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A COMPARITIVE STUDY OF CONTACT METAMORPHISM IN THE OSLO GRABEN, NORWAY

by

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The Oslo paleo rift is situated in the south-western part of the Baltic Shield and formed during an Permo-Carbonifereous rifting event. The presently exposed parts of the rift consist of Carboniferous and Lower Paleozoic sedimentary rocks along with alkaline extrusives and intrusives; the latter emplaced during intensive intrusive activity in the time-interval 300 - 250 Ma and the cause of widespread contact-metamorphism and hydrothermal activity in the surrounding sediments [e.g., 1].

This study deals with the attempt to compare the effect of contact metamorphism from 2 shallow intrusive complexes on Ordovician lithologically similar sediments. 1) The Drammen granitic intrusion is considered small (650 km^2) with a relative low solidus temperature (680°C) and considered a "wet" melt 2) The larvikite complex is large (2500 km^2) with a high solidus temperature (850°C) and considered a "dry" melt.

The phase-assemblage found in the Drammen aureole are wollastonite, andradite-grossular garnet and diopsidic-hedenbergitic diopside; whereas the phase-assemblage found in the Larvikite contact aureole also contain tremolite, biotite and chlorite. Scapolite is locally present. The phase assemblage is stable till 500 meter from the contact in the Drammen granitic aureole and 2500 meter in the Larvikite aureole. The difference in the aureole sizes is consistent with stable and radiogenic isotopic data for both aureoles.
In terms of stable isotopes the Drammen granitic aureole shows a steep front in oxygen ($\delta^{18}O$: 5 - 25 ‰) and no front in $\delta^{13}C$. The larvikite aureole shows a smooth front in both of the stable isotopes ($\delta^{18}O$: 10 - 25 ‰ and $\delta^{13}C$: -4; 2). $^{87}Sr/^{86}Sr$ isotopic data shows initial $^{87}Sr/^{86}Sr$ from 0.708 to 0.710 in the Drammen granitic aureole and initial $^{87}Sr/^{86}Sr$ from 0.708 to 0.714 in the larvikite aureole.
The Drammen granitic aureole can be divided in two trends dependant on type of lithology. Pure carbonates and limestones which can be modelled in type of processes: decarbonation acting in the pure carbonates and an external infiltration of a water-rich (< 0.1 CO_2) fluid for the limestones. The highest degree of metamorphism is around 590°C.

The larvikite aureole can only be modelled with locally very CO_2-rich fluids (< 0.6 CO_2). The origin of these fluids are considered to be internally derived and not related to the magmatic source. The highest degree of metamorphism can have been as high as 800°C, which must be considered due to the size and prolonged heating of this area by this intrusive complex.

References

[1] JAMTVEIT, B. et al. (1996): Flow and transport during contact metamorphism and hydrothermal activity: Examples from the Oslo rift. - In: Fluid flow and transport in rocks (eds. JAMTVEIT & YARDLEY), Chapmann & Hall, 57-82.