



A second glimpse of Early Cambrian life: new collections from Sirius Passet, North Greenland

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The German mining term *lagerstätten*, referring to a rock of any composition containing constituents of economic interest, has been widely applied to occurrences of abundant or unusually well preserved fossils (cf. Seilacher *et al.*, 1985). The Middle Cambrian Burgess Shale of western Canada is perhaps the most famous of all fossil-lagerstätte, with many of the approximately 140 known species preserving exquisite details of the soft anatomy of members of a community of organisms that was fossilised more than 500 million years ago (Whittington, 1985; Conway Morris, 1979, 1986; Gould, 1989). Other well known examples include the Upper Cambrian 'Orsten' of southern Sweden, the Lower Devonian Hunsrück Slate and the Jurassic Solnhofen Limestone of Germany (Stürmer *et al.*, 1980; Müller, 1985; Barthel *et al.*, 1990; summary in Briggs & Crowther, 1990, pp. 266–297). The term can be applied aptly to the Sirius Passet fauna of central North Greenland, where a wealth of exceptionally preserved fossils (e.g. Fig. 1) from the Lower Cambrian Buen Formation has been recorded from a small locality in western Peary Land, near the south-western end of the broad valley known as Sirius Passet (Fig. 2).

The locality yielding the Sirius Passet fauna was discovered in 1984, but substantial collecting was first possible in 1989 (Conway Morris *et al.*, 1987; Conway Morris & Peel, 1990; Peel, 1990). At that time, a collection of some 1500 slabs of mudstone was secured, yielding a fauna of more than 30 species. Interest in the Sirius Passet fauna reflects not only the anatomical information which can be derived from specimens preserving details of limbs and soft parts, but also the great antiquity of the locality. The assemblage is significantly older than the Burgess Shale lagerstätten of Canada, and of

similar age to the Chengjiang fauna of Yunnan Province, China (Chen Jun-yuan & Erdtmann, 1991; Chen Jun-yuan *et al.*, 1991; Hou Xian-guang & Bergström, 1991).

The most noteworthy members of the Sirius Passet fauna are articulated halkieriid worms (Fig. 1; Conway Morris & Peel, 1990; Peel, 1991), but the arthropod-dominated fauna also yields sponges, worms and several organisms of problematic affinities.



Fig. 1. Articulated halkieriid from the Buen Formation at Sirius Passet, central North Greenland, MGUH 19.728 from GGU collection 340103, $\times 2$. The worm-like body is covered by many hundreds of small sclerites, with prominent shells located anteriorly (turned to the right in this specimen) and posteriorly.

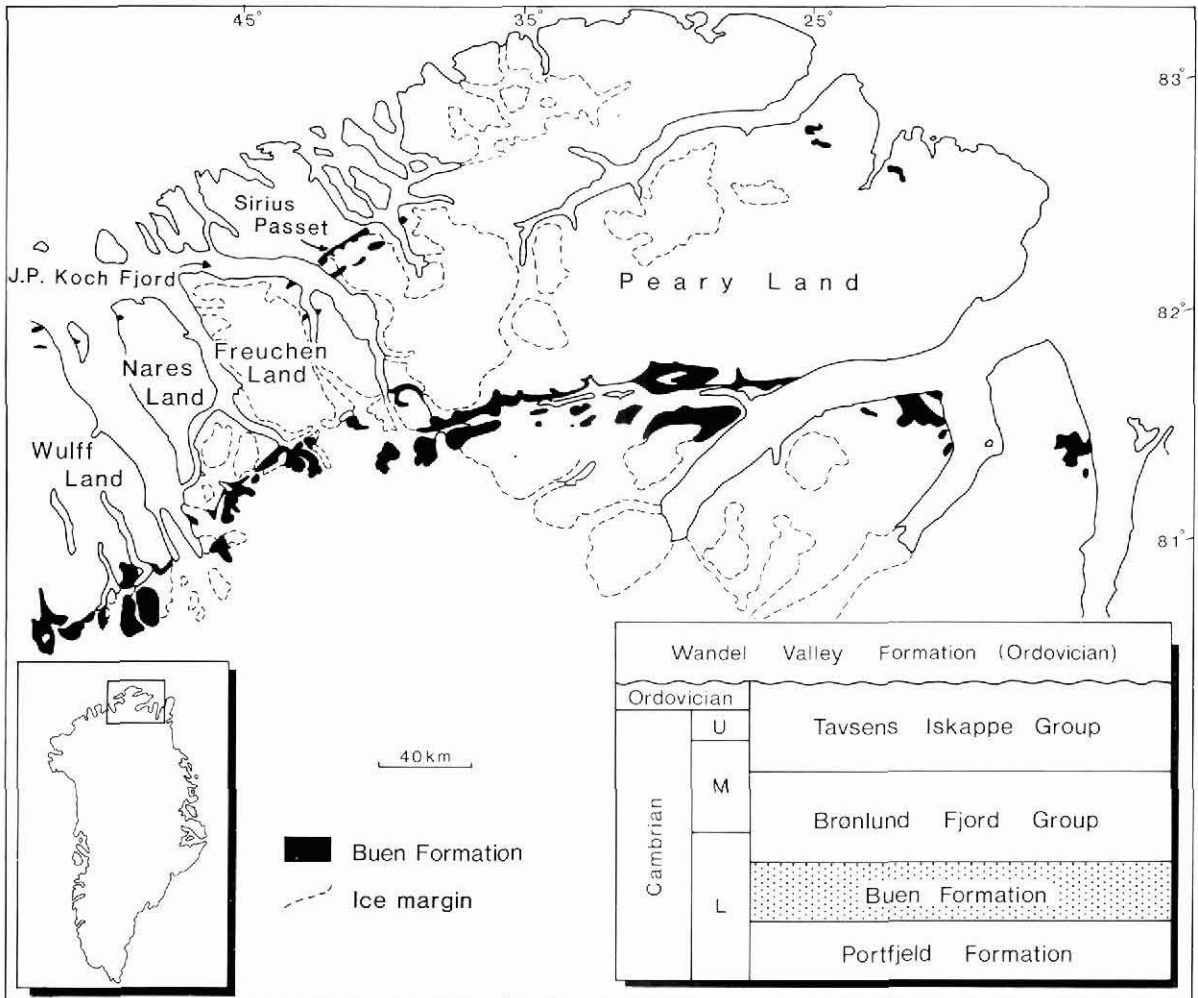


Fig. 2. Outcrops of the Buen Formation in central North Greenland showing the locality for the Lower Cambrian lagerstätten at Sirius Passet.

During July – early August 1991, a second 4-man expedition visited Sirius Passet. As in 1989, financial support for the fieldwork was provided by a grant from the Carlsberg Foundation, Copenhagen. Transport both to and within North Greenland was co-ordinated with several other groups from Danish scientific institutions under a logistic umbrella provided by Dansk Polarcenter. Three weeks of collecting benefitted from excellent weather, in contrast to the poor conditions which prevailed during the 1989 visit.

Collecting during 1991 yielded more than 3000 fossiliferous slabs and confirmed the image of the fauna established already in 1989. A number of additional specimens of halkieriids were obtained, together with numerous arthropods with preserved soft parts. Two specimens of a possible onychophoran are of particular interest on account of current discussions of the Cam-

brian record of this group (Ramsköld & Hou Xian-guang, 1991; Bengtson, 1991).

Despite limitations imposed by structural complexity and intermittent exposure, fieldwork in 1991 resulted in an increased understanding of the local stratigraphy and the sedimentological evolution of the immediate area of the fossil locality. The steeply-dipping fossiliferous mudstones of the Buen Formation occur in close proximity to horizontally-bedded platform carbonates of the stratigraphically older Portfjeld Formation; this contact has been interpreted previously as a structural feature, either a down-to-basin (i.e. north) normal fault or a back-thrust (A. K. Higgins, personal communication, 1991). Detailed mapping and the occurrence, locally, of carbonate slope facies at the contact, however, suggest that the boundary defines the original northern margin of the Portfjeld Formation carbonate platform. This

conclusion is compatible with the regional palaeogeography (Higgins *et al.*, 1991) and implies that the fossil-bearing mudstones of the Buen Formation were deposited basinward of the shelf edge, in a transitional 'slope' setting.

Thrust repetition was demonstrated within strata of the Buen Formation north of the contact with the Portfjeld Formation. Thus, minor tectonic modification of the boundary between the Buen Formation and the Portfjeld Formation can not be precluded. Preliminary correlation between the fossil-bearing, mud-dominated strata of the Buen Formation north of the shelf edge and the Buen Formation exposed in outliers on top of the Portfjeld Formation, in the area south of the edge, suggests that the former were deposited following the initial transgression of the karstified Portfjeld platform; this is compatible with the stratigraphic position of the Sirius Passet fauna suggested previously, namely within the lower part of the Buen Formation (Peel, 1990).

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