

The enigmatic Gula Complex of the central Norwegian Caledonides: new constraints on age and origin from zircon dating and geochemistry

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Reconstructing the closure of the Iapetus Ocean is a major task in order to understand the evolution of the Caledonian orogeny in space and time. Major questions remain regarding the timing of formation, closure and accretion of oceanic basins as well as the age and origin of continental fragments caught and incorporated into these oceanic domains during closure.

One of the largest, yet least constrained in terms of age and setting, of these continent-derived units is the Gula Complex, which is juxtaposed with Iapetus-derived oceanic units within the Trondheim Nappe Complex of the central Norwegian Caledonides. The Gula Complex consists of metamorphosed siliciclastic rocks with subordinate ribbon-chert, black schist and volcanic rocks of mainly mafic composition. In this contribution we present new geochemical data from volcanic rocks, U-Pb TIMS zircon ages from metavolcanites and dykes, and U-Pb LA-ICP-MS detrital zircon age spectra from metasedimentary rocks.

A basaltic andesite with an earliest Neoproterozoic zircon age was apparently associated with a brief volcanic interval represented by laterally extensive, MORB- to within plate-type rift-related basalts. Nearby metapsammites have maximum ages also consistent with deposition in the early Neoproterozoic. By contrast, detrital zircon spectra in other metapsammites indicate that parts of the Gula Complex were deposited in Cambro-Silurian times. Prominent latest Neoproterozoic and Cambrian detrital zircons (660-610, 530-490 Ma) reflect a source region atypical for both Laurentia and Baltica. Basaltic units with a back-arc type geochemical signature are tentatively thought to have formed within this time span. An intermediate dyke yielding Middle Ordovician zircons is possibly related to the back-arc basin type volcanism, indicating at least one magmatic pulse prior to the widespread Mid-Silurian trondhjemitic to dioritic magmatism well known from the Gula Complex.

Our new data demonstrate that the Gula Complex is a composite unit in terms of both age and setting. An early Neoproterozoic sedimentary basin with concomitant rift-related volcanism was overlain by a Cambrian to Silurian cover sequence that was at least partly associated with back-arc extension. Further work is required to separate the different parts of the sequence consistently on a regional scale, a distinction that is complicated by isoclinal folding and associated greenschist to upper amphibolite facies metamorphism in the Mid-Silurian. Nevertheless, our data represent a first step towards a better understanding of the age, origin and structure of this important fragment of the central Norwegian Caledonides.