Detrital zircon U-Pb analysis of Timanian passive margin successions and Caledonian nappes in Northern Norway and significance for Arctic reconstructions

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Geological Background

❖The Neoproterozoic passive-margin succession of the **Timanian** margin, northern Norway, includes the 9 km-thick, deep-marine to deltaic Barents Sea Group (BSR). To the south, a fluvial to shallow-marine platformal domain (TVR)[1] defines the succession. To the west, different rocks of the **nappe complexes** (Lower, Middle and Upper Allochthons) of the Norwegian Caledonides[2-5] occur.

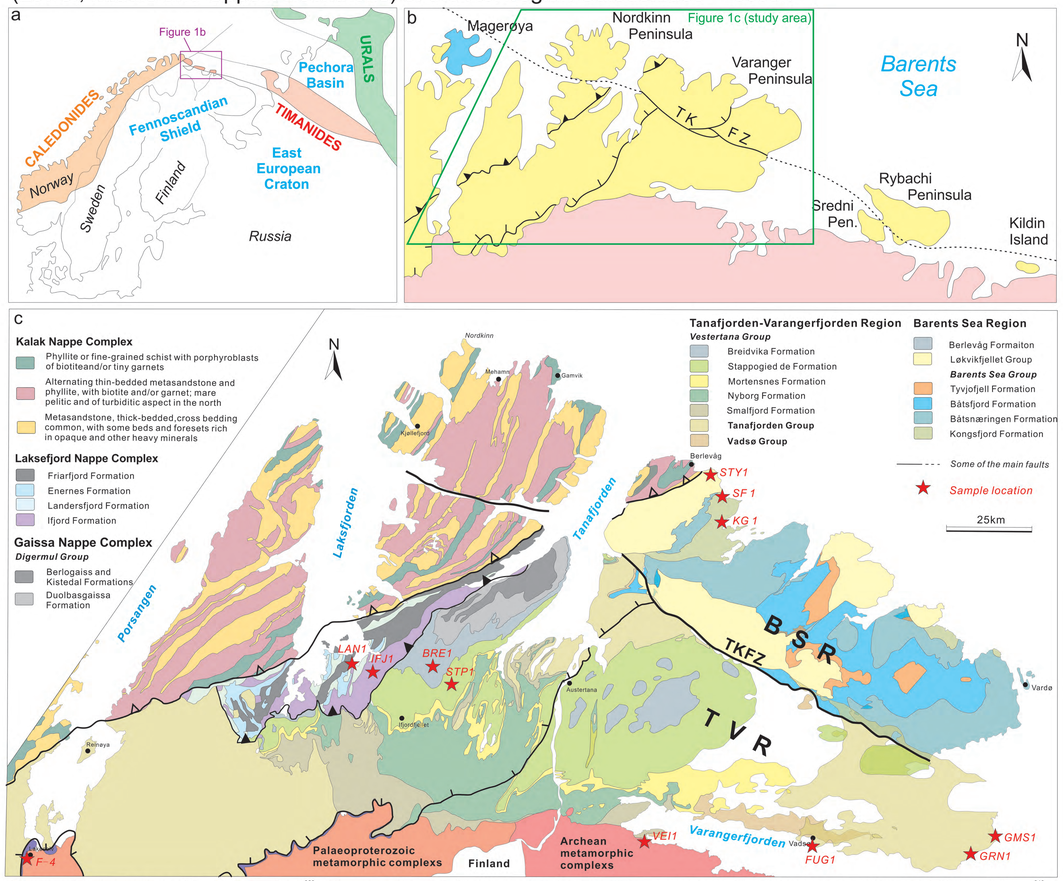


Figure **1a**. Location of the Timanides[6]; **1b**. Locaiton of the Rybachi, Sredni, Varanger and Nordkinn peninsulas and Kildin Island[1]. TKFZ-Trollfjorden-Komagelva Fault Zone; **1c.** Study area in North Norway, with sample locations (modified after 1:500 000 Finmark Bedrock Geology, NGU).

❖Aim:

a. To determine the age of each unit
b. To derive the provenance
c. To determine the age of clastics
d. To estimate the regional story

❖Significance:

Evaluate the provenance sources of these passive-margin and nappe complex sediments, possibly correlate them with now widely distributed Laurentian/allochthonous Timanian fragments, and provide a reference frame for assessing the degree of later recycling.

Conclusion

The Neoproterozoic Barents Sea succession was an established passive-margin depositional system with little to no coeval magmatism.

The Timanian "fingerprint" is found in the Stappogiedde Formation, Gaissa Nappe Complex, and probably represents the Timanian foreland.

Future Work 1) Stappogiedde Formation in the TVR. 2) Landersfjord Formation and Ifjord Formation in the LNC.

References:

[1] Roberts and Siedlecka, 2012; [2]Burke et al., 2007; [3] Gee and Pease, 2004; [4] Kirkland et al., 2006; [5] Kirkland et al., 2008; [6]Robert and Siedlecka, 2002.

U-Pb detrital zircon investigations (LA-ICP-MS and SIMS)

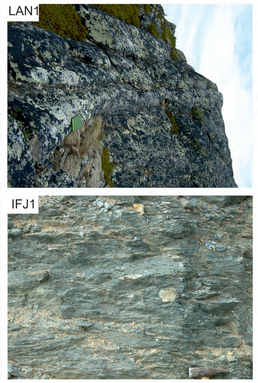
Baltica?

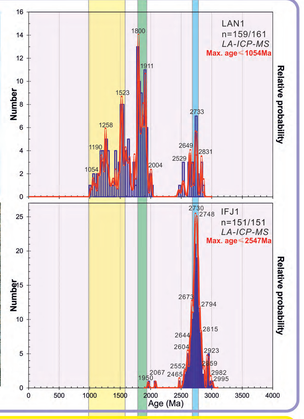
LAN1:
Tonian to Cryogenian?
Landersfjord Formation
IFJ1:
Palaeoproterozoic?
Ifjord Formation

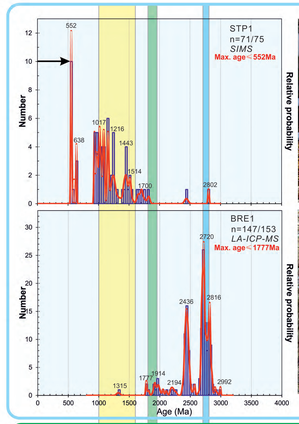
K-S Statistic

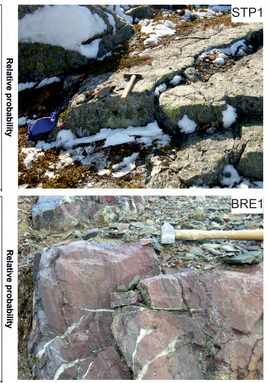
	LAN1	IFJ1
LAN1		0.817
IFJ1	0.000	

LAN1 ≠ IFJ1
Probably Baltica









Timanian 'Fingerprint'

STP1:
Late Ediacaran
Stappogiedde Formation
BRE1:
Early Cambrian?
Breidvika Formation

K-S Statistic

	STP1	BRE1
STP1		0.896
BRE1	0.000	

STP1 ≠ BRE1
STP1 might represent
TIMANIAN FORELAND

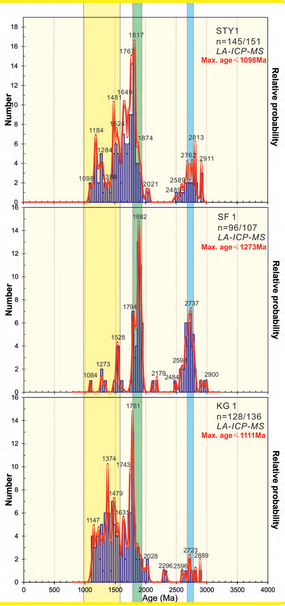
Timanian passive margin

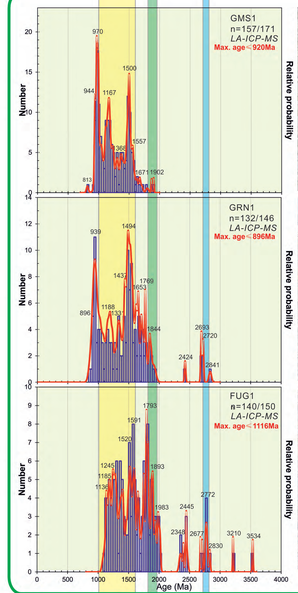
STY1:
Tonian to Cryogenian?
Styret Formation
SF 1:
Cryogenian or Ediacaran?
Sandfjorden Formation
KG 1:
Latest Tonian or Cryogenian?
Kongsfjord Formation

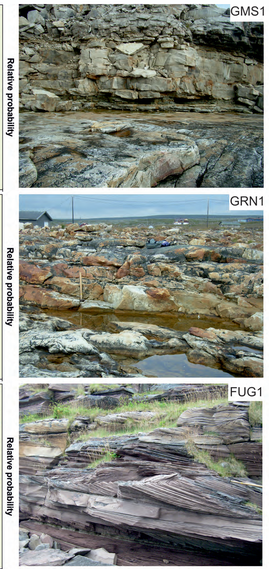
K-S Statistic

	STY1	SF 1	KG 1
STY1		0.504	0.180
SF 1	0.000		0.603
KG 1	0.028	0.001	

STY1 ≠ SF 1 ≠ KG 1
Not a single series







Pericratonic Baltica

GMS1:
Late Cryogenian
Gamasfjellet Formation
GRN1:
Cryogenian?
Grønneset Formation
FUG1:
Tonian or Cryogenian?
Fugleberget Formation

K-S Statistic

	GMS1	GRN1	FUG1
GMS1		0.240	0.456
GRN1	0.001		0.241
FUG1	0.000	0.001	

FUG1→GRN1→GMS1
A single series: through time losing older grains and increasing younger input.

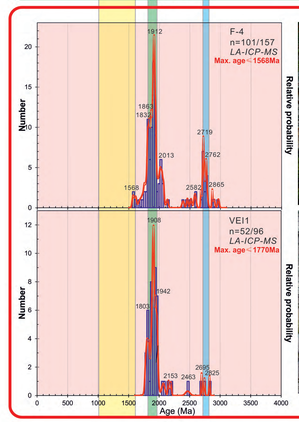
Baltica?

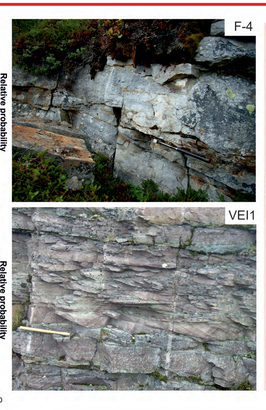
F-4:
Ediacaran-Cambrain
Dividal Group
VEI1:
Tonian or latest Stenian?
Veidnesbotn Formation

K-S Statistic

	F-4	VEI1
F-4		0.163
VEI1	0.318	

F-4 ≈ VEI1
Yes, Baltica!
1) Peak at 2800-2700Ma
2) Peak at 1950-1800Ma





SOURCES

2.8-2.7 Ga =
Neoarchean complexes of the northern Fennoscandian Shield

1.95-1.8 Ga =
Paleoproterozoic terranes of the northern Fennoscandian Shield, deformed during Svecofennian orogeny

Mesoproterozoic ages =

- *a source(s) concealed beneath the Caledonian nappes/adjacent shelf?*
- *a northward extension of the Sveconorwegian/ Grenvillian orogeny?*
- *a Tonian-emplaced, sandstone-dominated thrust sheet derived from the margin of Rodinia?*

Figure 2. Probability density versus age (common-Pb corrected age>1000Ma, use $^{207}Pb/^{206}Pb$ ages; <1000Ma, use $^{206}Pb/^{238}U$ ages).The number of grains indicated= those <10%discordant / the total number of analyses. The probability density plots exclude ages >10% discordant. Max. age = maximum age of two or more grains of the same age.