

Evidence of a Late Precambrian (637 Ma) Deformational Event in the Caledonides of Northern Sweden

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ABSTRACT

The Caledonian nappes in Scandinavia record two main phases of early Paleozoic metamorphism, but their pre-Caledonian tectonothermal history and paleogeographic position are largely unknown. Here we present a U-Pb age of 637 ± 3 Ma for metamorphic titanite in the 1776 ± 4 Ma (zircon age) Skårjá granitic gneiss in northern Sweden. The titanite age is interpreted to represent a Neoproterozoic tectonometamorphic overprint. Geochronologic and paleogeographic considerations suggest that the gneiss was located at the outermost margin of pre-Caledonian (north-west) Baltica and was affected by Neoproterozoic tectonic activity related to terrane accretion, the Baikalian (or Timanian) orogeny, coincident with Cadomian terrane accretion along the Gondwanan margin of northern South America and northwest Africa.

Introduction

The western Scandinavian geological infrastructure (fig. 1) is largely a result of the mid-Silurian (Scandian) collision of Baltica and Laurentia (Roberts and Gee 1985; Torsvik et al. 1996; Torsvik 1998), which resulted in extreme crustal thickening, emplacement of nappes onto the Baltica craton, and, ultimately, collapse of the mountain belt in Early Devonian times (Stephens and Gee 1989; Andersen and Jamtveit 1990; Andersen et al. 1991; Fossen and Rykkelid 1992; Eide and Torsvik 1996). An earlier phase of orogenic activity (Finnmarkian) was originally defined by Sturt et al. (1978) as an intraplate event affecting north Norway but is here considered as a subduction-related event happening offshore of Baltica (following Torsvik and Rehnström 2001). Evidence of early high-pressure metamorphism comes from eclogite-bearing nappes in northern Sweden. The age of the high-grade meta-

morphism is 505–500 Ma Sm-Nd (Mørk et al. 1988; Dallmeyer et al. 1991), and the subsequent retrogression and deformation has been dated to ~490 Ma with $^{40}\text{Ar}/^{39}\text{Ar}$ on hornblende (Dallmeyer and Gee 1986) and 500–475 Ma by U-Pb on titanite (Essex et al. 1997; fig. 1).

Knowledge about the pre-Caledonian evolution of the present western margin of Baltica comes largely from the nappes. A rift-related sedimentological (Kumpulainen and Nystuen 1985) and magmatic scenario (Zwaan and Van Roermund 1990; Andréasson et al. 1992; Andréasson 1994; Stølen 1994; Svenningsen 1994) is reasonably well constrained, and age determinations for the mafic dikes cluster around 610–590 Ma (Zwaan and Van Roermund 1990; Bingen et al. 1998; Svenningsen 2001). Little is known about the period preceding this rift event except for the Proterozoic protolith ages of allochthonous basement slices (e.g., Claesson 1980, 1987; Williams and Claesson 1987; Zachrisson et al. 1996). In northern Scandinavia, the allochthonous Seiland Igneous Province (fig. 1) indicates a different and still enigmatic evolution as evidenced by magmatic and metamorphic activity ranging from 850 to 500 Ma (Pedersen et al. 1989; Krogh and Elvevold 1990; Daly et al. 1991; Reginiussen et al. 1995). The initial magmatic pulse is also re-

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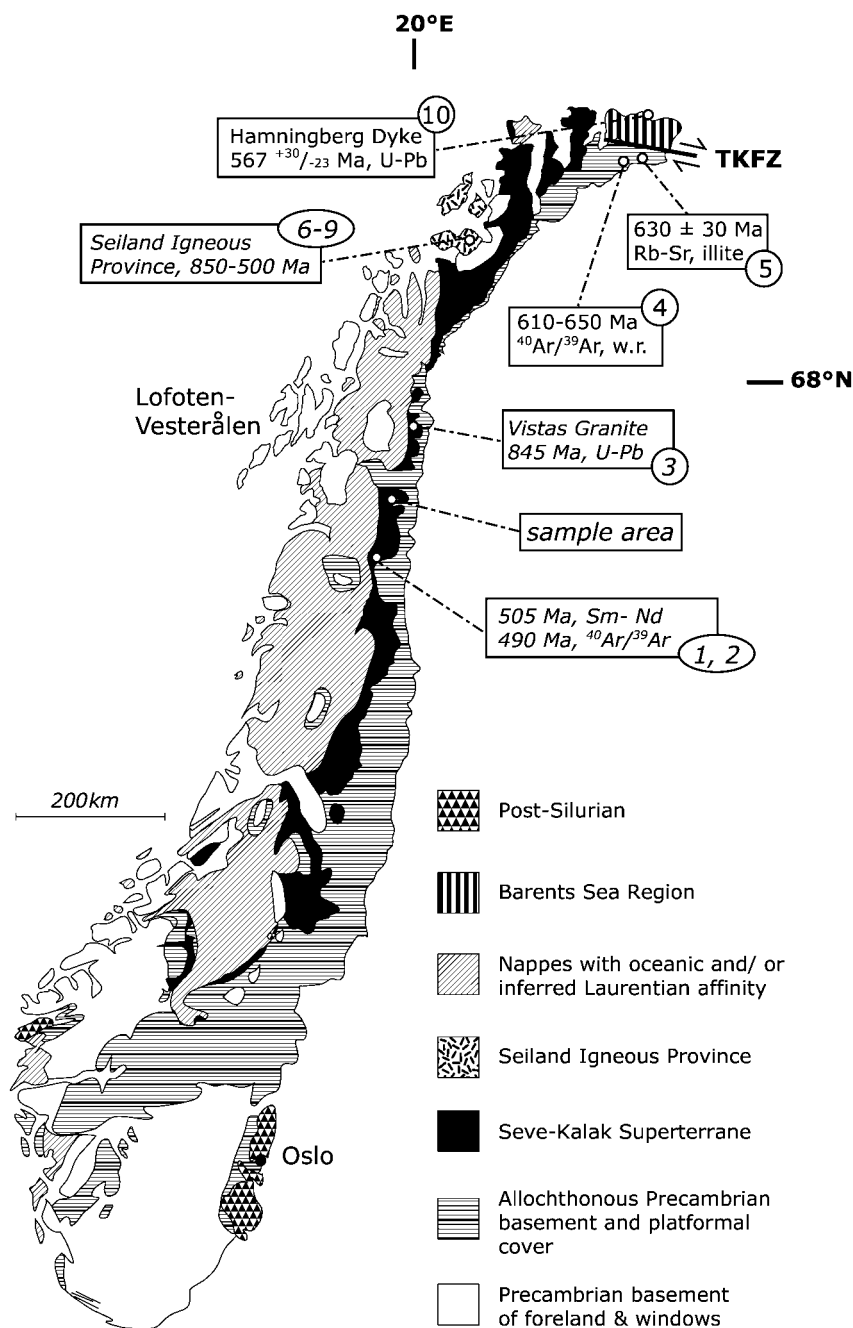


Figure 1. Simplified tectonostratigraphic map of the Scandinavian Caledonides. The sampled area is on the NW slope of Mt. Skårvatjåhkkå (67.3°N/17.5°E). The boxed numbers refer to ages; the ones in italics come from allochthonous units. The ages from 1 and 2 are on Finnmarkian eclogitization of the Seve Nappe Complex; ages from 4, 5, and 10 are on the Timanian event. Numbers refers to the following work: 1 and 2, Dallmeyer and Gee 1986; Mørk et al. 1988; 3, Paulsson and Andréasson 2001; 4, Dallmeyer and Reuter 1989; 5, Roberts et al. 1997; 6-9, Pedersen et al. 1989; Krogh and Elvevold 1990; Daly et al. 1991; Reginiussen et al. 1995; 10, Roberts and Walker 1997. TKFZ, Trollfjorden-Komagelva fault zone.

flected by an allochthonous 845-Ma granite in northern Sweden (Paulsson and Andréasson 2001).

In northernmost Norway (Varanger Peninsula; fig. 1) and NW Russia (Kola Peninsula), in areas not covered by Caledonian nappes, Neoproterozoic sedimentary rocks were deformed under very low-grade conditions (anchizone) during an event prior to $567 \pm 30/-23$ Ma, the age of a posttectonic mafic dike (Roberts and Walker 1997). Direct ages for folding and low-grade metamorphism are poorly constrained at 630–570 Ma based on Rb-Sr data for illite (Roberts et al. 1997) and on $^{40}\text{Ar}/^{39}\text{Ar}$ whole rock data (no valid plateaus; Dallmeyer and Reuter 1989). Roberts (2001) attributed this Vendian deformation in the Timan-Varanger Belt to the Timanian (or Baikalian) orogeny, an event that also affected large areas of (present-day) Arctic Siberia. In the Central Taimyr fold belt, garnet amphibolites associated with Baikalian deformation (collision between South and Central Taimyr) have been dated at 626 ± 27 Ma by K-Ar on hornblende (Ver-nikovsky 1997).

In this article, we present a U-Pb titanite age of 637 ± 3 Ma, dating a deformational event under amphibolite-facies conditions, from a Paleoproterozoic (1776 ± 4 Ma) granitic gneiss in the Swedish Caledonides. This is the first titanite age recording a late Precambrian deformational event within the Caledonian nappes of Northern Sweden, an event that is roughly coeval with the Baikalian and Cadomian orogenic events. We also present a paleogeographic model that attempts to accommodate these new results.

Regional Setting and Sampling

The sampling area is located in the western Oalgásj-Dielmmá Massif in the Sarek National Park, northern Sweden (fig. 1). The sampled rock is a part of the Seve Nappe Complex (Andréasson and Gee 1989), adopting the tectonostratigraphic subdivision of Svenningsen (2000). The Caledonian allochthon in the Sarek area can be divided into the Lower Allochthon, the Syenite Nappe Complex (SyNC), the Seve Nappe Complex (SNC), and the Köli Nappes (fig. 2). The lowermost part exposed in central Sarek is the SyNC (fig. 2), which consists of syenite, gabbros, and anorthosites, cut by felsic and mafic dikes, and with subordinate metasedimentary rocks. The syenites have an age of ~1780 Ma (E. F. Rehnström and F. Corfu, unpub. data) and can be tentatively correlated with the autochthonous rocks of the Lofoten-Vesterålen area (cf. Björklund 1989). The overlying SNC is divided into three separate nappes (fig. 2).

1. The Skárjá Nappe consists of a homogeneous semipelitic metasediment of garnet-biotite grade, with variations in quartz content interpreted as a primary sedimentary feature, and rare amphibolite boudins. A 5–10-m-thick slice of granitic gneiss, the Skárjá Gneiss, occurs in the upper part of the Skárjá Nappe (fig. 2).

2. The Mihká Nappe is dominated by micaceous quartzites and varying amounts (in places up to as much as 60%) of amphibolite boudins. Relics of an eclogitic paragenesis have been found in these boudins. Eclogitization of the Juron Quartzite farther south has been dated to 505 Ma (Mørk et al. 1988). The Mihká Nappe is equivalent to the Juron Quartzite (Andréasson 1986), and the age of eclogitization is probably similar (see figs. 1, 2).

3. The Sarektjåhkkå Nappe comprises mafic rocks, which in the sampled area occur as strongly foliated garnet amphibolite. In surrounding areas, they are better preserved, and primary relations between sedimentary screens and diabase dikes can be observed (e.g., Svenningsen 1994). Dioritic pods in the mid-ocean ridge basalt (MORB)-type diabase dikes have been dated at 608 ± 1 Ma by Svenningsen (2001), which tentatively linked them to the opening of the Iapetus Ocean.

Sample Description and Experimental Results

The U-Pb study was conducted on zircon and titanite fractions from the Skárjá Gneiss, a strongly banded gneiss with a granitic (modal) composition (fig. 3a). The leucocratic bands are dominated by quartz, K-feldspar, and plagioclase with an equigranular, granoblastic texture, and there are subordinate grains of light brown to medium green biotite. Dark green hornblende, garnet, titanite, and biotite dominate the darker bands. All minerals are in textural equilibrium and show no signs of retrogression or of having residual primary phases. Hornblende, biotite, and titanite together define the foliation of the gneiss. The accessory phases include apatite, zircon, allanite, and opaque minerals. The sample was crushed, ground, and wet separated on a water-shaking table prior to magnetic separation with a Franz separator.

The zircons are fairly homogeneous, consisting of light pink, slightly subrounded to stubby prismatic grains (fig. 3b). Three fractions were selected using criteria of quality (clear, noncracked, and inclusion free), size, and morphology (table 1). Two zircon fractions were abraded following the method of Krogh (1982) with subsequent selection of the best-quality grains. The titanite samples are very homogeneous, all the grains being light yellow and

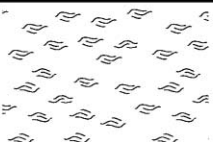
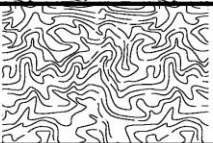

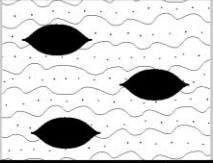
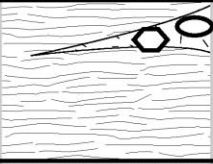

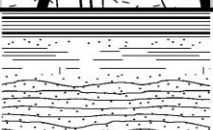
Köli Nappe Complex				Thrust sheets containing low-grade sedimentary and volcanic rocks, including serpentinites
				Dolomites, eclogites and garben schists
Seve Nappe Complex	Sarek- tjånkkå Nappe		608 ₁	Garnet amphibolites with remnants of sheeted-dyke complex
	Mihká Nappe			Micaceous quartzites with amphibolite to retro-eclogite boudins
	Skárjá Nappe		637 ₂ 1775 ₂	Garnet-mica schists, with very subordinate mafic lenses and a granitic slice
Syenite Nappe Complex			1780 ₃	Thrust sheets containing syenites, gabbros, anorthosites cut by felsic and mafic dykes. Thin slivers of metasedimentary rocks
Lower Allochthon				Neoproterozoic sedimentary cover sequences

Figure 2. Simplified, regional composite tectonostratigraphy of the Sarek area compiled from Stølen (1988) and Rehnström (1998). Thicknesses of units are not to scale. Numbers are U-Pb ages in Ma; numbers in italics and oval shapes refer to titanite ages, and pentagons indicate zircons. The shaded units represent those observed in the sample area. References are as follows: 1, Svenningsen 2001; 2, this study; and 3, E. F. Rehnström and F. Corfu, unpub. data.

lenticular in shape. Two fractions were selected from clear, noncracked inclusion-free grains and divided by size (table 1).

The grains were washed in dilute HNO₃ and rinsed in acetone and H₂O. The zircons were then placed in Teflon bombs, and the titanites were placed in Savillex vials; each sample was spiked with a mixed ²⁰⁵Pb/²³⁵U spike. The dissolution was done with HF and HNO₃ (Krogh 1973). Sample Z1 and both titanite fractions were subjected to chemical separation. Details of the procedure are outlined in Corfu and Noble (1992) and Corfu and Stone (1998), with modifications given in Corfu and Evins (2002).

The U and Pb isotopic ratios were measured on a Finnigan MAT 262 mass spectrometer in static mode using Faraday cups or in dynamic mode using an ion-counting SEM. Pb and U data were corrected for 0.1%/AMU fractionation with an additional bias correction for SEM measurements. The corrections for initial lead composition were made using the compositions modeled by Stacey and Kramers (1975). The resulting isotopic ratios were plotted using the ISOPLOT program (Ludwig 1999). The analytical work was carried out at the Geological Museum in Oslo.

The two titanite fractions yield overlapping and concordant data points that provide a concordia age

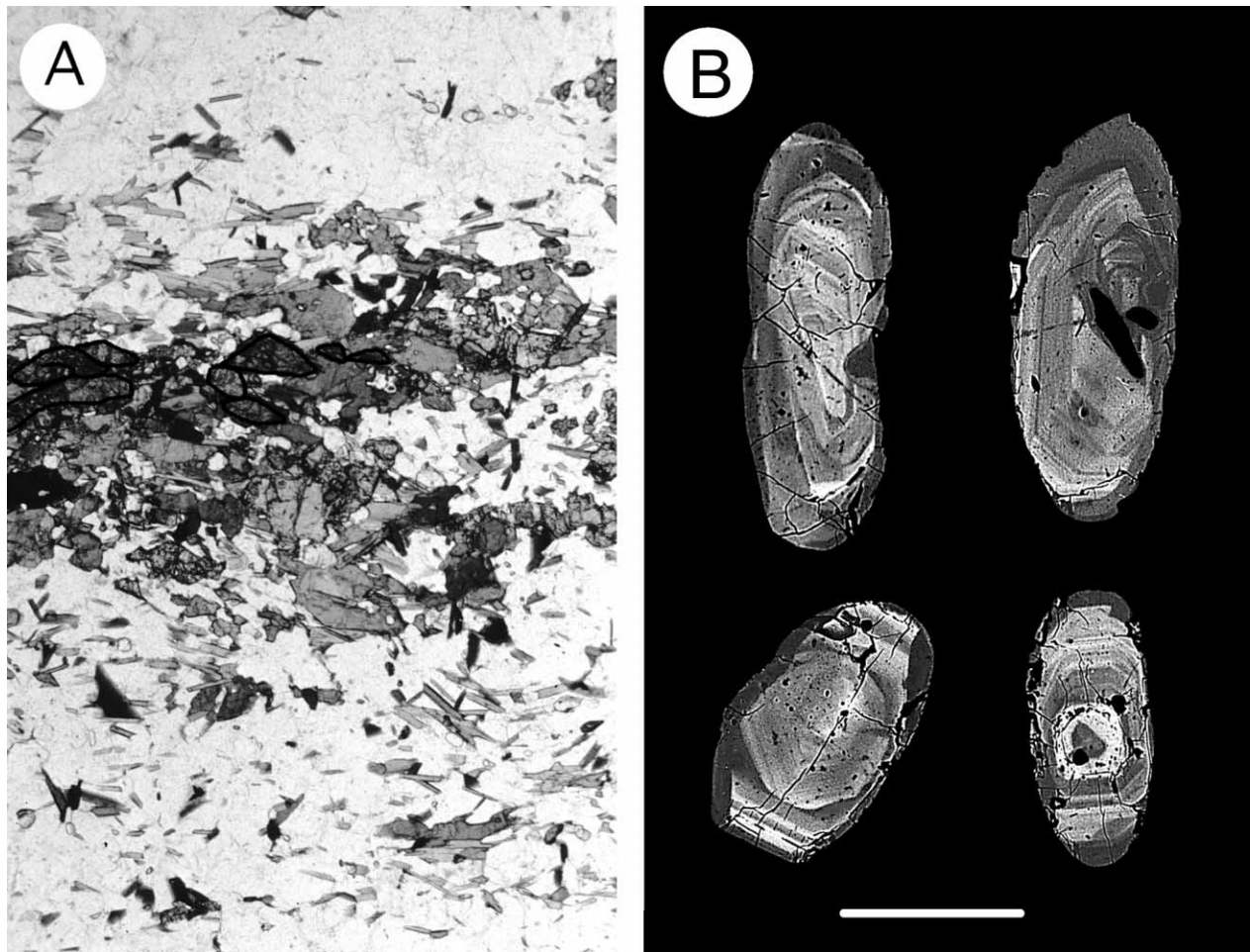


Figure 3. A, Photomicrograph of the Skárjá Gneiss. The view height is ca. 10 mm. The dark band consists of hornblende, biotite, titanite, garnet, and apatite, whereas the leucocratic bands consists of quartz, K-feldspar, and plagioclase. The titanite crystals have been marked with a thick black outline to enhance visibility. B, Backscattered electron image of typical zircons from the Skárjá Gneiss. Note the concentric zonation in the cores and the unzoned rim crosscutting this zonation. The imaged zircons are not those that were actually analyzed; these were of better quality and less cracked. The scale bar represents 100 μm .

(see Ludwig 1999) of 637 ± 3 Ma (fig. 4). Because titanite codefines the planar fabric, its age can be interpreted as dating the formation of the gneissose foliation in the Skárjá Gneiss. The zircon data are 4%–7% discordant and are collinear, yielding upper and lower intercept ages of 1781 ± 20 Ma and 723 ± 230 Ma, respectively. Because the lower intercept age is identical within error to the age of the titanite, we use a mixed discordia line calculated with both the zircon and the titanite data to refine the upper intercept age to 1776 ± 4 Ma, which is interpreted as the protolith age.

Discussion

Significance of the U-Pb Data. The Skárjá Gneiss is a strongly banded gneiss, where dark bands of

hornblende, biotite, garnet, and titanite define the metamorphic fabric. There are no relics of primary or prograde minerals, nor any signs of retrogression. The zircons have a disturbed U-Pb system, and the locally rather thick, unzoned rims seen in the back-scattered electron (BSE) images (fig. 3) could possibly reflect a phase of new growth or of recrystallization related to a secondary event (e.g., Connelly 2000). Such a mechanism could account for the discordance of the zircon data (fig. 4). The titanites, however, are very concordant; there is only one generation of lenticular-shaped, metamorphic grains, and they yield a concordant age of 637 Ma. We argue, therefore, that the titanites formed during deformation and that this age dates the for-

Table 1. U-Pb Data from the Skárjá Gneiss

Fraction ^a	Weight (μ g)	U (ppm)	Th/U ^b	Pbc ^c (pg)	206/204 ^d	207/235 ^e	2 σ (%)	206/238 ^e	2 σ (%)	ρ	206/238 ^e (Ma)	2 σ (%)	207/206 ^e (Ma)	2 σ (Ma)	Degree of discordance (%)
T1 cl l frag	74	25.7	.24	207	76.9	.8629	4.73	.1033	1.16	.24	634	± 7	624	± 96	-1.7
T2 cl s obl	99	20.3	.25	203	82.0	.8562	4.21	.1040	.64	.12	637	± 4	593	± 88	-7.9
Z1 cl s sr ab	9	283	.51	67	731	4.4418	.57	.3002	.49	.87	1692	± 16	1754.4	± 5.1	4.0
Z2 cl l stpr	4	151	.46	3.4	3305	4.3745	.47	.2967	.43	.95	1675	± 13	1747.8	± 2.6	4.7
Z3 cl frag ab	2	597	.45	2.1	10,095	4.1810	1.55	.2863	1.55	1.00	1623	± 44	1730.3	± 2.5	7.0

Note. Zircon analyses were corrected for blanks of 2 pg Pb and 0.1 pg U; titanites were corrected for 10 pg Pb and 0.3 pg U.

^a T, titanite; Z, zircon; cl, clear; l, large; frag, fragments; s, small; sr, subrounded; ab, abraded; stpr, stubby prismatic.

^b Model value calculated using 208/206 ratio and age of sample.

^c Total common Pb (including initial common Pb of sample and analytical blank).

^d Corrected for spike contribution and fractionation.

^e Corrected for spike, fractionation, blank, and initial common Pb.

mation of the gneissic foliation (see criteria in Gro-met 1991). A plausible tectonic setting for this 637 Ma event is discussed below.

Regional Significance. Interpreting the geological significance and paleotectonic setting of magmatic rocks and their metamorphic derivatives and deformational fabrics, now preserved as slivers in thrust sheets, nappes, and geological terranes is not straightforward. An interesting but complex history is preserved in our study area, and we can distinguish several key elements. First, the 1775–1780-Ma protolith ages for the Syenite and Seve Nappe Complexes (fig. 2) may suggest that the nappes have not been transported very far, as one can find correlative lithologies and basement ages, for example, in the Lofoten-Vesterålen area (cf. Björklund 1989). Second, the identification of a 637 ± 3 Ma deformational event (local?) in a gneiss of the Skárjá Nappe (Seve Nappe Complex; fig. 2) of presumed Baltic origin indicates a relation either with an early phase of Baikalian terrane accretion in northeast Baltica or alternatively an extensional phase preceding dike intrusion. Third, a 608-Ma sheeted-dike complex intruding Neoproterozoic passive margin deposits in the Seve Nappe Complex (Sarektjåhkkå Nappe; Svenningsen 2001) indicates rifting and initial sea-floor spreading, either in the Baltica margin realm or possibly at some other continental margin. Fourth, ca. 505 Ma eclogites (Mørk et al. 1988), in the Seve Nappe Complex (Juron Quartzite, Vuoggatjålme), demonstrate deep subduction at this time. As noted in the “Introduction,” this event has been interpreted as resulting from a Late Cambrian continent-arc collision (Finnmarkian event; see Dallmeyer and Gee 1986; Torsvik and Rehnström 2001) but perhaps also involved interaction between Baltica and the Kara Block (fig. 5). Finally, the elements, now present in the nappes, were thrust onto Baltica during the Scandian (Silurian) event following collision between Baltica and Laurentia.

Paleotectonic Setting. Paleomagnetic data for the time frame 700–600 Ma are, worldwide, virtually absent, controversial, or unreliable (cf. Meert and Powell 2001). It is therefore more useful to discuss the U-Pb titanite age obtained in this study in a 550-Ma paleotectonic framework (fig. 5) since most of Gondwana was essentially assembled at that time (Meert and Van der Voo 1997). There is ample evidence of compressional tectonics and magmatic activity prior to, or at 550 Ma, and we would like to draw the attention to some of these events.

1. Late Vendian (630–550 Ma) arc-related magmatism, metamorphic fabrics, and tectonic structures preserved in the Timan-Pechora-Rybachy-Varanger region (Gee et al. 2000; Roberts and Siedlecka 2002) marks the accretionary Timanian (or Baikalian) orogenic event, a period of complex arc/continent interaction along the present-day northeastern margin of Baltica.

2. Accretion of Central Taimyr to South Taimyr (part of the Siberian craton; see fig. 5B) marks the Baikalian event. Central Taimyr has been defined by the presence of accreted terranes (the Mamont-Shrenk and Faddey Terranes) with ophiolites and granitoids (800–740 Ma), and collision with South Taimyr occurred at around 630–570 Ma (Vernikovsky 1997).

3. Cadomian (ca. 760–660 Ma) arc activity and accretion of Avalonian and related peri-Gondwanan terranes (e.g., Armorica and Perunica) occurred along the Gondwanan margin, followed by the onset of the main phase of Avalonian volcanism at ca. 630 Ma (see Murphy et al. 2000). The Florida terranes of Carolina and Suwannee record a somewhat younger magmatic and metamorphic history (580–530 Ma; e.g., Heatherington et al. 1996; Dennis and Wright 1997), pointing to a complexity and temporal variation in the blocks involved in the peri-Gondwanan terrane accretion.

All these events were largely terminated at ca. 550 Ma; Gondwana was assembled and occupied

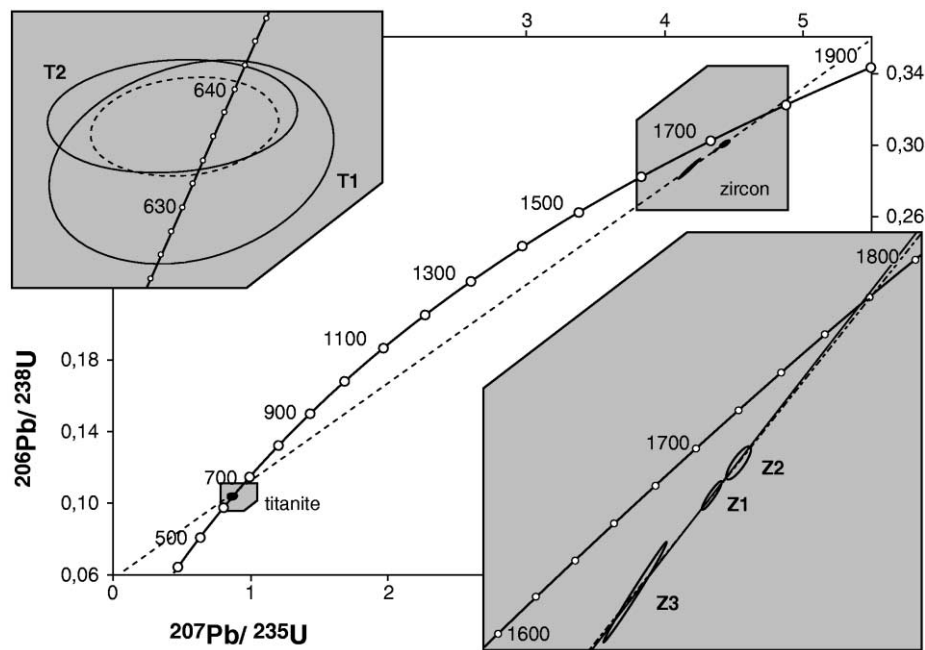


Figure 4. Concordia diagram with U-Pb data from the Skárjá Gneiss. Error ellipses reflect a 95% confidence level. The calculated concordia age of the titanites is 637 ± 3 (dashed ellipse), with MSWD (of concordance) = 0.79; error is 2σ (decay-constant errors ignored). In the zircon inset, the heavy discordia line has intercepts at 646 ± 21 and 1776 ± 4 Ma (MSWD = 0.33), whereas the dashed discordia has intercepts at 723 ± 240 and 1781 ± 20 Ma (MSWD = 0.083).

an area stretching from the South Pole to the Equator. Baltica terrane amalgamation was completed, and Central Taimyr had collided with Siberia (fig. 5). Laurentia, located in high southerly latitudes, probably rifted off South America at almost the same time (see also Cawood et al. 2001).

Prior to 550 Ma, the (present-day) northeastern margin of Baltica differed substantially from that shown in figure 5. Starting as a passive rifted margin in mid-late Riphean time, it passed through an oceanic stage (Scarraw et al. 2001) before final accretion of ocean-floor volcanites, island-arc plutons, and microcontinental blocks against Baltica in Late Vendian times. The result of this amalgamation is now exposed in the Timan Range and the northern Urals (Gee et al. 2000) and farther along the northern coast of Kola Peninsula and on eastern Varanger Peninsula in Norway (Roberts and Siedlecka 2002).

The 1776-Ma protolith age of the Skárjá Gneiss is compatible with ages from the Lofoten-Vesterålen area (Corfu 2000) and other autochthonous and allochthonous basement windows in northern Norway (Romer 1989; Skår and Pedersen 2000). This age, however, is not unique to Baltica since the period around 1800 Ma is one of worldwide crust

formation. The age of the Skárjá Gneiss is therefore not conclusive evidence for local derivation but it is strongly suggestive, considering its proximity and association with the underlying Syenite Nappe Complex. Correlations with the Seiland Igneous Province are problematic due to the lack of temporal constraints on the different events there. In addition, the 1776-Ma protolith age of the Skárjá Gneiss does not seem to have any counterpart in the Seiland area. We prefer to place a Proterozoic Baltic basement high, outboard of the present-day margin, in a position beneath a westward continuation of the Timan-Varanger Belt (fig. 5B). This area was involved in a metamorphic event under amphibolite facies at 637 Ma, and the Skárjá Gneiss was formed, perhaps in response to collision with an outboard terrane.

Further Geodynamic Implications. Throughout late Precambrian and Cambrian times, Baltica was geographically inverted at high southerly latitudes and faced peri-Gondwana terranes (including Avalonia) along northwest Gondwana (fig. 5). It is therefore likely that the Baikalian/Timanian belt in Baltica developed either as a conjugate (opposing) or extension of the Avalonian arcs. This paleogeographic link existed at least as far back as 580–590

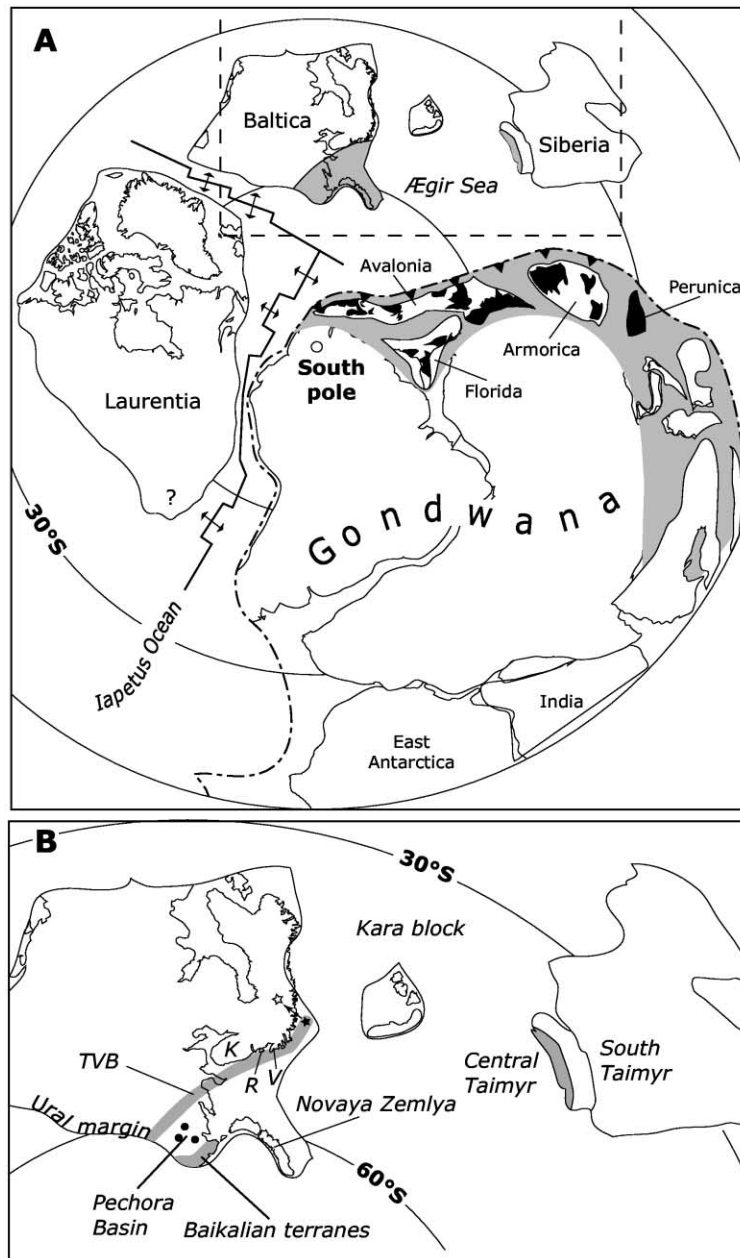


Figure 5. *A*, Late Vendian (ca. 550 Ma) plate configuration. *B*, Close-up of the inset marked in *A*. Abbreviations are as follows: *R* = Rybachi Peninsula, *K* = Kola Peninsula, *V* = Varanger Peninsula, *TVB* = Timan-Varanger Belt. The shaded areas are regions that show evidence of Cadomian-Baikalian-Timanian deformation, terrane amalgamation, and magmatism. The black dots indicate calc-alkaline magmatism (from deep drillcores; after Gee et al. 2000). The open star indicates the present-day position of the Skárjá Gneiss, whereas the filled star marks a hypothetical pre-Caledonian position. By 550 Ma, Gondwana was essentially assembled while Laurentia had probably started to rift away from South America (Iapetus opening), its position being somewhat uncertain. Also, the amalgamation of northern Baltica terranes was essentially completed while Central Taimyr had accreted to South Taimyr. Kara was an independent block (North Taimyr and Severnaya Zemlya) that did not collide with Siberia until the Permo-Carboniferous (Vernikovsky 1997; Metoelkin et al. 2000). Paleomagnetic reconstruction poles (ca. 550 Ma) are based on apparent polar wander paths (spherical fitted splines) and are as follows: Baltica = 57.3°N/120.5°E; Laurentia = 34.5°S/124.1°E; Gondwana = 7.2°S/329.5°E; Siberia = 47.9°N/337.3°E. Paleomagnetic data for the Kara Block at 550 Ma do not yet exist, and Kara is placed relative to Baltica based on a ca. 500-Ma paleomagnetic pole (Metoelkin et al. 2000). Peri-Gondwana terranes (in black) and Gondwana fits after Cocks and Torsvik (2001) and Dennis and Wright (1997). All the reconstructions were made in GMAP (<http://www.geodynamics.no>).

Ma (Meert et al. 1998; Torsvik and Rehnström 2001), and perhaps throughout the Neoproterozoic (Hartz and Torsvik 2002), if one accepts that Baltica was geographically inverted compared to classic Rodinia reconstructions (Dalziel 1992). If correct, this inverted position of Baltica throughout the Neoproterozoic has profound implications for models of Iapetus opening (fig. 5), and ca. 550 Ma may mark the initial birth of Iapetus (rift to drift) between North America–South America and the Greenland-Uralian margin of Baltica (Hartz and Torsvik 2002). Our 550-Ma reconstruction has some similarities with that of Cawood et al. (2001), but in our model we maintain a much closer proximity of Laurentia with both West Gondwana and Baltica (Uralian margin) and argue that 608-Ma MORB-type dikes and 505-Ma subduction-related eclogites, now preserved in the Seve Nappe Complex (Mørk et al. 1988; Svenningsen 2001), originated in the Ægir Sea realm and were unrelated to Iapetus opening and closure. Maintaining Baltica geographically inverted prior to 580–590 Ma, we also propose that early Baikalian/Timanian/Cadomian arc accretion and deformation (including our 637 Ma event) evolved in a paleogeographic setting not unlike that of figure 5.

Conclusions

The Skárjá Gneiss is a slice of metagranitic rock situated in tectonostratigraphic position interpreted to reflect the boundary between the pre-Cal-

edonian Baltica basement and marginal sedimentary sequences. A discordia calculated for isotope dilution thermal-ionization mass spectrometry (ID-TIMS) results on zircons from the gneiss and the upper intercept at 1776 ± 4 Ma is interpreted as the protolith age. The same rock contains one generation of titanite, presumably of metamorphic origin. The concordia age determined from the analyzed titanites is 637 ± 3 Ma. We correlate the gneiss with similarly aged rocks in the Lofoten-Vestrålen area and tentatively place the Skárjá Gneiss outboard of a geographically inverted Baltica in our paleogeographic reconstruction. It cannot be conclusively demonstrated in what tectonic regime the gneiss formed, compressional or extensional. However, we prefer to link deformation to a period of terrane amalgamation (Timanian orogenic event) that affected Baltica and was contemporaneous with Cadomian terrane accretion along the margins of Amazonia and northwest Africa.

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