Contact metamorphism and fluid-rock-interaction in the eastern Monzoni contact aureole; the Gardena sandstone formation

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The Monzoni intrusive complex in the centre of the western Dolomites is composed of a series of intermediate to basic plutones, which were emplaced into the Permo–Triassic sedimentary rocks during Mid Triassic times. The Gardena sandstone formation is characterized by terrigenous and fluviatile sediments, where the carbonate content increases towards the stratigraphically higher levels. The result of the contact metamorphic overprint is the formation of new mineral assemblages. New mineral assemblages formed as a result of contact metamorphic overprint in the about one kilometre wide thermal aureole.

In the predominately siliciclastic layers contact metamorphic mineral blastesis was subordinate. In these domains recrystalizations driven by grain boundary area reduction and static recrystallization of quartz occurred. In contrast, a succession of contact metamorphic mineral assemblages formed in the carbonate rich layers and in carbonate concretions.

The unmetamorphosed samples of the carbonate layers comprised the mineral assemblage quartz + plagioclase + K-feldspar + muscovite + calcite + dolomite. The first evidence for contact metamorphic overprint is the formation of chlorite at a distance of somewhat more than 1000 metres from the contact. The further prograde sequence comprises epidote, tremolite-aktinolite ($X_{Mg} > 0.7$) and diopside-hedenbergite ($X_{Mg} > 0.75$).

Unmetamorphosed samples of the carbonate concretions are chemically homogeneous and only contain the assemblage dolomite + magnesite ± quartz. The contact metamorphic equivalents were chemically altered and exhibit substantial amounts of silicate phases such as chlorite, talk, tremolite ($X_{Mg} > 0.90$) and diopside ($X_{Mg} > 0.95$).

In the carbonate concretion a decrease in the $\delta^{18}O$ (from 21 ‰ to 14 ‰ relative to SMOW) isotopic value occurs, with decreasing distance from the intrusive contact. This indicates infiltration of an external fluid along the banded hornfels layers of the Gardena formation. The $\delta^{13}C$ isotopic values were also shifted to slightly lower values (from -2 ‰ to -3.7 ‰ relative to PDB). This is ascribed to Rayleigh fractionation associated with infiltration driven decarbonation reactions.

The Gardena sandstone formation is not exposed at the direct contact because of a debris cover. Therefore temperature estimates can only be given from a minimum distance of 160 meters. At this distance the temperature is estimated at 500°C.

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