

### Field characteristics of metabasic sites

The metadolerites cropping out on the north coast of St Jonsfjorden below Konowfjellet form two large lenticular bodies lying within the main penetrative  $S_1$  syn-metamorphic Caledonian schistosity (Fig. 2, 3). The contact of the main meta-gabbroic body within the Konowfjellet sub-unit is not exposed along the coastal cliff section but on the elevated strand flat above small exposures of the semi-pelitic phyllites crop-out in a curved pattern defining the boudin like shape of the meta-dolerite. The meta-gabbro body is heavily fractured and cut by a series of west dipping faults that are commonly associated with meter wide alteration zones (Fig. SD1-1a). Internally the primary igneous textures are well preserved although the mineralogy has been partially replaced by metamorphic assemblages. An alternation of light colored feldspar-rich with dark green mafic bands is everywhere apparent and the steep to SW dipping banding is occasionally traversed by ductile shear zones that are superimposed by more brittle shears (Fig. SD1-1b). The second body sampled lies structurally above and to the west of the meta-gabbro and is partially exposed on the western flank of Konowfjellet. In cross section these intrusions lie on the overturned limb of a mesoscale east vergent  $F_1$  synformal fold (Fig. 3). Restoration of the fold suggests that the meta-gabbro intrusion, together with its banded character, was originally emplaced as a sill. Unfortunately, because exposures of metadolerites on the W limb of the Konowfjellet fold were unsuitable for palaeomagnetic sampling (the metadolerites are not in an *in situ* position, they occur largely in the debris), palaeomagnetic fold test could not be performed.

The structural setting of the meta-igneous rocks in the Kinnefjellet-Omafjellet area can be interpreted as shallow eastward dipping isoclinal synform-antiform pair of folds. These folds appear to show some limited late to post-fold back thrusting to the west possibly associated with the late N-S (WSFTB) synformal flexuring (Fig. 4) that extends southward to Protektorfjellet. The Kinnefjellet and Omafjellet meta-dolerites have many compositional and textural features in common (cf. Ohta 1985). Broadly they occur, like the St Jonsfjorden meta-gabbro, as lenticular or boudin-like bodies lying in the Caledonian  $S_1$  foliation (Fig. SD1-1c, d). The boudins are internally disrupted by numerous shear planes, with varying senses of slip, into rough sigmoidal lenses often truncated at high angles by conjugate fracture pairs indicative of normal to  $S_1$  failure (Fig. SD1-1d). Primary igneous textures are largely well preserved internally although, again, the mineralogy of these rocks is extensively replaced by metamorphic assemblages. Ductile shear zones with strongly aligned feldspar and mafic minerals often border both the main meta-dolerite bodies and may define the margins of the

internal sigmoidal lenses. Quartz and calcite veins that are often folded are a common feature of these meta-dolerites demonstrating the extent of late intrusion and/or syn-metamorphic fluid phase activity.

The meta-volcanics exhibit an array of characteristics along and across strike. In the largest exposure discovered in the Venernbreen moraine the base is characterized by a 2-3 m thick layer of pillow-like structures flattened into the Caledonian  $S_1$  foliation, (Fig. SD1-2a, b) that preserve a 1-2cm fine grained (chilled margin) rind with a markedly calcite filled vesicular core. This unit is overlain by a layer of volcano-clastics consisting of a variety of different sized lens-shaped bombs again flattened into the  $S_1$  foliation. They appear compositionally variable with some being pale-dark green to violet in colour and many are notably vesicular (Fig. SD1-2). They are set into a fine ash-like, strongly foliated, matrix that wraps around the clasts. The upper half of the exposure is dominated by a green fine grained, strongly foliated ESE dipping ash-like deposit. Ohta (1985) describes, many similar meta-volcanics duplicated in a lower thrust nappe to the east, along the Venernbreen backwall and in most of the nunatacs across the divide toward St Jonsfjorden (see Bergh *et al.* 2003).

Further north along strike to the south shore of Eidembukta three meters thick, strongly boudinaged fine grained green quartz-phyllite layers are intercalated with grey-green-white quartzites (Fig. 4). These may represent along strike equivalents of the above meta-volcanics as ash-fall deposits incorporated into the shallow marine platform quartzites. No similar correlatives were found to the south of Kinnefjellet.

## References

- Bergh, S.G., Ohta, Y., Andresen, A., Maher, H.D., Braathen, A. & Dallmann, W.K. 2003. *St. Jonsfjorden, Svalbard, 1:100000. Theme map No. 34.* Norsk Polarinstitut.
- Ohta, Y. 1985. Geochemistry of Precambrian basic igneous rocks between St Jonsfjorden and Isfjorden, central western Spitsbergen, Svalbard. *Polar Research*, **3**, 49–67.



Fig. SD1-1. Views of St. Jonsfjorden and Kinnefjellet Metadolerites. (a) View of St. Jonsfjorden metadolerite (b) Metadolerite, St. Jonsfjorden, showing well preserved NW-SE magmatic banding (left half of image). Right half, above hammer head (4 cm in diameter), shows ductile Caledonian (?) shear zone (between red lines) cutting obliquely through banding. Blue dashed lines show (later?) brittle shears indicating pure flattening. (c) Metadolerite lenses/boudins cropping-out along front of Kinnefjellet. (d) Green to light tan weathering meta-dolerite in central part of Kinnefjellet. Contacts with host dark phyllites with carbonate bands are evident and metadolerite is cut by anastomosing shear surfaces, calcite veining and in parts is foliated.

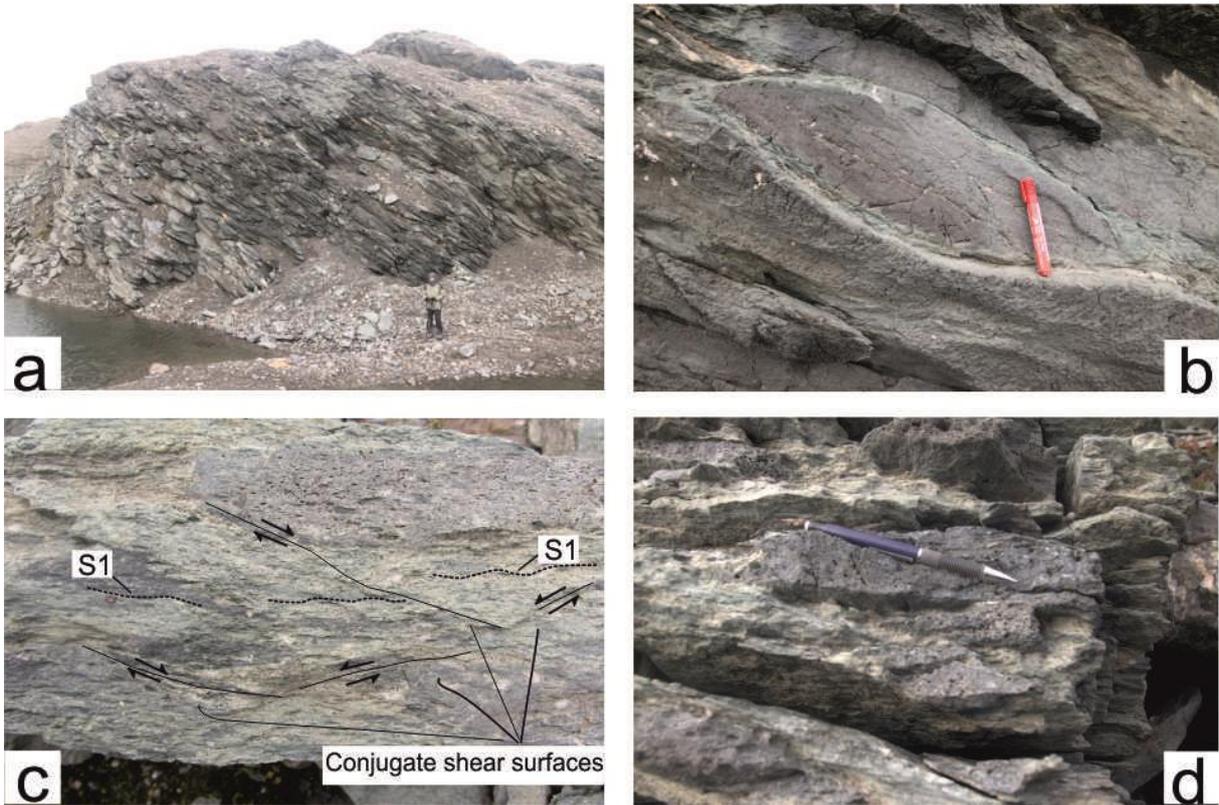


Fig. SD1-2. (a) Metavolcanics cropping-out within Venerbreen end moraine. Flattened pillow-like structures at base give way agglomerates in fine grained matrix (ash). Upper part of exposure consists of foliated ash. (b) Example of small pillow-like structure with vesicular interior and chilled margin. (c) Example of agglomerate with lenticular shaped (tectonically flattened) bombs of various compositions set in ash-like matrix. Bombs are flattened in plane of S1 which is displaced by conjugate shears. (d) Various sized vesicular bombs set in matrix of fine ash-small clasts. Numerous light coloured areas of carbonate.