Microscopic/SEM/BSE images of investigated metabasites

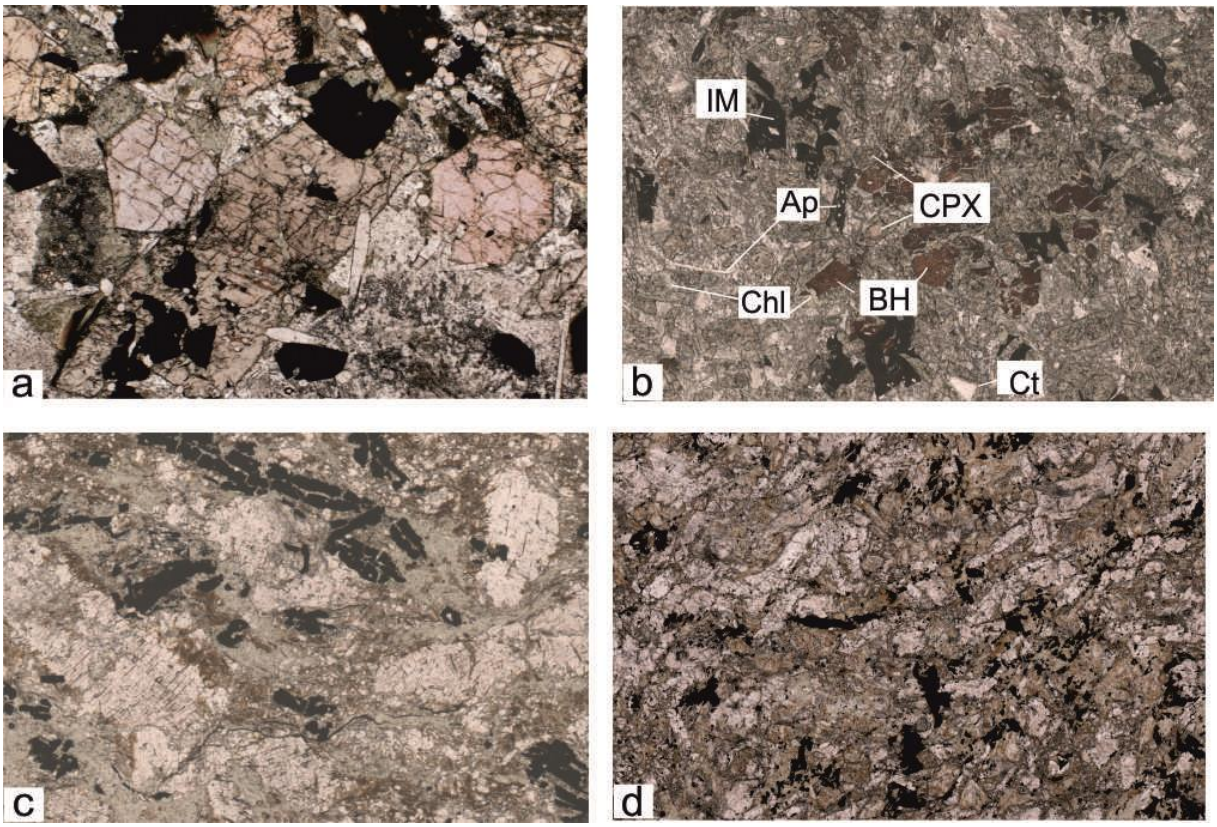

Fig SD5-1. Petrography of metadolerites from Oscar II Land. (a) Euhedral clinopyroxene accumulations within highly altered plagioclase, now nearly completely replaced by chlorite-actinolite. Unaltered needle-like apatite and Fe-Ti oxides are common (location St. Jonsfjorden, sample G-3). (b) Metadolerite with well preserved igneous texture, the pyroxenes (CPX) are very altered, often only a core remains but many are pseudomorphed by polycrystalline chlorite (Chl) aggregates. Large late magmatic ilmenite/magnetite (IM) are common. Basaltic hornblende (BH) to kaersutite is common as idiomorphic grains as is apatite (Ap) (location St. Jonsfjorden, sample Wt6). (c) Metadolerite (sample Wt12, St Jonsfjorden) with large altered plagioclase rimmed by biotite set in a dominantly chlorite matrix possibly derived from pyroxene breakdown. Ilmeno/magnetite (black grains) in intervening areas often in association with biotite. S_1 foliation is marked by thin bands of opaque minerals (mostly ilmenite). (d) Metadolerite (sample G7, St Jonsfjorden) from the western flank of Konowfjellet shows S_1 foliation from upper right to lower left of image. S_1 decorated with ilmenite/titanite pseudomorph after magnetite grains but earlier larger grains are wrapped by the foliation as are the feldspars. Pyroxenes are completely altered and partly replaced by biotite-calcite aggregates (the lower edges at all images are 7.2 mm).

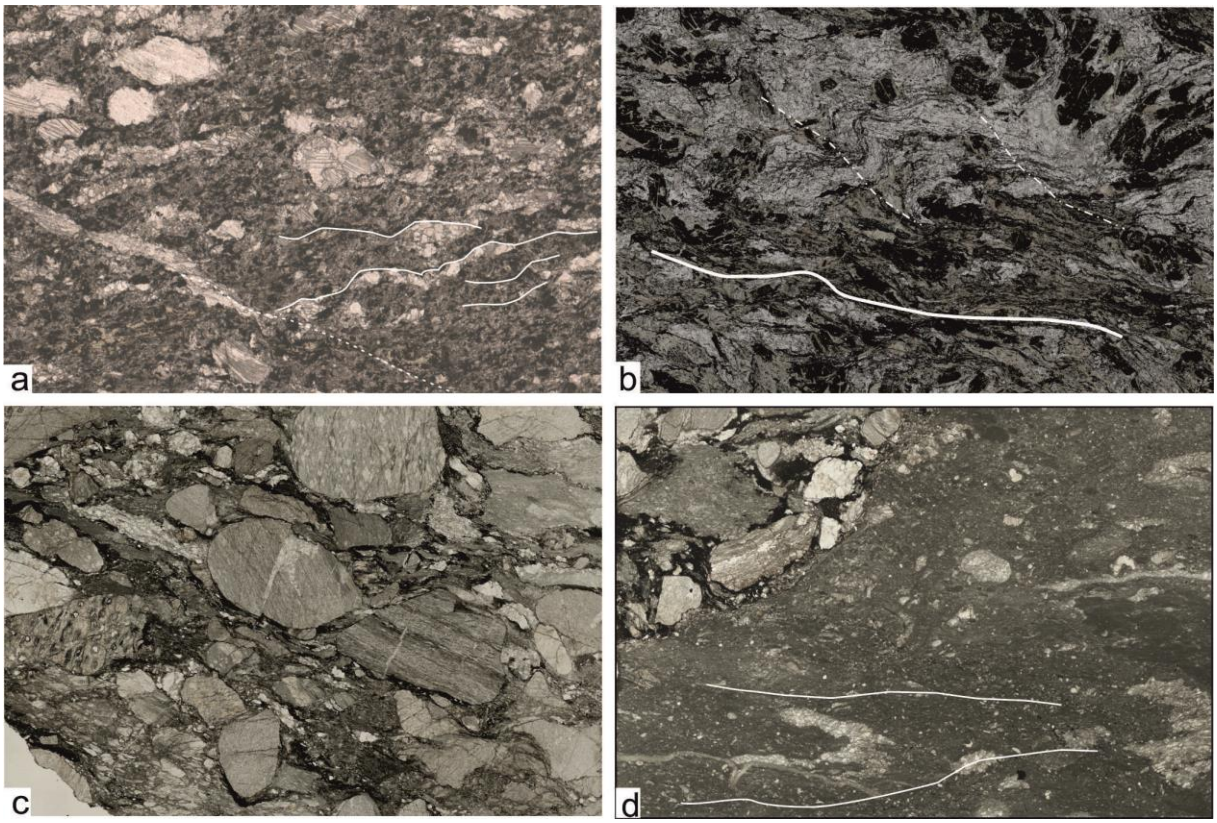

Fig SD5-2. (a) Metavolcanic sample Wt 56 (Venernbreen moraine). This section is from a flattened bomb in the volcanoclastics. S_1 is indicated by continuous white lines, shear surfaces by broken line. Vesicles may be filled by single deformed calcite crystals or by aggregates of calcite with small albite grains. (b) Metavolcanic sample Wt 23 (Venernbreen moraine) partly banded ash (?) deposit, albite rich layers alternating with chlorite layers. Opaques flattened and wrapped by S_1 foliation. F_2 crenulation folds are evident and S_2 cleavages indicated by broken line. (c) Metavolcanic sample Wt 8404 (Venernbreen moraine). Clast rich band in volcanoclastics layer. S1 foliation runs upper left to lower right. A number of the clasts appear exhibit a well developed foliation (e.g. top centre) at high angle to external S_1. (d) Metavolcanic sample Wt 8071 (Venernbreen moraine). Contact between ash-clast dominated bands in the volcanoclastics. S_1 indicated by the continuous white line which at a shallower angle than the bedding which runs top centre to lower left. Note folded calcite string between the two lines (the lower edges at all images are 7.2 mm).

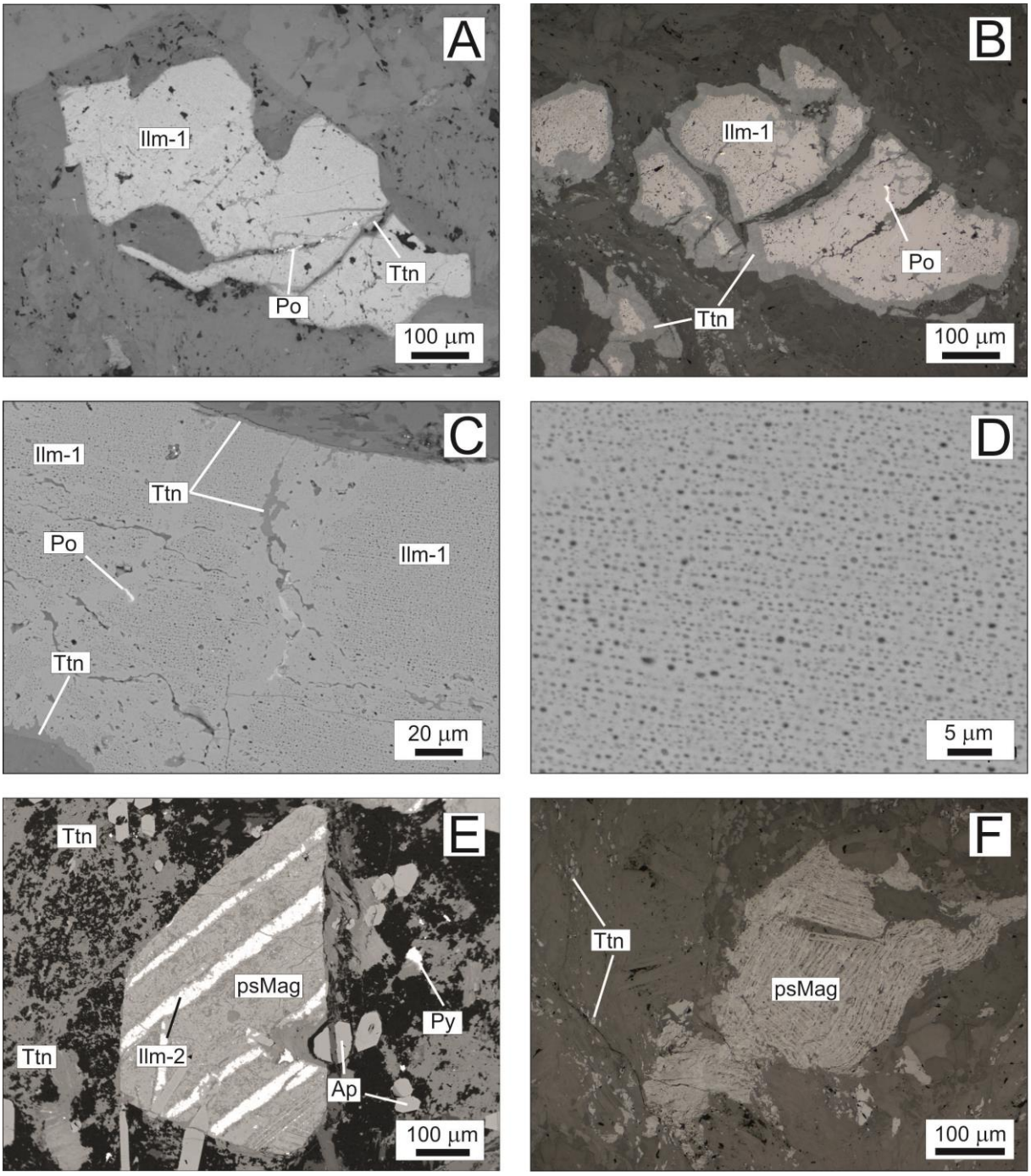
A
Ilm-1
Ttn
Po
100 μm
B
Ilm-1
Po
Ttn
100 μm
C
Ilm-1
Ttn
Po
Ilm-1
Ttn
20 μm
D
5 μm
E
Ttn
psMag
Py
Ttn
Ilm-2
Ap
100 μm
F
Ttn
psMag
100 μm

Fig SD5-3 (previous page). Mineralogy and petrography of Fe-Ti oxides in the metadolerites from the central western Svalbard. Photomicrographs a, b and f were taken using reflected polarized light under parallel nicols. Images a, b, and e are electron backscattered images (BSE, 15 keV, 20 nA). (a) Ilmenite phenocryst (Ilm-1) containing numerous small open spaces after dissolved hematite exsolutions. Ilmenite is replaced by titanite and pyrrhotite along fractures. St. Jonsfjorden, sample G-5. (b) Titanite rims along ilmenite grains - product of ilmenite breakdown during greenschist facies metamorphism. Ommafjellet, sample WT-14. (c, d) BSE images showing details of internal texture of ilmenite grains. The images show complete dissolution of lens-like hematite exsolution (now open spaces) and varying amounts of metamorphic titanite and pyrrhotite. St. Jonsfjorden, sample G-5. (e) Pseudomorph texture of metamorphosed dolerite. Magmatic apatite is the only mineral preserved from magmatic stage. The titanite pseudomorph after Ti-bearing magnetite phenocryst document subsolidus oxyexsolution of ilmenite (Ilm-2). The fine-grained oxide "dust" in the dolerite matrix is nearly completely replaced by titanite. St. Jonsfforden, sample G-7. (f) Titanite pseudomorph after Ti-bearing magnetite occurred in well recrystallized metadolerite. Kinnefiellet, sample WT-34.

Abbreviations: Ap - apatite, Ilm - ilmenite, Po - pyrrhotite, Py - pyrite, Ttn - titanite, psMag - titanite pseudomorph after magnetite.

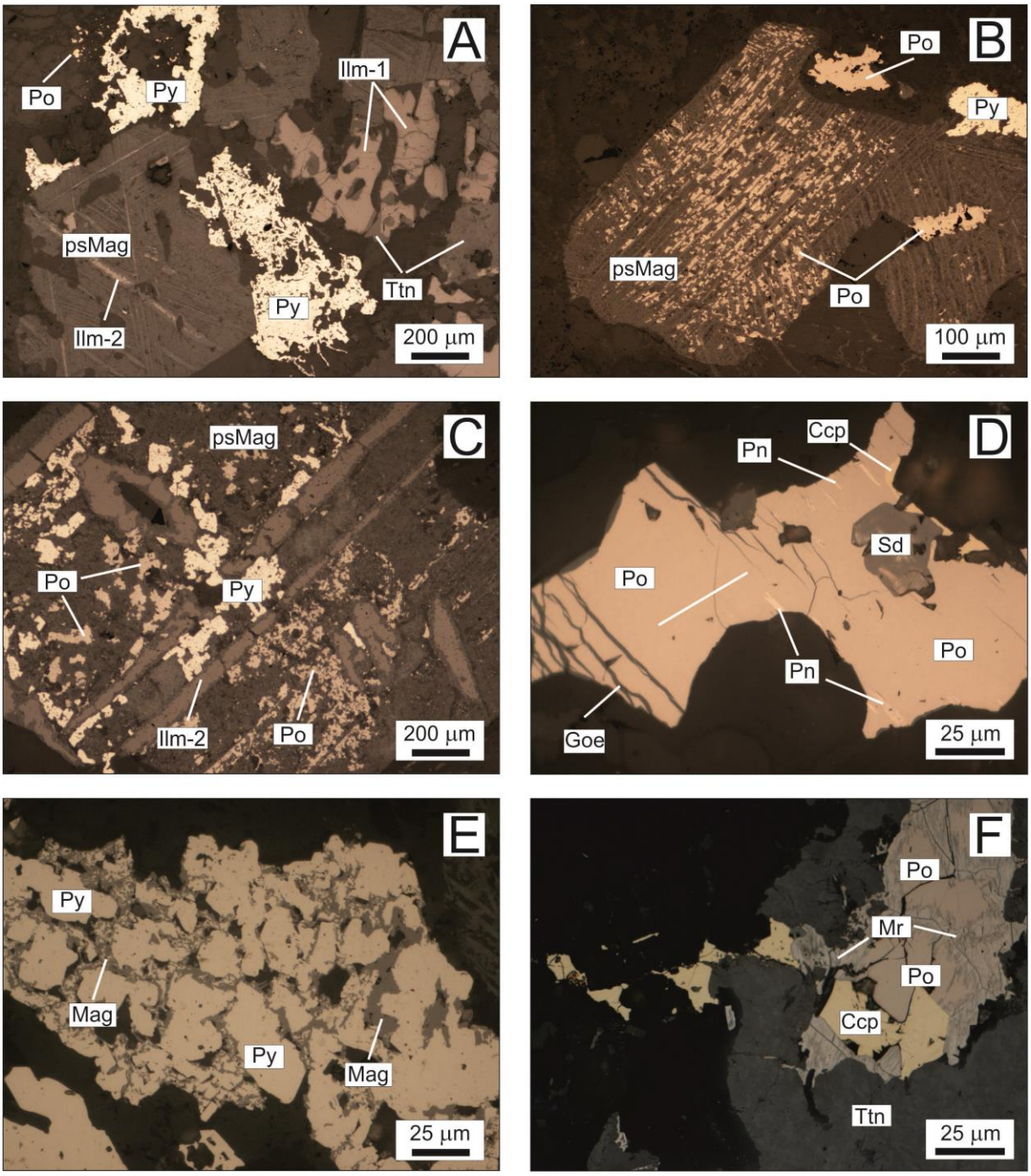
A
Po
Py
Ilm-1
psMag
Ttn
Py
Ilm-2
200 μm
B
Po
Py
psMag
Po
100 μm
C
psMag
Po
Py
Ilm-2
Po
200 μm
D
Pn
Ccp
Sd
Po
Po
Pn
Goe
25 μm
E
Py
Mag
Py
Mag
25 μm
F
Po
Mr
Po
Ccp
Ttn
25 μm

Fig SD5-4 (previous page). Sulphide associations within the metadolerites of the central western Svalbard. All photomicrographs were taken using reflected polarized light under parallell nicols. (a) Example of the most common sulphide/Fe-Ti oxides associations. Sieve texture of pyrite aggregates (developed during pyrrhotite breakdown) and titanium bearing magnetite grown contemporanously during metamorphism. St. Jonsfjorden, sample G-2. (b) Titanite pseudomorph after Ti-bearing magnetite that contains numerous small pyrrhotite intergrowths. St. Jonsfjorden, sample G-1. (c) Mineralogy of the titanite pseudomorph after Ti-bearing magnetite. Relics of trellis-type intergrowths of ilmenite (Ilm-2) grown during subsolidus oxy-exsolutions of titanomagnetite. St. Jonsfjorden, sample G-1. (d) Pyrrhotite grain with exsolutions of pentlandite and chalcopyrite, partly replaced by goethite. St. Jonsfjorden, sample G-8. (e) Pyrite/magnetite intergrowths developed during pyrrhotite breakdown. St. Jonsfjorden, sample G-2. (f) Typical sulphide association within recrystallized metadolerites, where primary pyrrhotite is replaced by marcasite. Kinnefiellet, sample WT-34.

Abbreviations: Ccp - chalcopyrite, Goe - geothite, Ilm - ilmenite, Mag - magnetite, Pn - pentlandite, Po - pyrrhotite, Py - pyrite, Sd - siderite, Ttn - titanite, psMag - titanite pseudomorph after magnetite.

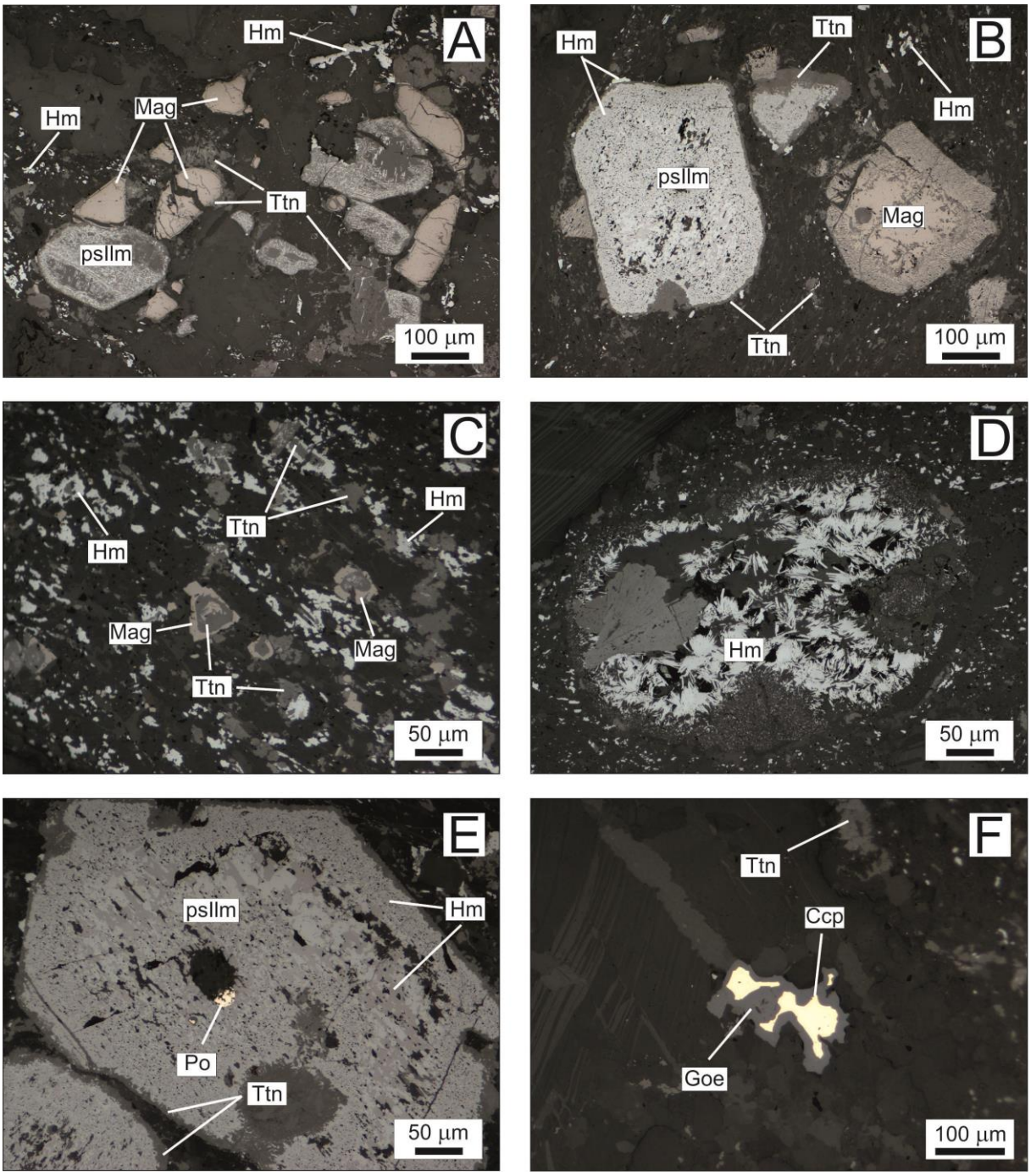
A
Hm
Mag
Hm
Ttn
psIlm
100 µm
B
Hm
Ttn
Hm
psIlm
Mag
Ttn
100 µm
C
Hm
Ttn
Hm
Mag
Mag
Ttn
50 µm
D
Hm
50 µm
E
psIlm
Hm
Po
Ttn
50 µm
F
Ttn
Ccp
Goe
100 µm

Fig SD5-5 (previous page). Mineralogy and petrography of Fe-Ti oxides in the metavolcanic rocks from the central western Svalbard. All photomicrographs were taken using reflected polarized light under parallel nicols. (a) Accumulation of hematite pseudomorphs after ilmenite phenocrysts, and slightly altered magnetite grains, initially replaced by titanite. In the matrix numerous grains of metamorphic hematite. Venernbreen moraine, sample WT-61. (b) Titanite in the form of minute intergrowths in the matrix, rims along hematite pseudomorph after ilmenite, and narrow zones at the border parts of magnetite phenocrysts. The outer rim of magnetite phenocrysts is additionally replaced by titanite and carbonates along {111} planes of magnetite. Venernbreen moraine, sample WT-63. (c) Magnetite-hematite-titanite association within metavolcanite matrix. The magnetite and hematite grow contemporaneously during metamorphism, just after titanite. Venernbreen moraine, sample WT-61. (d) Hematite - calcite aggregates filling void after degassing of the mafic melt. Venernbreen moraine, sample WT-61. (e) Rare inclusion of pyrrhotite within hematite pseudomorph after ilmenite. Venernbreen moraine, sample WT-63. (f) chalcopyrite replaced by goethite. Venernbreen moraine, sample WT-61.

Abbreviations: Cp - chalcopyrite, Goe - goethite, Hm - hematite, Mag - magnetite, Po - pyrrhotite, Ttn - titanite, psIlm - hematite pseudomorph after ilmenite.