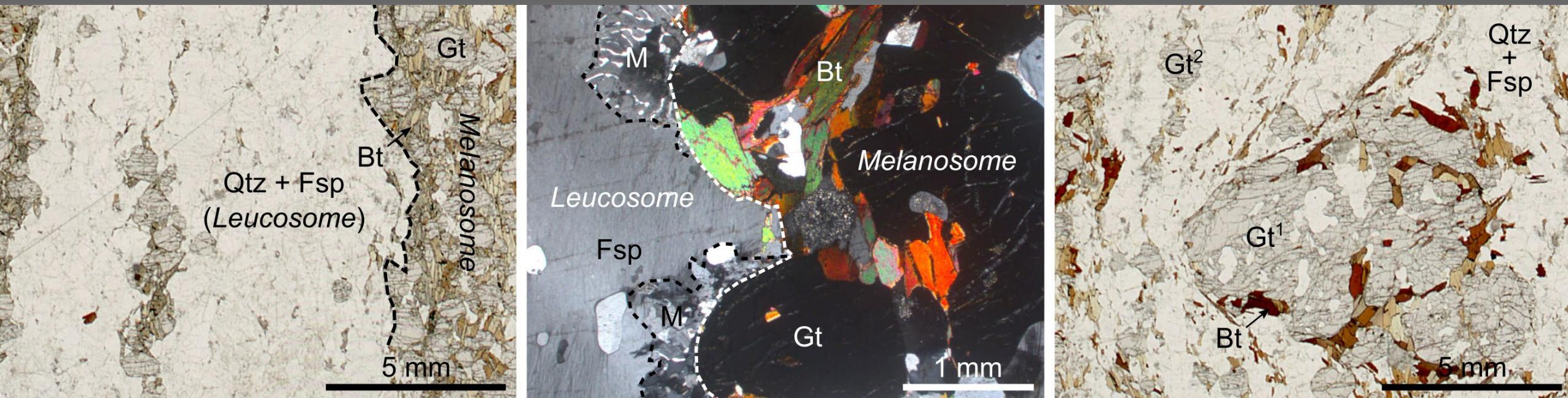




Mesoarchean nanogranitoids and fluid inclusions in migmatites of the Kangerlussuaq basement, Southeast Greenland



Silvio Ferrero¹, Gautier Nicoli², Kerstin Gresky²

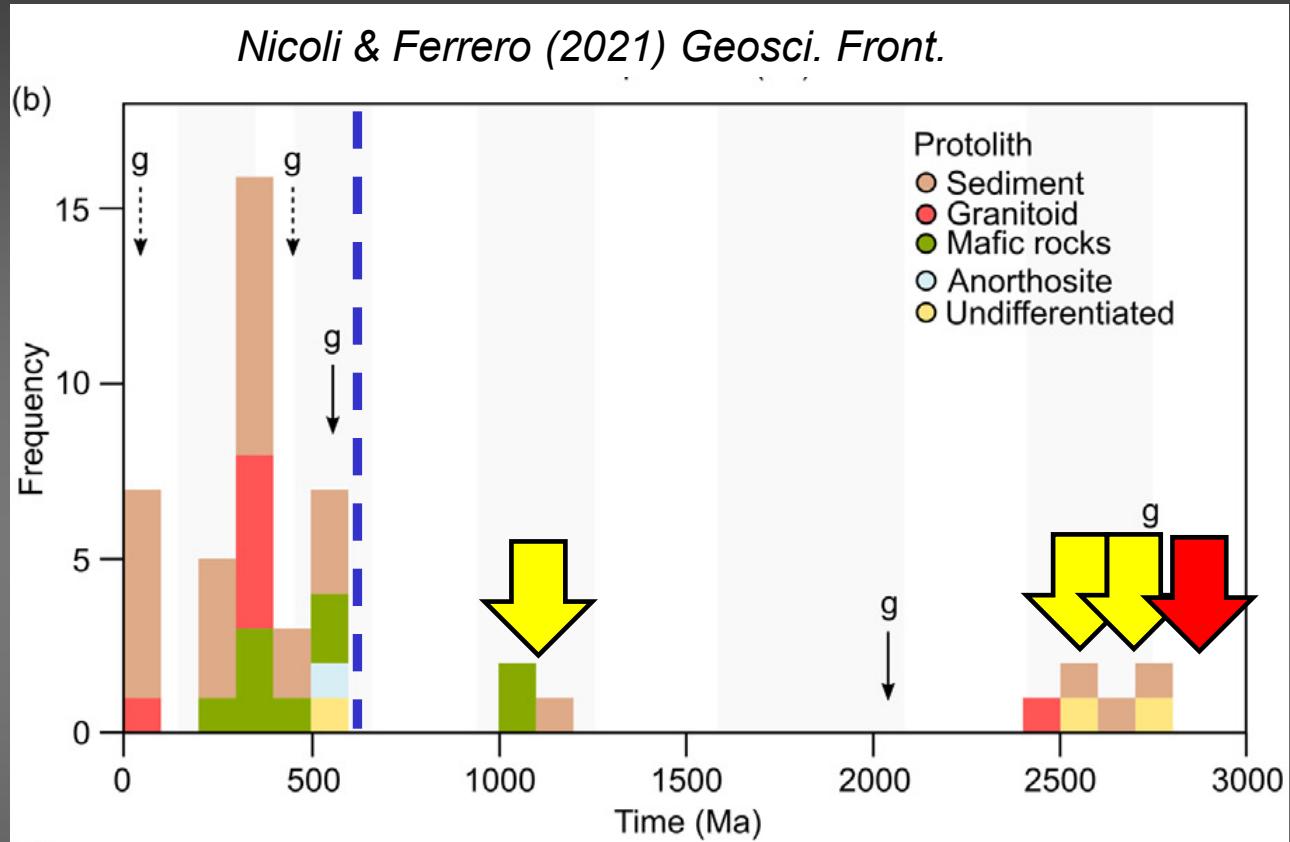
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Nanogranitoids through time

Nicoli & Ferrero (2021) Geosci. Front.



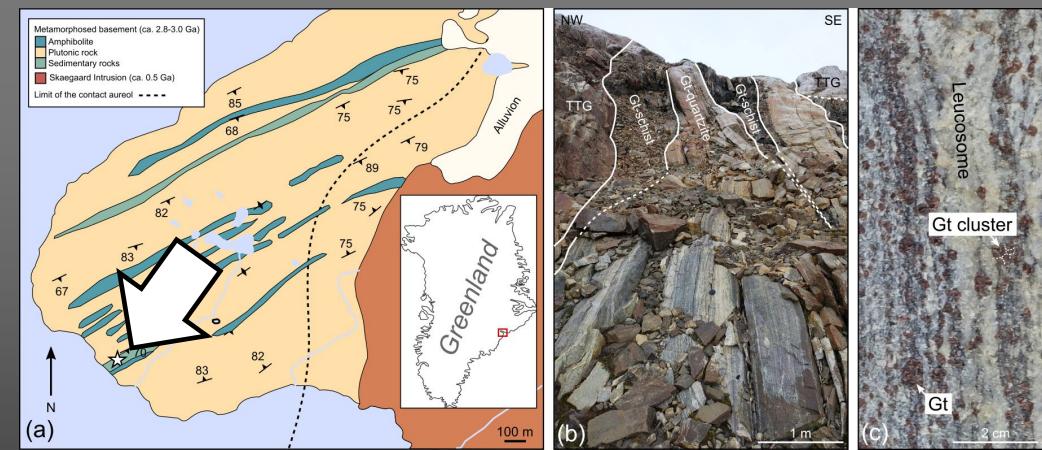
(1) 1050 Ma, Adirondacks (Darling, 2013; Ferrero et al., 2021; Nicoli et al., this session)

(2) 2580 Ma, Athabasca granulites terrane (Tacchetti et al., 2019)

(3) 2700 Ma, Limpopo Belt (Safonov et al., 2021)

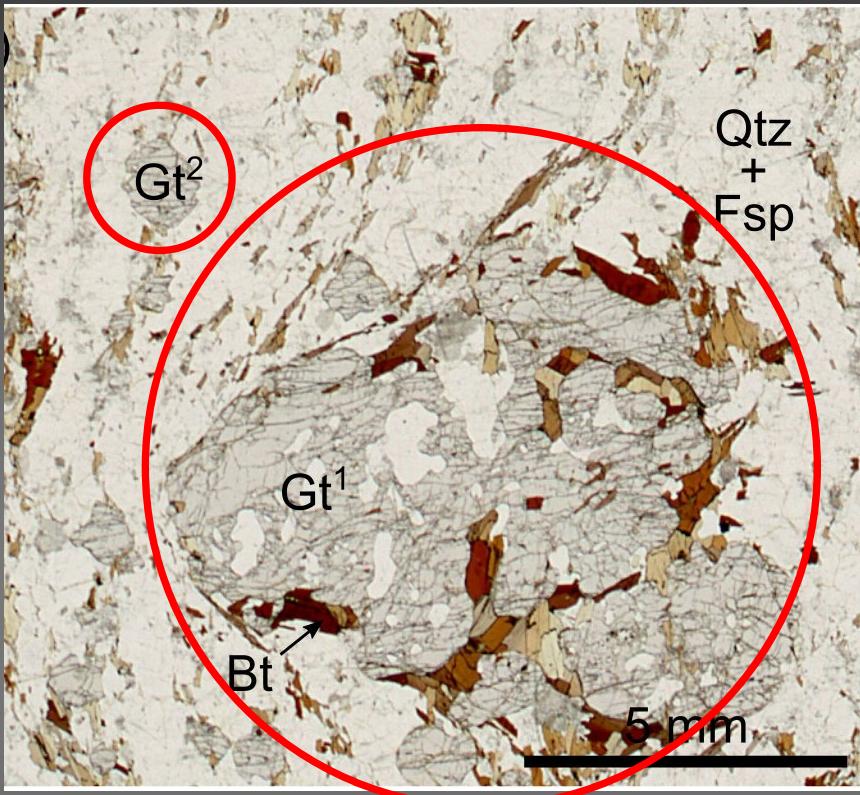
- Nanogranitoids (NG): (crystallized) inclusions of deep melts from anatexis

- Few cases in the Precambrian



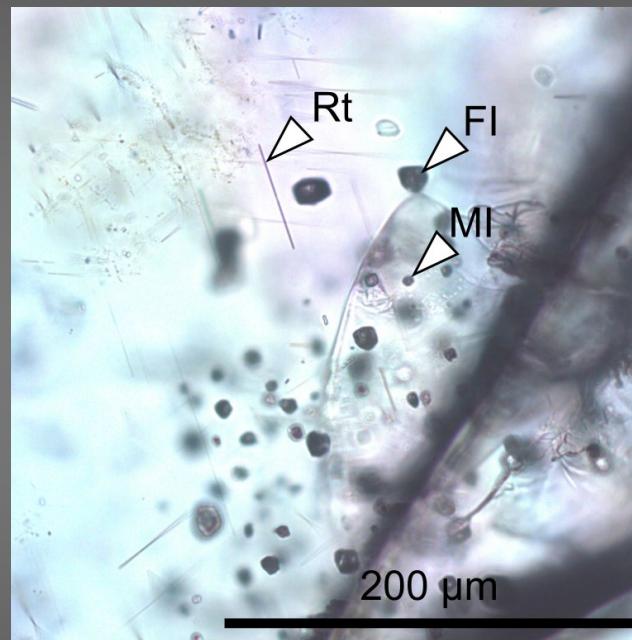
2860 Ma, Kangerlussuaq basement (Nicoli et al., 2022)

Mesoarchean nanogranitoids and fluid inclusions

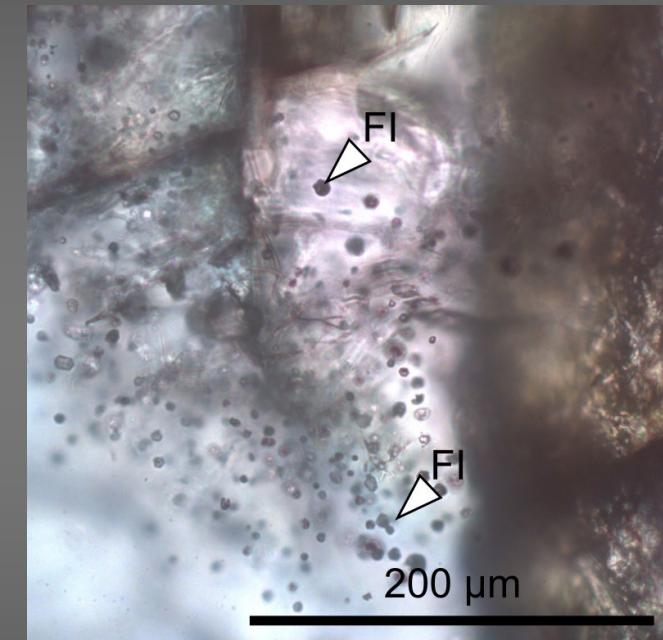


- Stromatic migmatites
Grt+Bt+Kfs+Qtz, no graphite
- Primary nanogranitoids (NG) and fluid inclusions (FI) in peritectic garnet

- Two generations of garnet



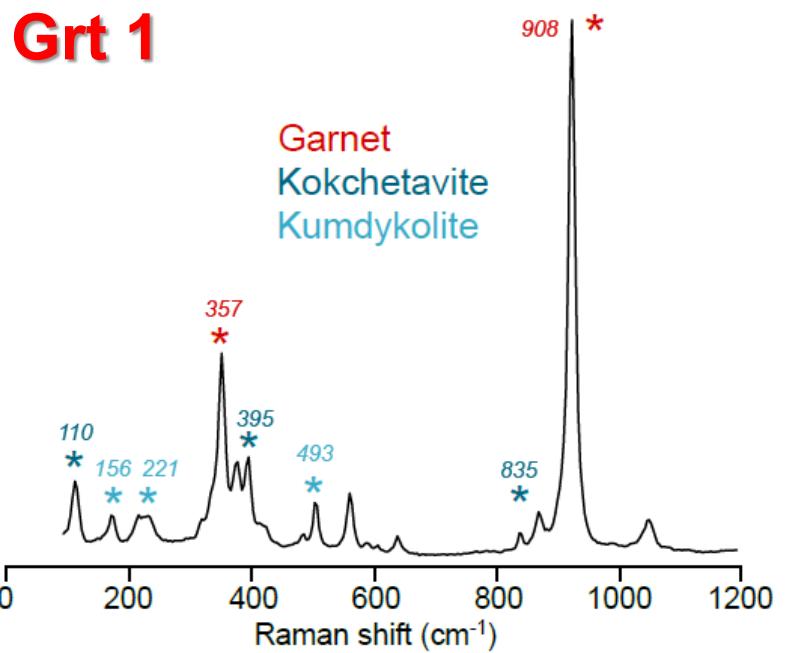
• **Grt¹**
Larger, xenoblastic
NG >> FI
Rutile needles+Qtz+Bt
> Pyrope



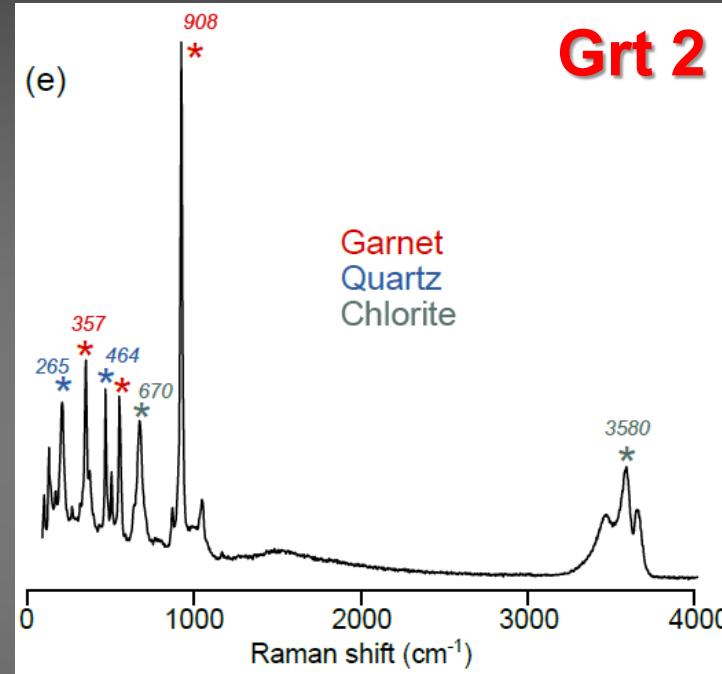
• **Grt²**
Smaller, idioblastic
FI >>> NG
< Pyrope

Two garnets, two melts, always with coexistent fluid

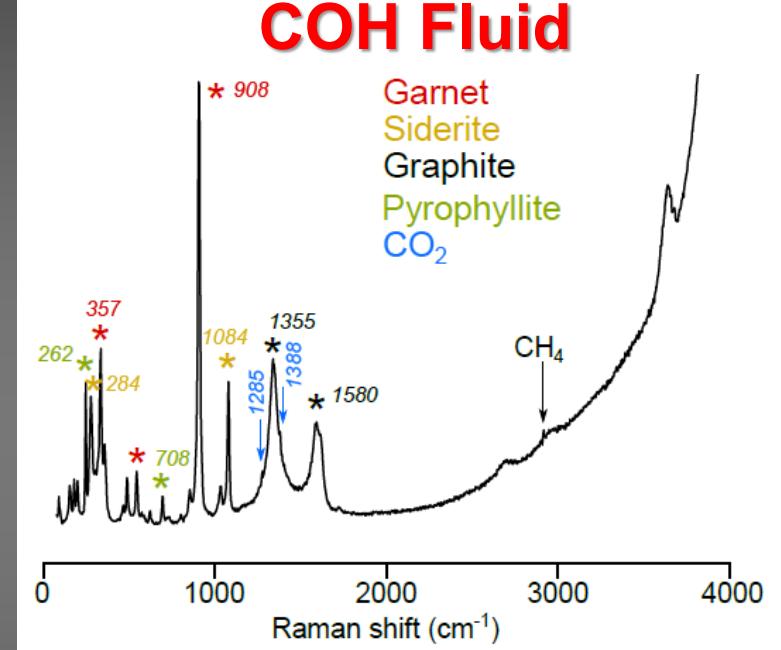
Grt 1



Grt 2



COH Fluid



- **Melt 1:**

Quartz/Cristobalite
+Kokchetavite
+Kumdykolite
+Phlogopite

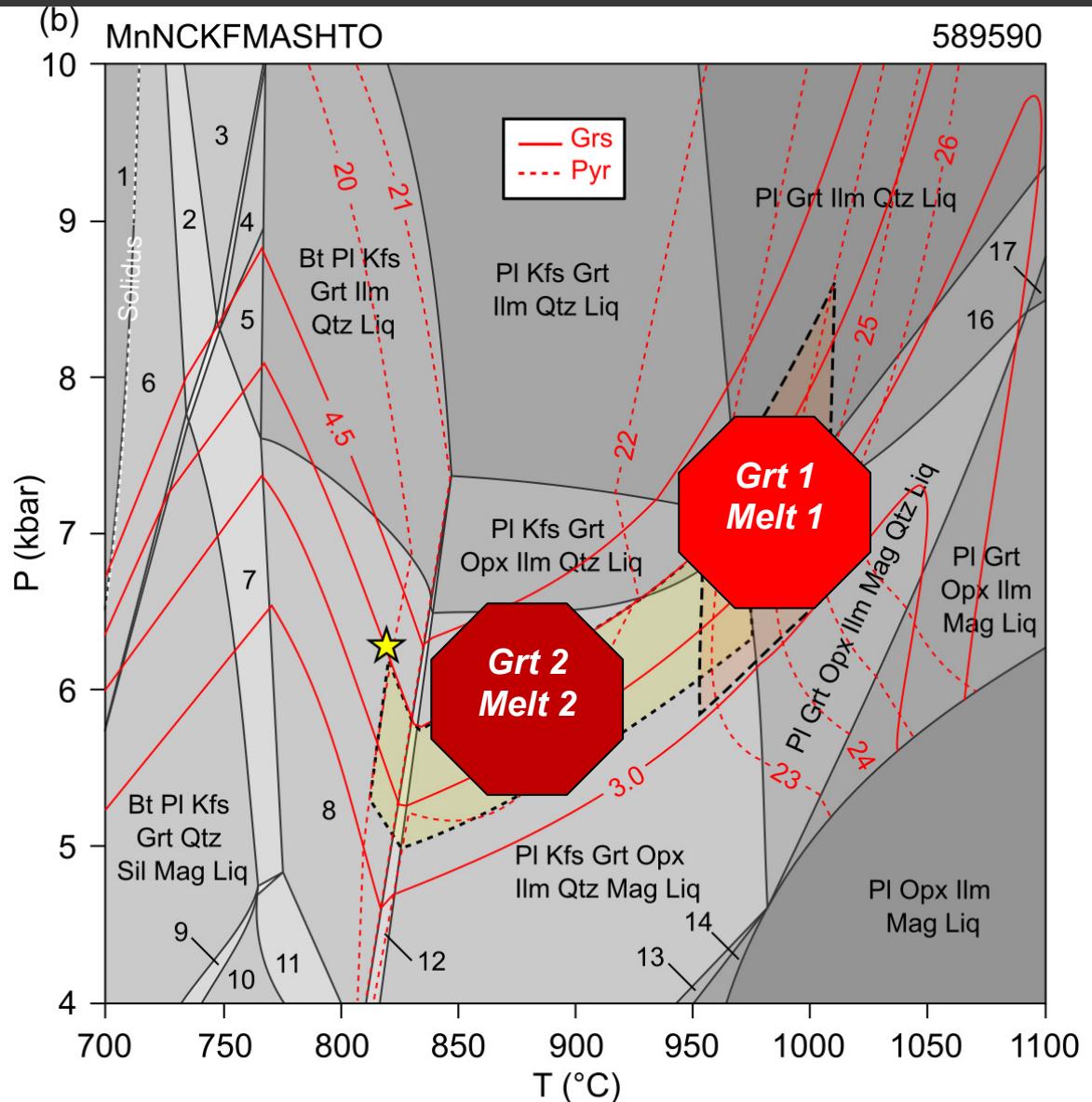
- **Melt 2:**

Quartz +K-feldspar
+Chlorite \pm H₂O

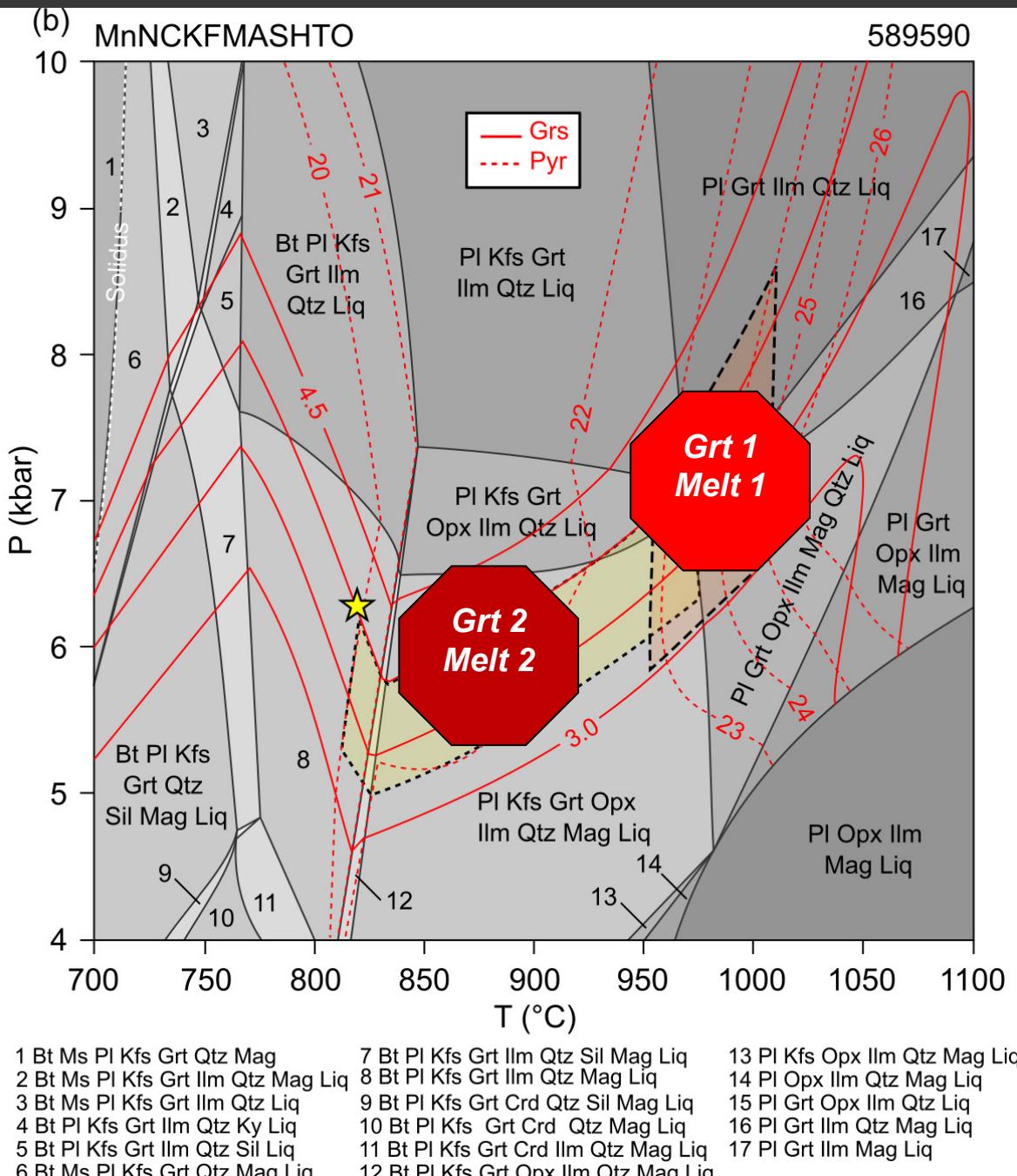
- **Primary fluid-melt immiscibility** during garnet growth

Partial melting at low-medium P and T \leq 1000°C

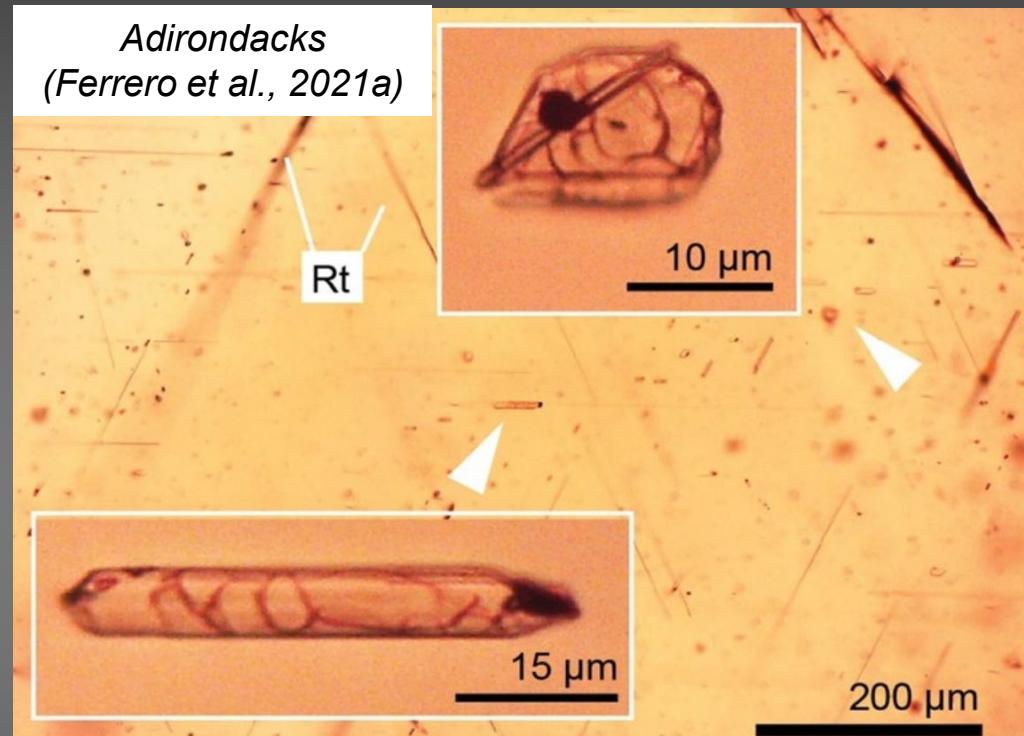
- Modelling show a supra-solidus evolution between 0.5 and 0.8 GPa
- Garnet/melt pairs are likely snapshots of **two different melting events** at $\neq T$
- **Rt needles+NG** in Grt 1 seems typical of garnets formed at T 950-1050°C (Ferrero et al., 2021a,b)



1 Bt Ms Pl Kfs Grt Qtz Mag	7 Bt Pl Kfs Grt IIm Qtz Sil Mag Liq	13 Pl Kfs Opx IIm Qtz Mag Liq
2 Bt Ms Pl Kfs Grt IIm Qtz Mag Liq	8 Bt Pl Kfs Grt IIm Qtz Mag Liq	14 Pl Opx IIm Qtz Mag Liq
3 Bt Ms Pl Kfs Grt IIm Qtz Liq	9 Bt Pl Kfs Grt Crd Qtz Sil Mag Liq	15 Pl Grt Opx IIm Qtz Liq
4 Bt Pl Kfs Grt IIm Qtz Ky Liq	10 Bt Pl Kfs Grt Crd Qtz Mag Liq	16 Pl Grt IIm Qtz Mag Liq
5 Bt Pl Kfs Grt IIm Qtz Sil Liq	11 Bt Pl Kfs Grt Crd IIm Qtz Mag Liq	17 Pl Grt IIm Mag Liq
6 Bt Ms Pl Kfs Grt Qtz Mag Liq	12 Bt Pl Kfs Grt Opx IIm Qtz Mag Liq	



Partial melting at low-medium P and $T \leq 1000^\circ\text{C}$



- **Rt needles+NG** in Grt 1 seems typical of garnets formed at T 950-1050°C (Ferrero et al., 2021a,b)

Conclusions

- Oldest occurrence of preserved nanogranitoids
- Fluid-melt immiscibility → COH fluid present partial melting
- First evidence of suprasolidus metamorphism in the area (previously 600-700°C / 0.3-0.4 Gpa)

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Letter



Mesoarchean melt and fluid inclusions in garnet from the Kangerlussuaq basement, Southeast Greenland

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Abstract
The present work reports the first anatetic melt inclusions found so far in the Mesoarchean basement in East Greenland. Using optical microscope observations and MicroRaman spectroscopy, we show that garnets in metasedimentary migmatite contain primary polycrystalline aggregates which can be confidently interpreted as former droplets of anatetic melt, i.e. nanogranitoids.

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References

- Ferrero, S., Ague, J.J., O'Brien, P.J., Wunder, B., Remusat, L., Ziemann, M.A., Axler, J. (2021a). High pressure, halogen-bearing melt preserved in ultra-high temperature felsic granulites of the Central Maine Terrane, Connecticut (US). *American Mineralogist*, 106, 1225–1236, DOI: doi.org/10.2138/am-2021-7690.
- Ferrero, S., Wannhoff, I., Laurent, O., Yakymchuk, C., Darling, R., Wunder, B., Borghini, A., O'Brien, P.J. (2021b) Embryos of TTGs in Gore Mountain garnet megacrysts from water-fluxed melting of the lower crust. *Earth and Planetary Science Letters*, 569, 117058, doi.org/10.1016/j.epsl.2021.117058.
- Nicoli, G. & Ferrero, S. (2021): Nanorocks, volatiles and plate tectonics. *Geoscience Frontiers*, 12, 101188.
- Safonov, O.G., Mityaev, A.S., Yapaskurt, V.O., Belyanin, G.A., Elburg, M., Rajesh, H.M., Smit, A.C., (2020). Carbonate-silicate inclusions in garnet as evidence for a carbonate-bearing source for fluids in leucocratic granitoids associated with granulites of the Southern Marginal Zone, Limpopo Complex. South Africa. *Gondwana Res.* 77, 147–167.
- Tacchetto, T., Bartoli, O., Cesare, B., Berkesi, M., Aradi, L.E., Dumond, G., Szabó, C. (2019). Multiphase inclusions in peritectic garnet from granulites of the Athabasca granulite terrane (Canada): evidence of carbon recycling during Neoarchean crustal melting. *Chem. Geol.* 508, 197–209.