

U–Pb and geochemical evidence for a Cryogenian magmatic arc in central Novaya Zemlya, Arctic Russia

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ABSTRACT

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A unique set of mafic intrusives collected during a 1921 expedition to Novaya Zemlya and reported to cut Devonian sedimentary rocks, are shown instead to represent a Cryogenian magmatic arc. Zircon and titanite in four samples from Mashigin Fjord and Matochkin Strait yield U–Pb ages of 716–704 Ma and the dyke geochemistry shows typical subduction-

zone features. These rocks have the characteristics of a peri-Gondwanan subduction-related complex, and originally could have been affiliated to the Avalonian systems before accreting to Baltica during the Timanian orogeny.

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Introduction

The High Arctic of Scandinavia and Russia consists of a collage of terranes joined along orogenic sutures and disrupted by Mesozoic and Cenozoic rifting and the development of oceanic basins. There are still many fundamental questions on the tectonic evolution and mutual relationships of the different terranes, and potential affinities to either Siberia or Baltica (Cocks and Torsvik, 2005; Metelkin *et al.*, 2005; Gee *et al.*, 2006; Pease and Scott, 2009).

Our study reports geochemical and U–Pb geochronological data on mafic dykes from central Novaya Zemlya. These had been inferred to cut Devonian sedimentary rocks, and consequently to provide a testimony for one of the post-Devonian Large Igneous Provinces known in the Arctic. Novaya Zemlya is remote, logistically difficult to reach, and inhospitable after decades of nuclear test programmes. For our dating study, however, we were able to use samples collected in 1921 by a Norwegian expedition led by Olaf Holtedahl and now stored at the Natural History Museum in Oslo (Nakrem and Gradstein, 2007). Thus, the samples are unique. Our initial aim was to test whether the dykes were related to a Large Igneous Province, but the results demonstrate

that the original interpretation of the age of the dykes was incorrect as they represent Neoproterozoic arc magmatism. The geological implications of this discovery are discussed.

Geological setting

Novaya Zemlya consists of an elongated and slightly curved, N-trending

couple of islands, which are separated by a narrow strait (Fig. 1). They are geologically linked to the Taimyr thrust and fold belt and the Kara block to the east and have been thought to represent the continuation of the Uralide orogen to the south, although some consider this to be incorrect (Torsvik *et al.*, 2008). Novaya Zemlya is dominated by

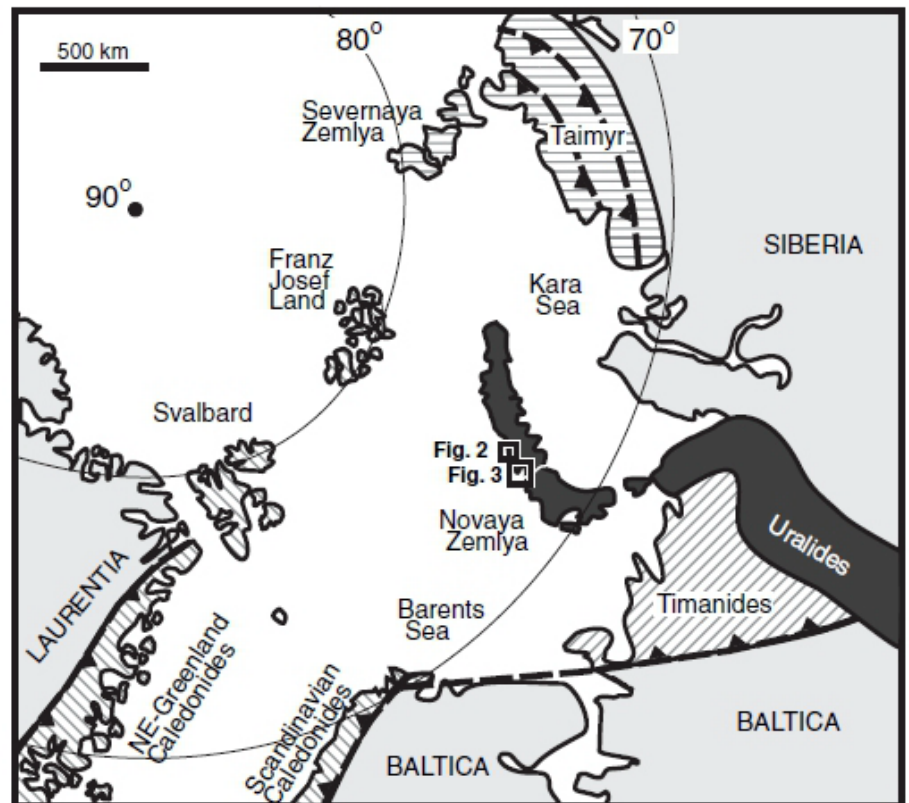


Fig. 1 Palaeoproterozoic configuration of the main tectonic elements of the north Atlantic polar region (modified from Gee, 2005). Coordinates approximate the present day position.

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