



## **A slice of Upper Allochthon in a Middle Allochthon terrain? An ID-TIMS U-Pb study of the Hardanger-Ryfylke Nappe Complex, SW-Norway**

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In southwestern Norway, Caledonian Nappes overly autochthonous and parautochthonous basement. The Hardanger-Ryfylke Nappe Complex is positioned south of the Jotun Nappe Complex, both assigned to the Middle Allochthon. It comprises a great variety of magmatic and sedimentary rocks, of greenschist to amphibolite facies metamorphic conditions. Previous extensive mapping, structural and geochemical analyses had distinguished three main units separated by mylonitic thrust zones, from bottom to top, the Dyrskard, Kvitenut and Revsegg nappe sheets. The available geochronological framework, established with Rb-Sr whole rock data, indicated mainly Mesoproterozoic ages for magmatic crystallization and subsequent deformation. Emplacement of the nappe stack occurred during the Caledonian orogeny but it is uncertain whether the three units were thrust as separate slices or together as one block. To increase our understanding on the evolution of these nappes we have carried out ID-TIMS U-Pb analyses using mainly single grains of zircon, titanite, rutile and apatite stemming from orthogneisses, metavolcanics, neosomes, pegmatites and granites.

Our data indicate both similarities and differences in the evolution of the three units. The lowermost Dyrskard Group comprises metarhyolites giving a crystallization age of about 1500 Ma. Metamorphism and deformation led to the formation of leucosomes at ca. 1000 Ma, also indicating a metamorphic overprint at ca 430 Ma.

The overlying Kvitenut Complex is dominated by orthogneisses with an age of crystallization of ca. 1600 Ma, and strong zircon resetting during metamorphism at 1000 Ma, both typical features of the main gneisses in the Jotun Nappe Complex. Leucosomes and a major granite body have zircon ages of 990-1000 Ma, comparable to that of the Dyrskard Group, which might suggest coeval evolution during this episode.

In the mylonitic thrust zone between Dyrskard and Kvitenut two generations of titanite occur, one revealing a Caledonian age at 430 Ma, but also an older one, which we tentatively interpret as giving the time of Sveconorwegian thrusting of Kvitenut on to Dyrskard which also reveals a later metamorphic overprint at around 930 Ma. Metamorphic overprint during the Caledonian event formed local pegmatites in both units.

The uppermost Revsegg Formation consists mainly of paragneisses. Dating of intrusive bodies of gabbro and granodiorite is still in progress, and hampered by the predominant xenocrystic character of the zircon population in the felsic units. Zircon and rutile in pegmatitic rocks indicate Caledonian intrusion and metamorphism at 430 Ma. However, in contrast to the other nappe sheets, in the Revsegg Formation we also find evidence for a ca. 450 Ma event in various minerals and lithologies. This age is not typical for the Middle Allochthon whereas it would fit the end of the Ordovician evolution of the upper Allochthon. Such an affinity had originally been proposed by Naterstad et al. (1973) but could not be confirmed by Rb-Sr work. Our data, however, point in that direction.

Naterstad et al. 1973. Norges Geologiske Undersøkelse