model of magma flow within a cylindrical pipe, in which the linear decrease in phenocrysts content from pluton margin inwards causes exponential decrease in the effective viscosity of granite magma. Consequently, according to the Poiseuille equation, such an exponential viscosity distribution across the conduit produces a central zone of high magma ascent velocity. The magnetic (AMS) fabric pattern in the Říčany pluton thus may preserve a record of helicoidal (spiral-like) magma ascent driven by viscosity partitioning in a steep conduit, which presumably linked an underlying magma chamber with a volcanic feeder at the surface. Except for one deep-seated granite-migmatite complex, no such helicoidal fabric pattern has been documented in a granite pluton as yet. In conclusion, it is proposed that the viscosity-partitioned helicoidal flow may be a more common magma ascent mechanism in shallow-level volcano-plutonic systems than previously envisaged.