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Tectonic implications of the metamorphic field gradient in the Austrian Drosendorf and Gföhl units, Moldanubian Zone

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The Moldanubian Zone in Austria is traditionally subdivided into several tectonostratigraphic subunits, which were juxtaposed to their nowadays position during the Variscan orogeny. The Gföhl unit at the highest tectonic position exposes the Moldanubian granulites at the top, underlain by the granitic Gföhl orthogneiss. At its base lies the Raabs unit, a sequence of mafic rocks (amphibolites and serpentinites) accompanied by metasediments. The Drosendorf unit represents a sedimentary sequence mainly consisting of paragneisses, amphibolites and marbles. At the lowest position the Ostrong unit is dominated by low-P paragneisses with local appearances of eclogites.

A comprehensive study along four W–E profiles from the Danube valley (P1) in the south, to the Thaya valley (P4) in the north, revealed a disparate distribution of metamorphic conditions within the Drosendorf and the Gföhl units (Raabs unit and Gföhl orthogneiss). Along P1 several lithologies of the investigated units show similar P–T conditions of 0.8–1.2 GPa and 750–800 °C, followed by a decompression stage to 0.6–0.8 GPa and ~750 °C. Towards the north the temperature within the Drosendorf unit is continuously decreasing to 650–700 °C, at pressure conditions of 0.4–0.8 GPa. P–T conditions for Raabs unit and Gföhl orthogneiss are decreasing as well but are increasing again at P4. At the western end of P4 they reach similar conditions as in P1 (0.6–1.0 GPa and 725–800), but a decrease towards the east can be observed. A slight W–E decreasing trend is also observable in P2 and P3. Th–U–Pb microprobe dating of several metasedimentary and orthogneiss samples resulted in a Carboniferous age (~340 Ma) for metamorphism. At one locality in the south an older monazite generation indicates an incipient collisional metamorphism in the Devonian (~370 Ma).

The observed N–S gradient indicates that the southern parts represent formerly deeper buried lower crustal parts, whereas towards the north middle crustal levels are exposed, which were exhumed in a first stage. In a second stage of exhumation in the northernmost area, the oblique thrusting of lower crustal segment including the Gföhl unit onto the already exhumed lower-middle crustal parts caused the formation of a duplex structure, which is responsible for the present appearance of the area around the Drosendorf window.