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Krzysztof BIRKENMAJER

Institute of Geological Sciences
Polish Academy of Sciences
Senacka 3
31-002 Kraków, POLAND

Non-glacial origin of the Slyngfjellet Conglomerate (Upper Proterozoic), South Spitsbergen

ABSTRACT: The Slyngfjellet Conglomerate which occurs at the base of the Upper Proterozoic Sofiebogen Group in South Spitsbergen had formed predominantly as a debris-flow deposit, with subordinate contribution by fluvial and probably lacustrine sediments. There is no evidence for glacial conditions at the time of formation of the conglomerate, the latter being much older than the latest Proterozoic Varangian glaciation tillites elsewhere in Svalbard. The Slyngfjellet Conglomerate originally filled buried valleys eroded by rivers in block-faulted and uplifted western margin of the Mid-Proterozoic Torellian Basin.

Key words: Arctic, Spitsbergen, Upper Proterozoic, geology (debris flow, fluvial, non-glacial metaconglomerate).

Introduction

The name Slyngfjellet Conglomerate has been introduced by Birkenmajer (1958; Slyngfjellet Conglomerate Formation — Birkenmajer 1972) for a conspicuous Upper Precambrian metaconglomerate up to 500 m thick, easily traceable in southern Wedel Jarlsberg Land, south Spitsbergen (Figs 1, 2), within the Hecla Hoek Succession. The conglomerate occurs at the base of the Upper Proterozoic Sofiebogen Group, and is directly followed by carbonates of the Höferpynten Dolomite Formation which, in turn, is succeeded by a thick sequence of phyllites with some quartzite and carbonate intercalations — the Gåshamna Phyllite Formation (Fig. 3). The Slyngfjellet Conglomerate Formation rests unconformably upon Middle and Lower Proterozoic medium-grade metamorphic rocks, the Deilegga Group and the Vimsodden Subgroup (Eimfjellet Group), respectively.

In southern Wedel Jarlsberg Land, the Slyngfjellet Conglomerate crops out between Fannypynten-Fannytoppen (northern coast of Hornsund) and Vrangpeisen-Konglomeratknausen (austre Torellbreen), moreover between Vrangpeisen and Jens-Erikfjellet (Fig. 2). The exposures between Fannypynten and

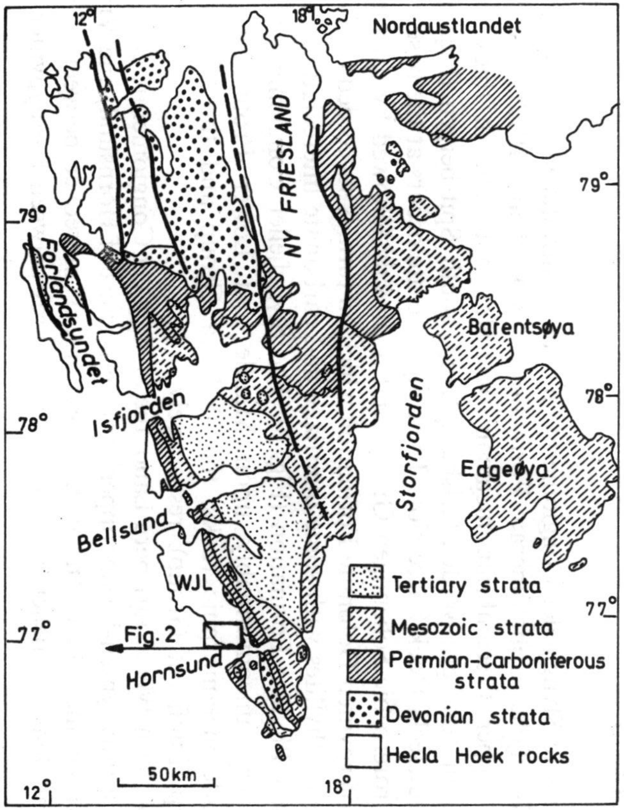

Fig. 1. Geological location map in Spitsbergen. Box — area shown in Fig. 2

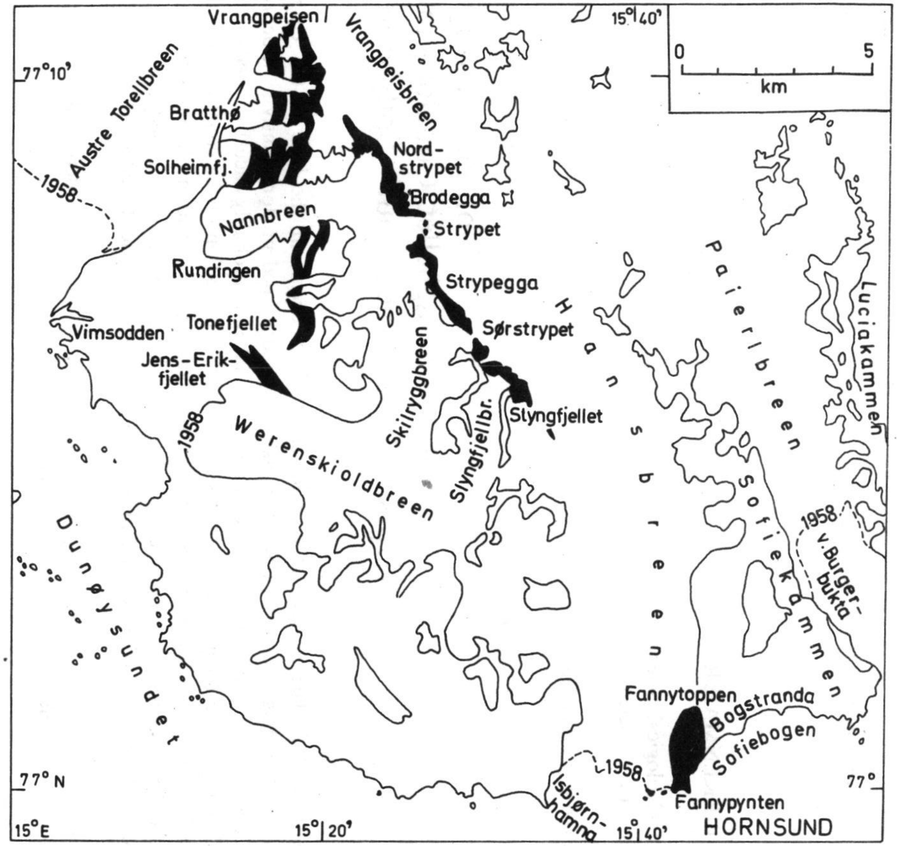

Fig. 2. Exposures of the Slyngfjellet Conglomerate Formation (in black) in southern Wedel Jarlsberg Land

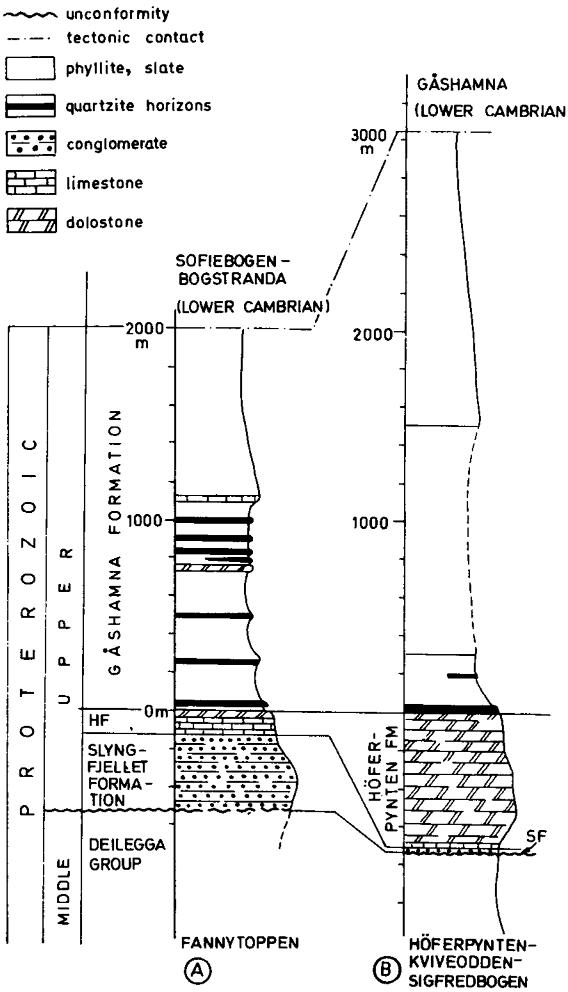

Fig. 3. Typical lithostratigraphic columns of the Sofiebogen Group north (Sofiebogen -- Bogstranda) and south (Gåshamna) of Hornsund

Vrangpeisen, along the western margins of the Hansbreen and Vrangpeisbreen glaciers, represent an eastern recumbent limb of a large anticlinorium built of Early through Late Proterozoic rocks. Between Vrangpeisen and Nannbreen, the conglomerate is folded together with its substratum (Deilegga Group); in the area of Tonefjellet and Jens-Erikfjellet, the south-western outliers of the conglomerate are within a complex polyphase tectonic structure (Figs. 2, 4). South of Hornsund the only known occurrence of the conglomerate is at Sigfredbogen, where the unit is barely 10 m thick and contacts with the Bergskardet Formation, upper part of the Deilegga Group (Birkenmajer 1960b, 1964). The conglomerate wedges out westward at Dunøyane where the

Höferpynten Dolomite Formation contacts directly with the Bergnova Formation (middle part of the Deilegga Group; *see* Radwański and Birkenmajer 1977).

Winsnes (*in* Major and Winsnes 1955, p. 27) reported north of Hornsund a „thick conglomerate or tillite" which he regarded to occur in the „break between the Høferpynten series and the adjacent thick Gåshamna phyllite".

Birkenmajer (1958) initially considered a possibility the Slyngfjellet Conglomerate being a tillite, but soon abandoned this view in favour of a fluvial origin, as no sedimentological evidence was found by him to support the glacial origin of the deposit (Birkenmajer 1959, 1960a, and later papers).

Harland (1979) whose preliminary field observations at Hornsund were restricted to two localities of the Slyngfjellet Conglomerate only, at Sigfredbogen (untypical) and at Fannypynten (strongly tectonized), considered the latter exposure to give an impression of a „typical tillite", and calculated thickness of the conglomerate to be of the order of 1.5 km, three times as much as Birkenmajer's measurements. Furthermore, against the evidence provided by Birkenmajer (*e.g.* 1960a, b, 1964, 1972; Radwański and Birkenmajer 1977) he put the Slyngfjellet Conglomerate Formation in a wrong stratigraphic position

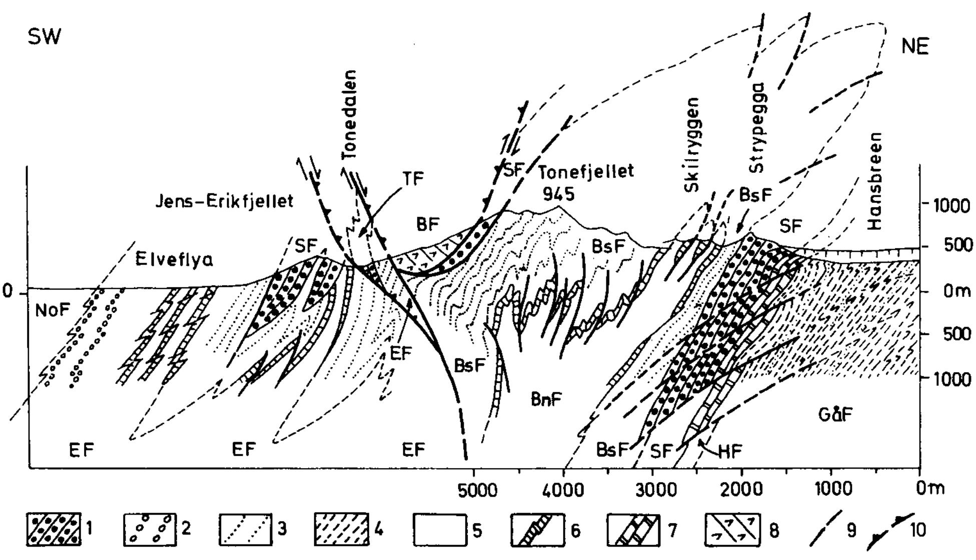

Fig. 4. Geological cross-section of the area between Jens-Erikfjellet and Hansbreen to show position of the Slyngfjellet Conglomerate. 1 - metaconglomerate; 2 - metatilloid; 3 - quartzite intercalations; 4 - phyllite-slate; 5 - schist; 6 - limestone (marble); 7 - dolostone; 8 - amphibolite; 9 - faults; 10 - overthrusts. Vimsodden Subgroup: NOF - Nottinghambukta Formation; EF - Elveflya Formation. Deilegga Group: TF - Tonedalen Formation; BnF - Bergnova Formation; BsF - Bergskardet Formation. Sofiebogen Group: SF - Slyngfjellet Formation; HF - Höferpynten Formation; GåF - Gåshamna Formation

above the Höferpynten Dolomite Formation, instead of below it. This apparently accomodated Harland's conviction that the conglomerate was of glacial origin, thus being necessarily the youngest unit in the Late Proterozoic lithostratigraphic column, directly correlatable with the Varangian glaciation tillites of the Polarisbreen Group, Ny Friesland. Harland's view is also shared by Hambrey *et al.* (1981), Hambrey and Waddams (1981), Hambrey (1983) and Harland (1985, Tab. 4; 1988) who consider the Slyngfjellet Conglomerate a tillite or tilloid of the Varangian glaciation.

Subdivision

Two informal units of member rank have been distinguished within the Slyngfjellet Conglomerate Formation: (1) a lower member consisting of yellowish to brownish conglomerate; and (2) an upper member consisting of green conglomerate, with subordinate sandstone, siltstone, and shale intercalations (Birkenmajer 1959, 1977, p. 144). This subdivision is best recognizable at Fannytoppen where the rock sequence is tectonically overturned, with the oldest rocks at the top of the hill. In other sections, the members mentioned may occur separately (*see* below).

A short description of lithologic characters of the Slyngfjellet Conglomerate Formation is given below.

(1) Slyngfjellet S, type locality of the formation (upper member). We see here green metaconglomerate (Fig. 5A) consisting mainly (70-80% vol.) of light-green to light-yellow lenticular or tabular, generally sharp-edged, sometimes subrounded, homogenous or laminated quartzite clasts 1-30 cm diameter. Quartzite slabs up to 50 × 50 × 10 cm in size sometimes appear, and there is an admixture (maximum about 1% vol.) of grey, often dolomitic limestone slabs 2-3 cm thick and 10-20 cm in diameter. There occur also single fragments of red shale 5-10 cm in diameter. The clasts are supported by green chlorite-rich schistose matrix which represents 20-30% of the rock volume.

(2) Slyngfjellet N and Sørstrypet (upper member). The conglomerate is here relatively slightly tectonized, with tabular angular clasts, and subrounded to well-rounded quartzite pebbles. The frequency of rounded to well-rounded pebbles increases northward, toward Sørstrypet, where they account for about half of the rock volume. There is no sorting or grading recognizable in quite chaotic clast arrangement.

(3) Strypegga (upper member). The conglomerate consists here mainly of slabs and discoidal fragments of light-yellow, light-green and whitish, fine-grained quartzites 8-18 × 3-5 cm in size. The clasts are supported by rather scanty schistose matrix. Similarly as at Sørstrypet, a considerable number of quartzite clasts are subrounded to rounded.

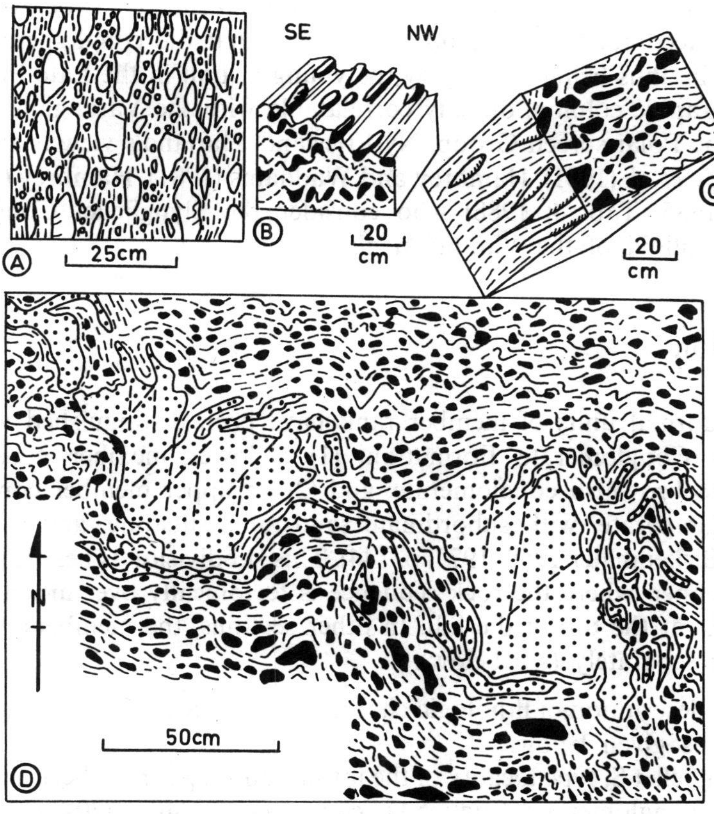

Fig. 5. Structures in the Slyngfjellet Conglomerate Formation. A - Slyngfjellet S, type locality, showing arrangement of angular, tectonically elongated clasts in chlorite-schist; matrix; B, C - western part of Fannypynten (near lagoon), tectonically elongated, predominantly quartzite clasts in corrugated chlorite-schist matrix; D - same locality, dismembered quartz-ankerite vein internally jointed, in folded quartzite metaconglomerate (black bodies) rich in chlorite-schist matrix (dashed)

(4) Brodegga (upper member). The conglomerate consists here of yellow, light-green, green, grey, sometimes nearly black, fine-grained quartzite clasts 1-30 (usually 2-10) cm in diameter. About 10% of the clasts are subrounded, the remaining ones being angular. Tectonically deformed, discoidal quartzite fragments occur frequently. Locally, the conglomerate is enriched in grey platy microcrystalline limestone fragments, and black to green chlorite-shale clasts 1-3 cm in diameter.

Further north, closer to Nordstrypet, appears a 10-m thick intercalation of yellow-green to rusty, fine-grained laminated sandstone, siltstone and shale, forming beds from 0.5 to 30 cm thick. Traces of small-scale cross-bedding are preserved here and there in the sandstones.

(5) Fannytoppen (lower and upper members). The green conglomerate member (upper) crops out well in the northern part of the hill where it contacts

with the Höferpynten Dolomite Formation, and at the southern end of the hill, close to Fannypynten. The conglomerate is here very strongly tectonized, its quartzite clasts are folded, lenicularized and considerably elongated. As a result, they are usually discoidal in shape, 5-20, sometimes up to 50-100 cm in diameter, and 2-10 cm thick. Similarly tectonized grey limestone clasts represent less than one per cent of the rock volume. There occur also single fragments of medium-grained gneissoid rocks resembling granites and migmatites (Birkenmajer 1960b; Smulikowski 1968; feldspathites of Harland 1979). The clasts are supported by equally tectonized, strongly corrugated green-grey chlorite-mica schist matrix.

The yellow conglomerate member (lower) forms core of a false syncline (recumbent anticline). It occurs in the central part of Fannytoppen (Fig. 6).

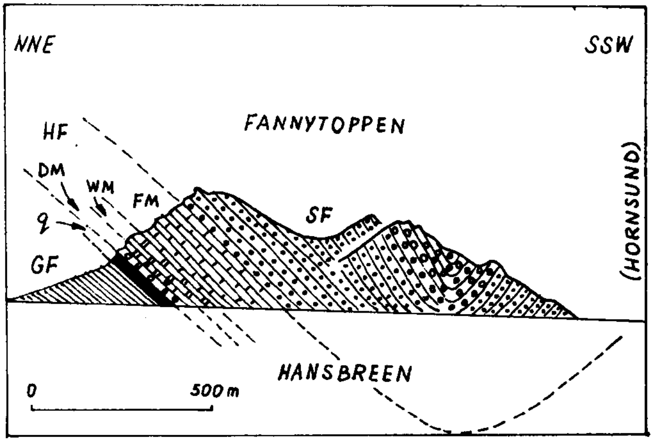

Fig. 6. Tectonically overturned Sofiebogen Group at Fannytoppen, as seen from Hansbreen. SF - Slyngfjellet Conglomerate Formation; HF - Höferpynten Dolomite Formation (FM - Fannytoppen Mbr; WM - Wurmbrandegga Mbr; DM - Dunøyane Mbr); GF - Gåshamna Formation (q - basal quartzite - shale horizon)

(6) Fannypynten (upper member). The green conglomerate is here as strongly tectonized as at Fannytoppen (Fig. 5B, C), and is often crossed by concordant — older (Fig. 5D) and discordant — younger quartz-ankerite veins, respective to schistosity of the conglomerate.

To Harland (1979) this rock gave an impression of a „typical tillite". Hambrey *et al.* (1981, Tab. 1, p. 598) reported the following percentages of clasts: quartzites — 60; feldspathites — 20; limestones — 5; dolomite — 15; sandstone — <1.

(7) Jens-Erikfjellet, slope above Werenskioldbreen (lower member). The conglomerate is well exposed and visible at a distance as a yellow zone obliquely crossing southern slope of the mountain. It consists of tectonized

lenticular boulders up to 30-50 cm in diameter which represent 70-90% of the rock volume: mainly light-green, light-yellow, pinkish and white, finely-grained quartzite, sometimes slightly calcareous, which in less tectonized parts of the conglomerate reveal subrounded and rounded shapes. Grey crystalline limestone fragments 1-15 cm in diameter occur very infrequently. The matrix which supports the clasts consists of yellowish quartz-schist, sometimes also of greenish chlorite-schist. Smulikowski (1968, p. 129, Figs 7, 8) recognized also discordant bodies of greenschists which, in the present author's opinion, could represent large slabs derived from the Elveflya Formation (Vimsodden Subgroup, upper part).

The conglomerate contacts directly with the Elveflya Formation which consists of light-yellow to grey-yellow quartz-sericite schists with thin (2-5 cm) sericite-quartzite intercalations, and of graphite schists (Fig. 4).

(8) Tonefjellet, top 933 m, and eastern slope (upper member). The green conglomerate consists here of greenish or yellowish quartzite boulders up to 70-100 cm in diameter, in scanty chlorite-schist matrix. The unit occurs in a rather complex tectonic position under an amphibolite (Brategga Formation, Skålfjellet Subgroup, Eimfjellet Group) thrust-sheet (Fig. 4).

(9) Sigfredbogen (lower member). The conglomerate is here only 10 m thick (Birkenmajer 1964, Figs 10, 11; 1972). It consists of highly deformed (lenticular) yellow or reddish quartzite pebbles and boulders 2-20 cm in diameter, supported by yellowish or reddish matrix. The conglomerate contacts with the Bergskardet Formation (upper part of the Deilegga Group).

Origin of tectonic deformation

The degree of tectonic deformation of clasts within the Slyngfjellet Conglomerate Formation varies greatly between the exposures, even within the same tectonic zone. In the recumbent eastern limb of the Precambrian anticlinorium of southern Wedel Jarlsberg Land (Figs 2, 4), the clasts are least deformed between Nordstrypet and Slyngfjellet (Fig. 5A), and strongest deformed at the southern end of the zone, at Fannytoppen and Fannypynten (Fig. 5B-D; *see also* Hambrey and Waddams, 1981, Fig. 3).

The mode of formation of mesostructures in matrix-rich Slyngfjellet Conglomerate presented in Figure 7, is based on observations from the latter area. Strong orogenic compression (σ_1) parallel to bedding initially produced gentle crumpling (Fig. 7B), and finally tight isoclinal corrugation (Fig. 7C); the axial surfaces of mesofolds follow here the direction of median stress (σ_2), the maximum elongation of tectonized clasts is in the direction of minimum stress (σ_3).

Concordant quartz-ankerite veins which occur in the conglomerate are similarly deformed, corrugated and lenticularized (Fig. 5D).

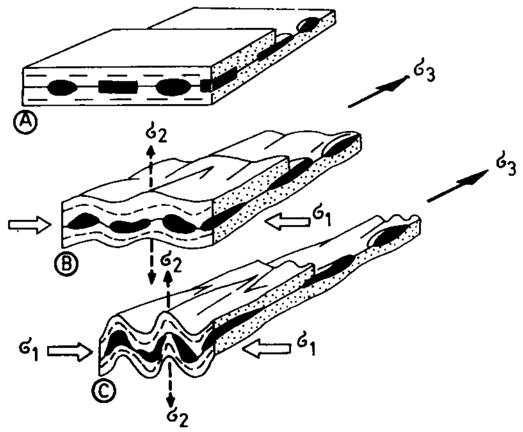

Fig. 7. Stages of formation of tight isoclinal folds in the Slyngfjellet Conglomerate Formation (explanations in the text)

Age of tectonic deformation

Structural analysis of the Precambrian terrain in south Spitsbergen gives evidence for two major orogenic phases which could be principally responsible for tectonic deformation of the Slyngfjellet Conglomerate Formation: (A) the Jarlsbergian, and (B) the Caledonian foldings (Birkenmajer 1975, 1981).

(A) The Jarlsbergian folding, between the Upper Proterozoic Sofiebogen Group (Slyngfjellet, Höferpynten and Gåshamna formations) and the Cambrian Sofiekammen Group, corresponds in age to the conventional Proterozoic/Cambrian boundary, about 600 Ma. Phyllitization of the Sofiebogen Group rocks best expressed in the Gåshamna Formation, is attributed to this phase of folding, as fragments of the Gåshamna phyllites occur as secondary deposit already in the basal Cambrian Blåstertoppen Dolomite Formation (Birkenmajer 1960a, 1978).

(B) The Caledonian folding proceeded in Spitsbergen in several stages, the main deformation being the Ny Friesland orogeny (*sensu* Harland, 1961), which in northern Spitsbergen has been dated at 430-450 Ma (Gayer *et al.* 1966). The following four stages of deformation are recognizable at Hornsund, south Spitsbergen:

— The first stage was expressed as a strong W — E or SW — NE-directed compression; it had produced low- to high-angle east-vergent thrusts involving mainly Ordovician and Cambrian carbonate complexes and their phyllitic substratum (Gåshamna Formation) which acted as a glide zone. The tectonic units then formed slid off their root zone which is represented in southern Wedel Jarlsberg Land by a Proterozoic anticlinorium shown in Figure 4;

— The second stage included mineralization of already formed tectonic units by ore-bearing quartz-ankerite veins, generally concordant with stratification and/or tectonic schistosity of Precambrian through Lower Ordovician complexes;

— The third stage was expressed as tight isoclinal folding of the Slyngfjellet Conglomerate and its concordant mineral veins (see the previous stage), best evidenced from the area of Fannytoppen — Fannypynten (Fig. 5B-D). Location of such deformation along some specific N — S and NNW — SSE-oriented zones in the Caledonian orogen of south Spitsbergen, *e.g.* along linear recumbent eastern limb of the Precambrian anticlinorium between Fannypynten and Vrangpeisen (Figs 2, 4), might lend support to large-scale strike-slip displacements between crustal blocks at this stage of the Caledonian orogeny. Harland (1971) postulated a late Devonian age of such strike-slip (sinistral) displacements, but on mineral-vein evidence from Hornsund (see below) they could already start before the onset of the Devonian sedimentation;

— The fourth stage is documented by almost undeformed discordant quartz-ankerite veins which cut through the concordant ones, and through their host Hecla Hoek Succesion rocks. This stage evidently post-dates the above-discussed strike-slip displacements (3rd stage), but may be still pre-Devonian in age, as fragments of vein quartz appear at Hornsund as secondary deposit for the first time in the basal Devonian (Siegenian) conglomerates, and no quartz-ankerite veins are known to cross the Devonian and younger rocks (Birkenmajer and Wojciechowski 1964; Birkenmajer 1981).

(C) Post-Devonian deformations. Evidences of late-Caledonian Svalbardian phase folding (post-Late Givetian but pre-Tournaisian), and of Variscan folding (which in inner Hornsund resulted in local thrusting of Lower Carboniferous and older rocks during the mid-Carboniferous Adriabukta phase), are missing so-far from the western Precambrian terrain of South Spitsbergen. Tertiary deformation of the Precambrian rocks was strong in inner Hornsund, in the major thrust zone, but was only feebly expressed in the western rigid block in form of transversal strike-slip faults and associated fracture cleavage and small-scale fault-related corrugations (Birkenmajer, 1986). Conjugate joints as those cutting through concordant quartz-ankerite veins within the Slyngfjellet Conglomerate (Fig. 5D) could probably be attributed to Tertiary deformation.

Hambrey and Waddams (1981) recognized two deformation phases, D_1 and D_2, within the Slyngfjellet Conglomerate at Fannypynten, which they thought to correspond with mid-Palaeozoic (Caledonian) and Tertiary orogenies, respectively. Kowallis and Craddock (1984), on their own evidence from the Kapp Lyell diamictites of Bellsund, consider the D_1 event to be Caledonian (early Palaeozoic) but do not exclude an older, Jarlsbergian (latest Precambrian) age. Based on a K-Ar apparent age of 284 ± 10 Ma obtained from muscovite on the S_2 cleavage surfaces in the basal clast-poor Kapp Lyell diamictite (tillite), they conclude that the D_2 event was Carboniferous or older, but not Tertiary as assumed by Hambrey and Waddams (1981).

Provenance of clasts

Quartzite. Fine-grained, laminated quartzite clasts which occur in the Slyngfjellet Conglomerate resemble very much quartzite intercalations from the Bergskardet Formation (upper Deilegga Group). They are also similar to quartzites from the Gulliksenfjellet and the Steinvikskardet formations (Eimfjellet Group); however the lack in the conglomerate of aphibolite fragments which are characteristic for the latter formation, and for the whole Skålfjellet Subgroup, would rather eliminate both formations as possible sources of quartzite clasts.

Limestone. Grey, often dolomitic limestone (marble) clasts are very similar to carbonate intercalations from the Bergnova Formation (middle Deilegga Group).

Red and green shales. Provenance of red shale fragments found at Slyngfjellet is unknown. The green shale fragments, as well as the majority of material in the conglomerate matrix will fit quite well the lithologies of the Deilegga Group.

Greenschist. Discordant greenschist blocks recognized at Jens-Erikfjellet and here interpreted as slabs from the underlying Elveflya Formation (Vimsodden Subgroup), would fit with the mode of occurrence of the Slyngfjellet Conglomerate at that locality.

Granitoids. Granitoid (granitic gneiss) fragments found at Fannytoppen-Fannypynten, represent according to Smulikowski (1968, p. 141) albitized granites, with chequered albite formed due to albitization of a potassium feldspar, probably microcline. These rock fragments could have derived from equivalents of the Gangpasset Migmatite Formation, but exposed outside the area dealt with in the present paper.

Other clasts. Smulikowski (1968, pp. 141-142) mentions also the presence at Fannypynten of muscovite-schist and quartz-albite schist fragments, which could have derived from either the Deilegga Group or the Vimsodden Subgroup, and of contact-rock fragments of unknown provenance and Precambrian age.

Conditions of sedimentation

Strong tectonic deformation of the Slyngfjellet Conglomerate generally precludes any more detailed sedimentological study. However, even the few observations collected by the present author in the area of lesser deformation, between Slyngfjellet and Nordstrypet (see above), allow to confirm earlier suggestions of a non-glacial character of the original deposit (Birkenmajer 1960a).

The size of quartzite clasts, which are the main element of the conglomerate, usually ranges from large pebbles through cobbles to boulders, indicating a high-energy sedimentary environment. The clasts are usually angular to subrounded, locally, and subordinately, also rounded to well rounded. Angular large slabs of quartzite, sometimes also of limestone and greenschist, locally appear in larger amounts. The clasts are, as a rule, supported by pelitic-psammitic matrix which represents up to 30 per cent of the rock volume. There is a general lack of sorting, grading and preferred orientation (*e.g.* imbrication of clasts) in the conglomerate.

The above characteristics are consistent with a predominant debris-flow regime of transport and deposition. Contribution by running water was subordinate, as no lag-concentrates, imbricated pebbles, large-scale cross-stratification, sand point-bars and related overbank-type deposits characteristic for fluvial regime were recognized. Occasional intercalations of fine-grained laminated and small-scale cross-bedded sandstones alternating with siltstone and shale, are indicative of restricted fresh-water reservoirs. Subrounded to well-rounded pebbles-cobbles-boulders which occur in a considerable amount could have derived mainly from unconsolidated fluvial deposits of similar age, but outside the main area of deposition of the Slyngfjellet Conglomerate, incorporated to the conglomerate by any of mass movement-type mechanisms.

There is no direct evidence of glacial conditions during the sedimentation of the Slyngfjellet Conglomerate in form of glacial tills, striated (ice-scratched) stones, roches moutonnées at the base of the conglomerate, dropstones of many sizes in finer-grained rhythmic sediment intercalations, ice-wedges, etc. Many such features have been recognized in the Varangian diamictites elsewhere in Svalbard (*e.g.* Hambrey 1982, pp. 545-546). The present author sees therefore no reason for comparison of the Slyngfjellet Conglomerate with the latest Proterozoic Varangian glaciation tillites (Polarisbreen Group and equivalents) in Svalbard on either sedimentological or stratigraphic grounds.

The deposition of the Slyngfjellet Conglomerate was first of all a result of the Torellian diastrophism expressed as block-faulting and uplift, followed by deep erosion, probably by rivers (Fig. 8). Coarse debris-flow-type conglomerates with minor contribution by fluvial and lacustrine sediments would indicate an arid, probably not too cold climate with seasonal rainfall which had

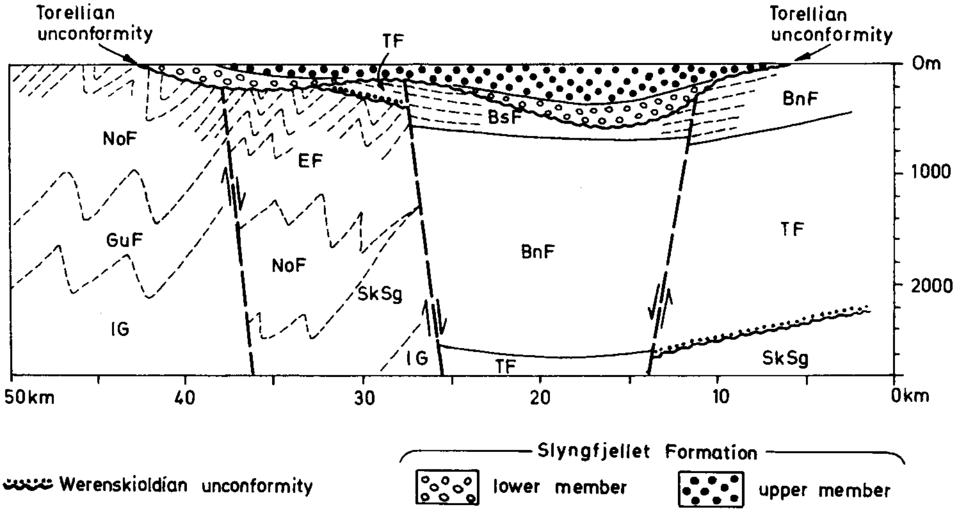

Fig. 8. Relation of the Slyngfjellet Conglomerate to its substratum - a reconstruction based on geological relations in southern Wedel Jarlsberg Land. Deilegga Group: BsF - Bergskardet Fm.; BnF - Bergnova Fm.; TF - Tonedalen Fm. Eimfjellet Group: EF - Elveflya Fm. (Vimsodden Subgroup); NoF - Nottinghambukta Fm. (Vimsodden Subgroup); SkSg - Skålfjellet Subgroup. Isbjørnhamna Group - IG. West on the left; east on the right

activated weathering covers to form landslides eventually transformed in debris flows burying a pre-existing river-valley system.

Appearance of the Höferpynten Dolomite Formation directly upon the Slyngfjellet Conglomerate Formation, with lagoonal-type reddish to yellow laminated limestone at the base, followed by intertidal to subtidal dolostone complex rich in sedimentary breccia, oolite-pisolite and algal stromatolite structures (Birkenmajer 1972; Radwański and Birkenmajer 1977), indicates warm climate conditions following upon dry ones.

Conclusions

(1) The Slyngfjellet Conglomerate represents mainly a debris-flow deposit, with minor contribution by fluvial and lacustrine-type sediments;

(2) The conglomerate fills deep buried valleys eroded prior to it by rivers in block-faulted and uplifted western margin of the Mid-Proterozoic Torellian Basin, following the Torellian diastrophism (Mid — Late Proterozoic boundary);

(3) There is no evidence for glacial conditions at the time of formation of the Slyngfjellet Conglomerate;

(4) Correlation of the Slyngfjellet Conglomerate with the latest Proterozoic deposits formed during the Varangian glaciation elsewhere in Svalbard is not justified on either sedimentological or stratigraphic grounds.

(5) Filling-up the pre-existing valleys by the Slyngfjellet Conglomerate caused levelling off the relief before a marine incursion which had deposited nearshore, lagoonal to intertidal and subtidal, warm-climate carbonate sediments of the Höferpynten Dolomite Formation.

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Streszczenie

Zlepieniec Slyngfjellet, który występuje u podstawy górnoproterozoicznej grupy Sofiebogen w południowym Spitsbergenie, utworzył się jako osady w przewadze typu spływów gruzowych, z podrzędnym udziałem materiału żwirowego przyniesionego przez rzeki (fig. 1-7). Nie ma żadnych wskazówek sedymentologicznych na utworzenie się kompleksu zlepieńcowego w warunkach klimatu polarnego. Zlepieniec Slyngfjellet jest znacznie starszy niż późnoproterozoiczne tillity odnoszone do zlodowacenia Varangian. Zlepieniec Slyngfjellet wypełnia kopalne doliny wyerodowane przez rzeki w wydźwigniętym blokowo wzdłuż uskoków zachodnim obrzeżeniu środkowoproterozoicznego basenu Torella (fig. 8).