Description of investigated geochronological samples

Sample AMF13 (palaeomagnetic site AMF2)

The AMF13 sample is from a metabasic sheet intruded into an unfoliated part of a granitoid body exposed on the south flank of Femmilsjoen (Fig. 1, Fig. SM2-1a). The sampled sheet shows no evidence of a chilled margin. The plagioclases are randomly oriented preserving a primary ophitic to the sub-ophitic igneous texture but they are altered and have oligoclase to albite range of compositions. The largely augitic pyroxenes are rimmed by amphiboles with a tschermakitic composition. Minor biotite, often chloritized, is present with ilmenite and titanite. The sample is cut by millimetre wide chlorite rich veins providing pathways for the fluid (H_20/CO_2) infiltration during or after the intrusion of the protolith.

The amphibole $^{40}Ar/^{39}Ar$ ages (Fig. 3a and Supplementary material 3) range from 489+/-16 to 1197+/-95Ma and there are no obvious relationships between the $^{38}Ar/^{39}Ar$ or the $^{37}Ar/^{39}Ar$ ratios and the calculated ages. The data may reflect a partial resetting at some time during the Caledonian Orogeny of the mineral assemblages and their isotopic signatures. Field relations and microstructural observations indicate that the protoliths were emplaced after the first (M1-D1) tectonothermal event but before the second M2-D2 amphibolite facies (Caledonian *sensu lato*) event.

Sample AMF45 (palaeomagnetic site AMF5)

This sample is from a discordant, folded and boudinaged sheet of strongly foliated amphibolite located ca 1km east of Vassfarbukta (Fig. 1, Fig. SM2-1b). The Caledonian M2-S2 foliation is defined by arrays of biotite and nematoblastic hornblendes which wrap around larger sieve textured amphiboles with plagioclase, quartz and apatite as inclusions. The feldspar – quartz inclusions are often elongate and define a pre-syn amphibole porphyroblast crystallization (M1-S1?) foliation with an apparent rotational arrangement. The M2-S2 fabric is cut by an array of ductile shear planes, which are predominantly down-to-the-right (Fig. SM2-1b) although planes with the opposite sense are found.

The $^{40}Ar/^{39}Ar$ ages (Fig. 3b and Supplementary material 3) range between 393+/-8 to 596+/-40Ma and there is a correlation between the ages and the ^{37}Ar /^{39}Ar ratio. This suggests variations in the Ca/K which reflects the alteration of the biotite. Large variations in the Ca/K ratio together with marked age differences can indicate excess argon in the fluid phase

responsible for the biotite alteration. The two prominent peaks at 394+/- 8.3 and 451+/12Ma on the probability density plot may indicate that the sampled rock records two thermal overprints in these intervals. The older more diffuse peaks may reflect the absorption of the excess argon by some of the biotite grains.

Sample AMF107 (palaeomagnetic site AMF 6)

Sample AMF107 is from a composite amphibolite (Fig. 1, Fig. SM2-1c) from the Polheim area. The sampled part of this exposure is a coarse-grained strongly foliated garnet-hornblende -andesine amphibolite. The garnets, which occur in distinct bands, are of uneven size and are usually rounded with inclusions. Most hornblendes with bands of partially altered plagioclase aggregates define the M2-D2-S2 foliation. A few larger more irregular amphiboles wrapped by the S2 foliation are also found.

The $^{40}Ar/^{39}Ar$ ages range from 335+/-62 and 435+/- 12 Ma (Fig. 3c and Supplementary material 3) with a weighted mean age of 391+/-17. There is a correlation between the ^{37}Ar /^{39}Ar ratios and the age suggesting the biotite is partially altered and probably linked to argon excess.

The probability density plot (Fig. 3c) displays a simpler data array with the main age around 380.7 Ma with an overlapping peak at around 428Ma possibly representing two thermal events.

Sample ESZ G90-8

The mylonite located along the Eolussletta Shear Zone (ESZ) which is here interpreted to effectively define a major east directed thrust ramp (Fig. 1) has been analyzed via the *in-situ* LA-ICP-MS $^{40}Ar/^{39}Ar$ method. The mylonite is characterized by numerous augen-like feldspar porphyroclasts in various stages of grain size reduction that are bordered by muscovite rich pressure shadows such as seen in Fig. SM2-1d.

The $^{40}Ar/^{39}Ar$ ages (Fig. 3d and Supplementary material 3) range from 394+/-5 to 1413+/-35Ma but the probability density plot suggests that the older ages are insignificant. The 400-500Ma ages are probably more significant and are interpreted to reflect the interval in which the micas in the pressure shadows and those defining the mylonite foliation grew.

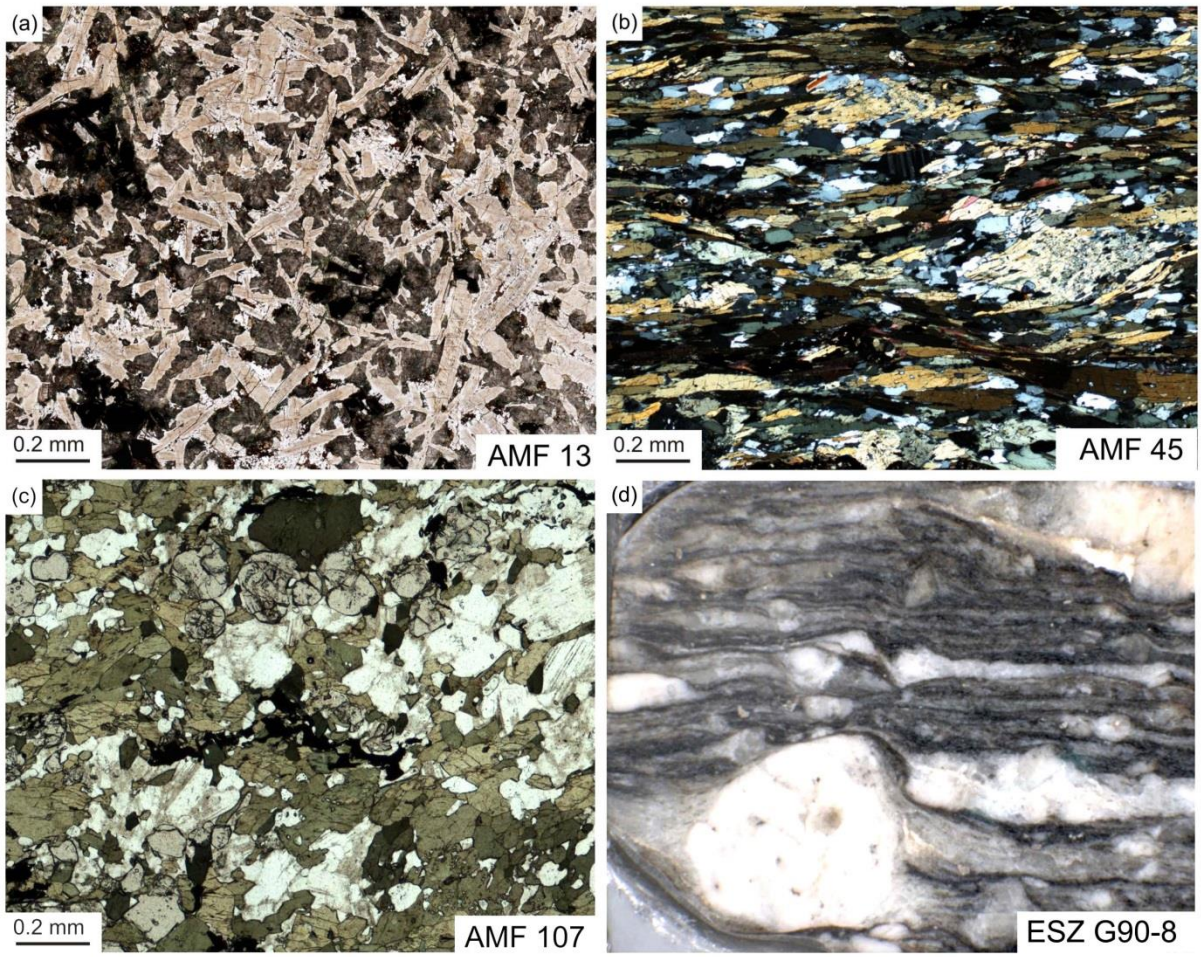

Fig. SM2-1. **(a)** Thin section of sample AMF13 (site AMF2, Femmilsjoen); note the partially altered plagioclase retain original igneous texture while the ophitic pyroxenes are replaced by amphiboles. **(b)** Thin section of the sample AMF45 from a folded discordant sheet near Vassfarbukta (site AMF5); the main S2-M2 schistosity is defined by nematoblastic hornblende grains and elongate andesine arrays; the presence of a few larger poikiloblastic hornblendes, with pressure shadows, suggest they are relics of an earlier amphibolite facies growth (M1-S1?) event; note the presence of east-dipping and west-dipping shear surfaces suggesting a late to post-M2 pure shear event giving rise to lateral spreading/extension. **(c)** Thin section of the sample AMF 107 (site AMF6; Mosselbukta, Polheim) - a strongly foliated garnet-hornblende-andesine amphibolite; the garnets which are located in distinct bands are of uneven size and are rounded and may contain inclusion trails (S*i*) that are not continuous with the external foliation (S*e*); most hornblendes have developed rational crystal faces and with the elongate strings of partially altered plagioclase define the S2-M2 schistosity; a few irregular (M1) grains contain what appear irregular exsolution grains suggestive of isothermal decompression. **(d)** Thin section of the mylonitic sample ESZ G90-8 from the mylonite located along the Eolussletta

Shear Zone; the section is that used for the *in situ* Uv-MS $^{40}Ar/^{39}Ar$ age determination of micas in the pressure shadow of the large ca 5mm Kspar (bottom left of section).