

New constraints on kinematics and timing of the Periadriatic Fault System from the petrology and Lu-Hf apatite geochronology of Giudicarian magmatic lamellae and the Presanella intrusion (Southern Alps, Italy)

Stipp, M.¹, Nommensen, L.², Münker, C.³, Pomella, H.⁴ & Fügenschuh, B.⁴

¹ Helmholtz-Zentrum für Ozeanforschung Kiel, Wischhofstr. 1-3, 24148 Kiel, Germany (mstipp@geomar.de)

² Geolog. Institut, Universität Freiburg, Albertstr. 23b, 79104 Freiburg, Germany

³ Inst. f. Geol. u. Mineral., Universität zu Köln, Zülpicherstr. 49b, 50674 Köln, Germany

⁴ Inst. f. Geol. u. Paläont., Universität Innsbruck, Innrain 52, 6020 Innsbruck, Austria

The Periadriatic Fault System (PFS) extends from west to east over 700 km through the Alps. Along this prominent Tertiary corridor of strike-slip faulting all the major Alpine intrusions are emplaced. The Adamello batholith is the largest of these intrusions consisting of five major intrusive units with a progressive younging towards the NE from mid-Eocene to mid-Oligocene times. The Presanella tonalite is the youngest of these intrusive units. It is located where the W-E to WSW-ENE trending dextral transpressive Tonale fault segment of the PFS is truncated by the SSW-NNE trending Giudicarie fault. Along the northern Giudicarie fault (NGF) a sequence of magmatic lamellae is aligned. To constrain the intrusive relationships and the age of these magmatic lamellae with respect to the Adamello batholith, we analyzed major and trace element compositions of the igneous units and dated representative samples by Lu-Hf apatite geochronology. Five samples were taken from the NW Presanella, the NE Presanella, and the southern Rumo, northern Rumo and Meran lamellae. Petrologically, the Presanella samples represent tonalites, while the Rumo and Meran lamellae have quartz-dioritic compositions, but differences in modal composition are small. All five samples define a metaluminous, sub-alkaline trend. The most significant feature is the decreasing SiO₂-content from SW to NE with the exception of the northernmost sample from the Meran lamella displaying a slightly higher SiO₂-content than the northern Rumo lamella sample. Trace element characteristics indicate a syn- to post-collisional setting. Epsilon Hafnium-values of all bulk rock samples are negative and very similar ranging from -3.5 to -4.2, except for the sample from the NW Presanella with a slightly lower radiogenic composition ($\epsilon_{\text{Hf}} = -5.1$). As expected, apatite separates from the NE Presanella and the Meran lamella exhibit high Lu/Hf-ratios and radiogenic Hf isotope compositions. Calculated whole rock-apatite Lu/Hf-ages of the two samples range from 30-32 Ma, with errors of less than 1 Ma, and overlap within error. Since the closing temperature of apatite is very high (>650°C; BARFOD et al., 2005), these ages can be assumed to represent intrusion ages. The small variations in petrology and geochemistry of the Presanella intrusion and the magmatic lamellae as well as the corresponding apatite Lu-Hf ages suggest that both originate from the same magma source. Variations within the Adamello batholith and even within the Presanella intrusion are larger than the variations between NE Presanella and the three investigated magmatic lamellae samples from the NGF. This observation together with the field record of a tectonic rather than an intrusive emplacement with intense brittle deformation (POMELLA et al., 2011) imply that the magmatic lamellae have been tectonically dissected from the NE Presanella intrusion and transported up to 50 km northwards by sinistral transpressive displacement along the NGF.

BARFOD, G.H., KROGSTAD, E.J., FREI, R. & ALBARÈDE, F. (2005): Lu-Hf and PbSL geochronology of apatites from Proterozoic terranes: A first look at Lu-Hf isotopic closure in metamorphic apatite. - *Geochim. Cosmochim. Acta*, 69: 1847-1859.

POMELLA, H., KLÖTZLI, U., SCHOLGER, R., STIPP, M. & FÜGENSCHUH, B. (2011): The Northern Giudicarie and the Meran-Mauls fault (Alps, Northern Italy) in the light of new paleomagnetic and geochronological data from boudinaged Eo-/Oligocene tonalites. - *Intern. J. Earth Sci.*, 100: 1827-1850.