

Succession of Caledonian tectonic events in the pre-Devonian basement of NW-Spitsbergen

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In the Liefdefjorden area, NW Spitsbergen, a several km-thick sequence of Proterozoic metasedimentary rock units was affected by a polyphase structural evolution during the Caledonian Orogeny. In the field, a relative succession of tectonic events could be detected by structural field work. As a result, the Early Caledonian development was initiated by three ductile events (E1 to E3), which are recorded by the development of a metamorphic layering (S1), the formation of two generations of isoclinal folds (F2, F3) and the development of a penetrative foliation (S3) in mica schists and marbles of the Krossfjorden Group in Early to Middle Ordovician times. While the fold axes of the first isoclinal folding (F2) are more or less E-W oriented, the trend of the second isoclinal folding (F3) is dominated by N-S fold axes. The Early Caledonian evolution E1-E3 was followed by a thermal event (E4) in the Late Ordovician/Early Silurian, which was characterized by migmatization of large parts of the basement in NW Spitsbergen and by the emplacement of the so-called grey granite and pegmatite and aplitic dikes in Middle to Late Silurian times. The late orogenic development was dominated by mylonitization (E5) in the Late Silurian, which affected the deformed metasedimentary rocks and undeformed migmatites, granites and dikes. N-S to NE-SW trending lineations on the mylonite foliation characterize this event. The Caledonian Orogeny was terminated by folding with the formation of km-scale synforms and antiforms (E6) around N-S trending axes, the intrusion of late-orogenic granites (E7) in Late Silurian/Early Devonian times, and late-orogenic extension (E8). The structural field studies demonstrate that the tectonic evolution during the Caledonian Orogeny in NW-Spitsbergen was much more complex than seen before. The separation of different tectonic units and interpretation of the kinematics during the different events as well as possible relations to the other pre-Devonian basement areas of the postulated neighboring terranes remain problematic.