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The Tonalitic Lamellae along the Giudicarie Fault System: age data and tectonic implications

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The NNE-SSW striking Giudicarie Fault System (composed of the Northern and Southern Giudicarie Fault and the Meran-Mauls Fault) represents a distinctive bend and offset in the Periadriatic Fault System (PFS). It terminates the E-W striking Tonale Fault Zone to the east, and the ESE-WNW striking Pustertal-Gailtal Fault to the west. Along the Giudicarie Fault System Oligocene tonalitic bodies occur, subsumed under the term 'Oligocene Tonalitic lamellae'. Along the southern part of the Northern Giudicarie Fault only a few < 50 m thick and 200 m long lenses crop out, often strongly affected by brittle deformation. So far no tonalitic bodies have been found between the locality Rumo (Val di Non) and Pawigl (south of Meran), i.e. for some 20 km. From Pawigl to the NE the lenses are more continuous, up to 150 m thick and less affected by brittle deformation.

Fission Track analyses was carried out on samples from tonalitic lenses along the Northern Giudicarie Fault and the Meran Mauls Fault, together with some samples from Permian intrusive bodies.
Except for one tonalitic body (south of Meran) and the Permian Brixen Granite, the analysed samples yielded apatite ages ranging between 11.6 $\pm$ 1.1 Ma and 8.1 $\pm$ 1.4 Ma. Thermal modelling, using the HeFTy® program by Ketcham (version 1.5.6; 2008), indicates enhanced cooling between 19-14 Ma (Early-Middle Miocene) for the Oligocene bodies, followed by a significant deceleration of the cooling rates. Some samples point towards a second phase of accelerated cooling between 6-4 Ma.
The mid-Miocene change in cooling is possibly related to the change from the so-called Insubric (Prosser 1998) to the Valsugana deformation phase (e.g. Prosser 1998; Castellarin 2000). According to Prosser (1998), deformation during the Insubric Phase (Late Oligocene - Early Miocene) caused E-directed thrusting along the Giudicarie Fault System, while the Valsugana phase (Middle- Late Miocene) is characterised by left lateral transpressiv movements.

Zircon fission track ages from the Oligocene Tonalites display a younging trend from the Adamello Pluton in the south, 22.3 $\pm$ 1.4 Ma (near Malé), towards Meran, 16.7 $\pm$ 1.1 Ma. From Meran farther to the north, ages get older again (30.0 $\pm$ 2.4 Ma; near Mauls). This pattern indicates slightly more late-stage exhumation due to backthrusting in the area of Meran, a feature already indicated by the geological map.
The zircon Fission Track data from Permian intrusions are less straightforward. Both the Brixen and the Kreuzberg Granite yielded ages of ca. 100 Ma (data from the Kreuzberg Granite according to Viola et al. 2001), whereas the Ifinger Granodiorite yielded 19.8 $\pm$ 1.9 Ma near Meran, and 38.6 Ma at its northern end near Weissenbach (Viola et al. 2001). Moreover the Permian and the adjacent Oligocene intrusives yielded similar zircon ages (19.8 and 18.9) near Meran, and comparable apatite ages (11.3 and 8.7) which yielded similar modelled Tt-paths. This points to passive exhumation of both magmatic bodies, together with
the separating Periadriatic Fault, in the hangingwall of the SE-vergente Naiftal thrust, as mapped by Irschara & Pomella (2006).

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