

## REPORT BY E. WEGMANN ON THE WORK CARRIED OUT IN 1932-33 AND 1934

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The investigation of Northeast Greenland made by the Germania Expedition and the Nathorst Expedition showed the presence of a number of different formations. The extension of these formations and their mutual relations were observed along the fjords, and thereby a preliminary survey of the geological conditions was obtained.

The next period is characterised by LAUGE KOCH's "Stratigraphy of Greenland". The numerous formations discussed here were increased in number during the expeditions in 1929, 1930, and 1931. However, the structural picture of the geological conditions was not altered very much in these years. The faults which had already been demonstrated by NATHORST were localised more exactly. Not until the far-reaching migmatization supposed by BACKLUND, according to which the crystalline zone was no longer regarded as the substratum of the Caledonian sediments but as an active part of the Caledonian orogeny, was the aspect of the Caledonian development actually changed.

BACKLUND's hypothesis, which was prepared on the basis of the potrographical conditions, brings him in conflict with the geologists of the Cambridge Expedition and with TEICHERT, who all considered the crystalline areas as the *passive* Archæan substratum of the Caledonian series. What was at that time designated as "tectonics", was not structural investigations but only a chronology of unconformities; notably FREBOLD united these unconformities and regarded them as orogenic phases. The chronology was to indicate at what times the deeper-lying beds of East Greenland had moved, but between these tectonic phases there had been no movements, but tranquility. The interest taken in these phases was so concentrated that the structural investigations were nearly neglected. It became the principal task of WEGMANN to try to make a more detailed structural analysis. The different "structural types" were to be separated, and the movements which had formed them should be investigated in such a way that not only their chronology but also their mechanic character could be determined.

The migmatic problem, which BACKLUND had discussed from a petrologic point of view, was now to be treated according to the methods of the "Structural Geology" with which WEGMANN was familiar from his investigations in Finland through many years. Thereby the problems of the Caledonian orogeny were to be more thoroughly elucidated.

It was a very big programme, and it soon appeared that it was not possible to carry it through to its full extent during the comparatively short time which was at his disposal; but even if not all the problems were solved, still a number of studies and observations were made which were useful to later expeditions, especially in the preparation and planning of their working programme. A number of the works should, therefore, be considered as *preparations for works carried out on later expeditions*. Hence not very much was published, but information was given to the members of later expeditions, who then got an opportunity of amplifying the particulars received.

The first summary of the results regarding the Caledonien zone was given in Medd. om Grønl. Vol. 103, Nr. 3. Other summaries were published in "Mitt. der Schaffh. Naturf. Ges."

The greater part of the material, especially a number of panoramas, drawings and sketches and all the collections have not yet been worked up.

In the summer of 1932 WEGMANN went by the ship "Godthaab" to Clavering Ø, arriving there on July 26. At the scientific station "Eskimonæs" he had an opportunity of observing the Caledonien gneiss rocks which had been described by BACKLUND. He also got an impression of the landscape and its general structure at the head of Godthaabs Golf, as the ship sailed into the fjord in order that the zoologists might take some bottom samples. As the zoologists naturally were only interested in the animal remains, all the rock constituents were washed away, but WEGMANN, however, succeeded in collecting some minerals from the zoological bottom samples. The first water sample was taken on July 14th, off the coast (the locality was given as approximately 74° N. 18—19° W.). Over a short distance there were depths of 200, 420 and 165 m. All samples showed morainic bottom of different composition. Gradually the zoologists, too, became interested in collecting rocks, and the samples were later examined by Mrs. ELLEN MERTZ of the Geotechnical Laboratory in Copenhagen. The results were published by R. SPÄRCK in Medd. om Grønl. Vol. 100 Nr. 1 and by ELLEN MERTZ, Danmarks Geol. Undersøgelse ii. series, No. 60 1937 pp. 1—143 6 pl. A summary of all the analyses of the bottom samples hitherto taken will be found in HÜBSCHER's work (Medd. om Grønl., Bd. 115, Nr. 3).

On July 27th, WEGMANN travelled by the ship round Kap Broer Ruys to Nordfjord. During one day's stay he had an opportunity of

studying the conditions there, particularly the relation between the Devonian and the Caledonian formations.

The voyage along the magnificent sections in the central part of Kejser Franz Josephs Fjord allowed a number of very interesting observations of the folding structure to be made. Notably between Eleonores Bugt and Junctiondal observations of fundamental importance were made. On deck it was possible to draw under much better conditions than onboard the motor boat. The different formations were here so intensely coloured that they could be seen at a great distance. The syncline north-east of Junctiondal is characteristic of the type of folding in the most westerly syncline. The remaining part of the series is plicated (*plissoté*), while the lower part shows *boudinage* structures. While, thus, the uppermost part represents a zone of compression, the lowermost part is a zone of tension, and between them there is a neutral zone which mainly consists of the shales of the "multicoloured series", but often the folding is disharmonious.

The ship arrived at Ella Ø in the afternoon. Here WEGMANN met with the staff at the station, among others the two cartographers S. O. STENØR and O. SIMONSEN, who were to spend another winter at the place, and gave WEGMANN most valuable information about the topographic, meteorologic, and marine conditions, which later proved to be of great use to him during his journeys.

The purpose of the autumn journeys was in the first place to get a survey of the structure of the vicinity, principally the crystalline zone, and to prepare the spring journeys by laying out depots.

The first journeys were planned to include investigations of Kempes Fjord and its ramifications.

Aug. 3rd.—WEGMANN travelled with POULSEN as his assistant in a small Faroe boat through Kempes Fjord to Dicksons Fjord. They went ashore in various places and camped near the Fulach Gl. valley on the north side of Dicksons Fjord.

Aug. 4th.—Ascent to Røde Støvhorn. Here the gneisses were studied and photographed, and a huge ultrabasic inclusion about 800 m high was found.

Aug. 5th.—By boat they continued to the innermost parts of the fjord. They went ashore in various places and studied the gneisses and their structure. On the southern shore light gneisses with pegmatite veins were principally found. Near Langenthaler Gl. shales rich in biotite and amphibolites were found. In these the granite, aplite and pegmatite veins showed *boudinage*. Accordingly the deformation had continued also after the *mise-en-place* of the pegmatites, and the shales were bent round the more granitised areas, which could be shown by numerous photographs and drawings.

Aug. 6th.—At the head of the fjord samples of sand were taken and preliminary sand analyses made. Wherever it was possible, sand was washed in order to ascertain the presence of important heavy minerals and ore. Often samples were taken on the beach, in moraines or in débris. These sand samples were later treated by Dr. von Moos of Zürich, (see M. o. G. Vol. 103, 4). The great folds in the gneiss show a general pitch towards the interior of the fjord. Thus one meets higher and higher structural elements in the direction westwards. The gneisses lie in great folds, which are distinct by their different colours. A number of very characteristic strata due to quartzites in the Eleonore Bay series can be distinguished. The fold is rather complicated with involutions. It is difficult, therefore, to give a good tectonic picture, more particularly as good maps were missing. On account of the very primitive maps, many drawings and measurements were needed in order to fix important points. A number of panorama pictures were also taken.

Aug. 7th.—Travelled by boat to the mouth of Melch Dal and to Kap Robert. The folds were studied and sketched.

Aug. 8—9th. The voyage was delayed owing to a breakdown of the motor. Later they arrived at the southern shore near Hisingers Gl. Down at the sea migmatites with aplite and pegmatitic veins and often amphibolite strata were found. These were overlain by a horizon which was more strongly deformed. Above these followed several layers of carbonates with silicates. WEGMANN went along the glacier in order to get a lookout through Bocksrietdalen to Kjerulfs Fjord. On the top of the limestones there are micaschists and quartzites with a metamorphic facies different from that found in the gneisses in the lower complex. This more elevated complex has different folding directions.

Aug. 10th.—The party travelled towards the outer part of Dicksons Fjord. From Aug. 3rd. to 10th the weather was unusually fine. The temperature of the air varied from 9° to 14°C. in the inner Dicksons Fjord, and the vegetation is the most luxuriant one which is known in Northeast Greenland. Shrubs more than 1 metre high are found there.

Aug. 11th.—The party travelled to Kap Hedlund, where investigations were made in the vicinity.

Aug. 12th.—Bad weather with storm, rain and fog. Returned to Ella Ø in the evening.

Aug. 13th—14th.—Arrived at Ella Ø early in the morning. Later in the day the collections at Kap Hedlund were fetched by a larger boat.

Aug. 15th.—Went by boat to Deceit Bugten, where WEGMANN camped alone. The boat returned.

Aug. 16th.—An ascent was made to the foot of Hjelman in order to study metamorphic shales and their transitional forms.

Aug. 17th.—Went for a long excursion up through Murgangsdalen.

The outer part of the valley is formed by a broad delta. Some distance up the valley the river flows in a canyon cut in quartzites and partly in metamorphic shales, the quartzites here showing transition to a metamorphic facies. Towards the evening the river suddenly swelled heavily. WEGMANN hurried back to the camp, but on his arrival the small terrace on which he had camped was completely flooded and the camp had disappeared. The level of the river constantly rose from 11 p. m. to 12 p. m. by about 10 cm in ten minutes. After midnight on Aug. 18th., the river swelled still more and carried with it much mud, sand and large stones. There were also large quantities of plant remains in the water of the river. The water continued to rise till 2.30 a. m., it was stationary till 2.45 and rose heavily again till 3.15. At 3.45 the water in the river began to fall, and until 4.40 it had fallen by about 1½ metres. At 5.15 it had fallen 2 metres below the maximum, and at 6 a. m. some gravel banks began to appear. In the forenoon there was less water in the river than the days before. The river had, when it was biggest, filled the entire broad valley to a breadth of 1.5 km and to a height of about 4 metres. The whole inundation had lasted nearly 12 hours. The quantity of water during that time may be estimated at about 200 mill. cu.metres. The water was very rich in solid material, and many pebbles and large blocks up to 1 metre in diameter were carried along and later on remained lying there. When the water was highest, the collision of the blocks could be heard. All the material which was carried out into the sea bore a great resemblance to morainic material, since all sizes from fine sand to large stones were found, completely unsorted. It was impossible to state the amount of the rolling material with certainty, but it might be estimated at at least 2 mill. tons.

During the catastrophe WEGMANN lost the whole camp, which consisted of a tent, a sleeping bag, a gun, provisions and a number of apparatus and notes. There was nothing to do but to wait for 4½ days, during which time the water of the river was the only food to be had. One of the days a dog-like track was found in the sand, presumably a wolf track. WEGMANN spent the night on a large erratic block. Not until Aug. 22nd did a boat come to the place and it took him to the Ella Ø station. On the night between Aug. 27th and 28th, the ships "Godthaab" and "Gustav Holm" left Ella Ø, and on Aug. 30th the autumn journeys began.

Aug. 30th.—The party went by a Faroe boat to Kap Elisabeth; the folds in the Devonian were studied.

Aug. 31st.—After a repair of the motor, the party continued to Bastionen.

Sept. 1st.—Strong gale.

Sept. 2nd.—Travelled together with the geodesists in order to lay

out depots near Renbugten and Kjerulfs Fjord. Now there was only a possibility of landing at the place where the geodesists were to land, and the geologic investigations were therefore somewhat fragmentary.

Sept. 3rd.—Excursions into Renbugten. The sand samples contained much garnet, hornblende, epidote, and titanite.

Sept. 4th.—Walked up into the valley.

Sept. 5th.—Came to the mouth of Kjerulfs Fjord. Ascended the mountain at the corner of Kjerulfs Fjord and Kejser Franz Josephs Fjord. Studied the crystalline schists, which proved to be the same as were found south of Hisingers Gl. on Aug. 9th. The zone of these schists therefore runs, as was to be expected, from the foot of Lugano Bjerg through Bocksrietdalen across Kjerulfs Fjord. Sand samples were found here containing much garnet and hornblende.

Sept. 6th.—The depot was laid out and rock samples were collected. Started the return journey.

Sept. 7th.—Arrival at Ella Ø.

Sept. 9th.—Made another journey by a Faroe boat to the western Vega Sund in order to study folds and overthrusts in the Devonian and the morphology of the district.

Sept. 10th.—Travelled to Aakerbloms Ø. Here a Devonian conglomerate resting on the Eleonore Bay formation was studied. On the south side the remains of the boat of the zoologists which was wrecked in September 1931 were found. A depot was laid out near the southern end of Polhems Dal. Although the motor did not work satisfactorily, Jägmästarens Ø was visited, and the party camped near Kap Peterséns.

Sept. 11th.—Arrived at Ella Ø after a troublesome voyage owing to difficulties with the motor.

Sept. 13th.—Laid out a depot by motor boat at the northern end of Polhems Dal.

Sept. 14th.—Laid out a depot for the archæologist on Geographical Society Ø. WEGMANN thereby got an opportunity, in Sofia Sund, to study folds and thrust planes in Svedenborgs Bjerg and the remarkable distribution of boulders in the Devonian formations.

Sept. 18th.—Left by boat for Aakerbloms Ø in order to rescue the zoologists' boat. During the unsettled weather of the last few days the boat had, however, suffered much, and only a small part of it could be saved. The salvage took place on Sept. 19th and 20th, and on the 20th a voyage was made to Kap Peterséns, where studies in the Eleonore Bay series were made.

Sept. 21st.—The boat of the geodesists arrived at the camp and the two boats sailed together back to Ella Ø.

Sept. 22nd.—Made reconnaissances on Maria Ø.

Sept. 23rd.—Made reconnaissances in Rud. Johansens Dal. Thereby

the boat travels of the autumn were in the main finished and the investigations had to be restricted to the nearest vicinity of the station.

On September 28th the Faroe boat was pulled ashore and then there were many days with bad weather so that the travelling boat could not be pulled ashore until October 4th. In case a fire should break out at the wintering station it was fitted to serve as archives for drawings and notes.

Still on October 5th an excursion could be made to the mountains behind the station and photographs taken, but a heavy snowfall on Oct. 6th—8th prevented longer excursions after that time.

October 16th.—The sea began to freeze. The sun no longer shone on the station.

October 31st.—The ice was so thick that the first journey with dog sledge could be made to Kap Alfred.

In the course of October WEGMANN tried, on the basis of the existing maps, to coordinate his observations. In some fields the results were fairly satisfactory, in others not. It further appeared that if the gneisses in the inner fjord areas were to be investigated, it was too great a task also to clear up the structural conditions of the Devonian; WEGMANN informed the leader of the expedition hereof by wire, proposing that the latter task should be given to another geologist next year and proposed Dr. H. BÜTLER from Schaffhausen for this work.

In the course of the winter only a few small excursions were made on Ella Ø and in February a short journey to Sues Sund.

### First spring journey.

On April 9th WEGMANN set out with a sledge and a Greenlander in order to continue his tectonic studies north of Ella Ø. The next day they reached Renbugten, whence excursions were made, and on Louise Boyds Land an ascent was made on April 13th, in order to get a view westwards. Here a bear was killed. At Renbugten another ascent was made in one of the side valleys. On April 15th, investigations were made near the east cape on Fränkels Land with the complicated gneiss lamellae. From this place the party travelled across Junctiondal to Blomsterbugten, and on April 19th they arrived at the depot behind Teufelsschloss. Round Teufelsschloss the snow was very deep and troublesome.

On April 20th a travel was made across the pass to Duséns Fjord and out to the Devonian limit. After returning to the depot, they followed the coast of the north side of Ymers Ø on April 23rd, some distance east of the Devonian limit; there was very deep snow here.

After having visited Kap Weber, Bjørneø, and Kap Ovibos, the party arrived at Nordfjord on April 26th. Owing to deep snow it was not possible to penetrate into Moskusoksefjord. They therefore travelled to the innermost part of Geologfjord and there made an ascent to the pass of Brogetdal.

On April 30th, they camped in Eleonores Bugt and continued southwards after a snowstorm, and at Nanortalik they met with the geodesists.

On May 4th and 5th, investigations were made in Kejser Franz Josephs Fjord round Kap Mohn, notably in order to study the tillites, and the party at last arrived at Ella Ø in the evening of May 5th.

### Second spring journey.

As early as May 11th, WEGMANN set out with a Greenlander and a sledge northwards, reaching Nanortalik the same day. In the following days they travelled westwards and at Kjerulfs Fjord they studied the limestones which are characteristic between the inner migmatite complex and the other crystalline formations. It was ascertained that in these innermost ramifications of the fjord there were, among the grass leaves, large accumulations of mica, which is transported by the wind and deposited among the vegetation. With an addition of humus they will comparatively quickly form a fine earth rich in potassium, which is particularly favourable for the formation of a rich vegetation.

On May 14th, they reached the head of Kjerulfs Fjord. In several places of the valley sides there were now rivers which formed lakes on the fjord ice.

May 15th.—A skiing excursion was made through Bocksrietdalen to Hisingers Gl. and from here they got a view out through Dicksons Fjord.

May 16th.—The party reached the outermost part of Kjerulfs Fjord. Now more water was constantly forming on the ice. The next day they continued to the front of Nordenskjölds Gl. Large avalanches constantly fell down the steep mountain sides in the innermost part of the fjord. Observations of the special melting forms of the snow were made; these melting forms much resemble certain melting forms in the tropics which are here called 'nieves penitentes' (WEGMANN, *Eis- und Schneeformen in Nordostgrønland. Der Naturforscher*, 11. Jahrgang 1935, pp. 414—419, 5 fig. TROLL, Carl Büsserschnee (Nieve de los penitentes) in den Hochgebirgen der Erde. Ein Beitrag zur Geographie der Schneedecke. *Ergänzungsheft No. 240 1942*, 103 p. 22 pl. photograph of Knækdalen cf. pl. 12).

The party now travelled mostly by night. On May 18th, they reached Nigglis Dal and the next day continued in the direction of Renbugten.

May 20th.—An excursion was made with an empty sledge to the southern shore of Isfjord, and the next day they arrived at Nanortalik where they met the archæologist and a Greenlander. An excursion was made to Murgangsdalen in order to supplement the observations from the south.

May 22nd.—The party arrived at Ella Ø.

### Third spring journey.

Round Lyells Land and through Polhems Dal.

May 28th.—WEGMANN started with two sledges and both the Greenlanders. The next day they penetrated into Segelsällskapet Fjord to the southern side of Polhems Dal, whence they were to start. From here the Greenlanders were sent home and in the first days excursions were made, e. g. to the Norwegian trapper's hut, to Kap Mæchel on the other side of Forsblads Fjord, and to Arwidssons Ø. Another excursion was made to the south coast of Forsblads Fjord on June 10th.

June 13th.—Washing out of sand was made at the mouth of Polhems Dal. Owing to melting snow it was impossible to make long excursions in the middle of June, and the time was used for collecting samples in the vicinity of the camp in Polhems Dal and studying the lithology of the sediments.

June 22nd.—They set out with the first depot into the land. Some distance inland the river was very big and could not be passed.

Two days later another load was taken along. A third load was carried inland on June 25th, and on June 26th the first removal of the camp had come to an end.

June 27th, and 28th.—An excursion was made to Jelsdal and up the glacier to an altitude of 1250 m. In the first days of July the camp was removed to the watershed, and on July 5th, the first rock samples were carried to Narhvalsund.

July 4th.—A camp was established in Hasdal, and on July 11th, and 12th, excursions were made in the vicinity with an ascent to Jeanets Bjerg. During the night the geodesists paid a visit. The two following days some collections were taken to Narhvalsund, and on July 15th, the collections and WEGMANN were fetched by motor boat and taken to Ella Ø, he had then been quite alone during 45 days. The journey had been rather troublesome, since the equipment with which he had to work was only intended for sledge journeys and therefore was far too heavy.

### First summer journey.

July 18th—21st.—Ymers Ø and Antarcitics Sund were visited. An excursion was made behind Skildvagten in order to study the tillites

and their substratum. The collections from Kjerulfs Fjord, Renbugten, and Blomsterbugten were fetched.

July 22nd.—An excursion was made to the plateau between Skildvagten and Johnstrups Bjerg and from July 23rd to July 29th, a voyage was made by motor boat to Segelsällskapets Fjord and Alpefjord, which were studied more closely with ascents in the innermost part of Alpefjord. Here the party met the Norwegian research vessel "Polarbjørn", which was warned against a submarine moraine in front of Gully Gl. (cf. WEGMANN, Berichtigung, Mitt. d. Naturforsch. Ges. Schaffhausen, Bd. 13, 1937, No. 4, p. 24).

On July 28th, the depot in Polhems Dal was taken onboard and the party continued to Ella Ø.

### Second summer journey.

On Aug. 2nd, the "Godthaab" arrived at Ella Ø with Dr. BÜTLER and the Swiss summer assistant BÜRGI.

Aug. 5th.—WEGMANN got an opportunity to make a 500 km long trip by seaplane over part of the working field from Ella Ø across Teufelsschloss, Rendalen, Isfjord, Kjerulfs Fjord, Dicksons Fjord, Forsblads Fjord, Alpefjord and Berzelius Bjerg to Ella Ø. The seaplane flew at a height of 3500—4000 m. Many photographs and sketches were taken, and this flight was a good orientation for future excursions and it was also of great importance for the working together of the results obtained, especially from the districts from which no cartographic material was available at that time. In the case of future investigations such flying excursions should be made at the beginning and at the end of the investigations and if possible once in the middle of the work for the sake of a general view. At 9 p. m. WEGMANN, BÜTLER and BÜRGI left for Kempes Fjord.

Aug. 6th.—The party camped in the interior of Dicksons Fjord. The following day the party made an ascent of Rødhorn, which was 1860 m high, up through the Fulach valley and over the glacier to the great plateau which is situated at an altitude of nearly 1600 m.

Aug. 8th.—They continued to Minger Bjerg (2112 m) at which they arrived about midnight. Gipfelflur is very pronounced here, only Payers Tinde forms a higher island to the east. Towards the west the level of the mountains rises, being at the same time more divided, partly into peaks, partly into plateau-like mountains.

Aug. 9th.—A descent with rope was made down steep ice walls on the glacier to the west of Thun Søerne, where the party camped at an altitude of 1071 m. The vegetation was luxuriant here. The lakes have formerly had a far greater extent and the present lakes are only

relics. The lakes are surrounded by moraines, and part of the old lake bottom is covered with blown sand. They continued down to Murgangssø, which had been partly drained the previous year. There were still icebergs at the shore. A barometric observation showed that the ground-water level in this lake owing to the sudden sinking was less than 39 m; but very distinct shore lines were found higher up, notably about 70 m above the present level of the lake. The bottom sediments of the more or less dried up lakes are much exposed to the action of the wind, and in windy weather great dust clouds are formed.

They continued over the transverse glacier and it proved that the greater part of the water which runs out of the lake must have passed under the ice. In the moraines a number of crystal flowers were found, probably a sulphate which only forms when the air is very dry. Below the barring glacier there were still traces everywhere of the drainage of the lake. Large rocks were washed clean and all earth and vegetation had disappeared. A canyon which had before been full of morainic material was empty and the river run through it. In the valley there were distinct traces of glacier oscillations up to a size of 1 km. The party continued down to the bend in the valley which they reached on Aug. 10th, at 3 p. m., and here they camped at an altitude of 306 m. The last part of the way they passed through more or less metamorphic quartzites. In the afternoon they went down to the coast in Kempes Fjord and were fetched by motor boat and sailed back to Ella Ø.

Another journey into the interior of Kempes Fjord was started on Aug. 12th, and on Aug. 13th they ascended the mountain behind Kap Hedlund (771 m).

Aug. 14th.—They camped in Røhss Fjord, and on Aug. 15th, WEGMANN and BÜTLER made an eight hours' excursion into Skræntedal at the head of Røhss Fjord. The following day the Suomi Bjerg was ascended.

Aug. 17th.—They travelled into Rhedins Fjord in order to collect samples after having been ashore in a number of places along the coast. Another ascent was made here, and in the afternoon BÜRGI, who had made sand washings, and some archæologists at Kap Hedlund were fetched, whereupon they all travelled to Ella Ø.

Already the next day another journey by motor boat was started to Kap Dufva and further on to Kap Lagerberg and Forsblads Fjord with many landings along the coast. The voyage was made together with the geodesists.

Aug. 21st.—WEGMANN and BÜRGI went over Randenæs in order to study pegmatites, and the next day SIMONSEN, the geodesist, in company with BÜRGI went over Tærskeldal to the Violingletcher. WEGMANN made investigations from the motor boat along the south coast of the fjord.

Aug. 23rd.—An excursion was made into Tærskeldal, but the investigation had to be interrupted since orders were received over the radio to be on Ella Ø not later than Aug. 24th. The "Gustav Holm" arrived here on Aug. 27th, and went south in the evening.

Aug. 28th.—WEGMANN had an opportunity, during a short stay at Scoresbysund, to study the gneisses and take samples. In the evening the ship set her course towards Iceland.

A short survey will be given here of the depots which were laid out in the autumn of 1932 for the sledge journeys in the following year. They were intended for two geodesists with a Greenlander, and for the geologist with a Greenlander, with two and one sledge, respectively.

In Renbugten the following provisions were laid out by motor boat: 5 boxes of pemmican for the dogs of 36 kg each, 35 l kerosene, 1 big box of rye biscuits, 8 packages of oat grit, 4 packages of chocolate, 50 cartridges, 1 package of Meta, 10 boxes of matches, 15 rolls of film (for cartographical use), tea, salt, 1 package of Elesca, barley grits and dried fruit, 3 tins of milk, sugar, 1½ kg butter, 2 tins of fruit of 1 kg each, 4 tins of fruit of ½ kg each, 7 tins of man pemmican of ½ kg each, and 56 dinners.

The depot in Kjerulfs Fjord was as in Renbugten, but with 60 dinners; the depot at Teufelsschloss was like that in Renbugten but with 53 dinners and 1 tin of man pemmican of 4 kg; the depot at Nanortalik was like that in Renbugten, but with 8 boxes of pemmican for the dogs of 36 kg each and 13 dinners and 20 rolls of film for the cartographers. At Kap Hedlund there was a depot consisting of 40 l of kerosene, 1 box of pemmican for the dogs of 36 kg, 3 tins of man pemmican of 4 kg each, 1 box of rye biscuits, tea, salt, sugar and 2 packages of chocolate.

The above-mentioned depots had been laid out by motor boat in the autumn and none of them were destroyed in winter by bears or in other ways.

By limiting the working field so that it only comprised the crystalline rocks west of the Devonian WEGMANN succeeded, in broad features, in taking a survey of the tectonics of the fjord ramifications from Alpefjord in the south up to and including Geologfjord in the north.

The work was impeded owing to the fact that the means of transport had to be shared with the geodesists from the arrival in 1932 to the middle of August 1933, and not until then did WEGMANN have his own scientific assistant and his own motor boat, which, however, could only be used for 1½ weeks. It goes without saying that the work was much impeded by the absence of topographical maps. The flying excursions made by WEGMANN to some extent remedied this defect.

The skiing equipment was very primitive, and light equipment for walks inland and ascents of mountains was lacking.

### Summer journeys in 1934.

A number of journeys were planned for this summer, partly to Staunings Alper, partly towards Geologfjord, but especially westwards to the districts west of the head of the ramifications of Kempes Fjord towards the less metamorphosed sediments of the Petermann series.

WEGMANN had chosen the two Swiss geologists and mountain climbers GANSSER and MASSON for his companions. Furthermore WEGMANN had himself purchased the whole equipment in order to get it as adequate as possible under the exacting ascents. Towards the end of the summer they got an opportunity to make a few small excursions in Nordostbugt in the inner Scoresby Sund. Here the gneisses were studied more closely and samples were taken. It proved that these gneisses consisted of metamorphosed quartzites of the Eleonore Bay series. When the ship on her way northwards reached the mouth of Davy Sund, WEGMANN was taken to Ella Ø by the seaplane in order to communicate with Dr. BÜTLER as quickly as possible. This was of great value for the planning of later works. The weather was overcast, but as there were no shadows, the colours of the strata could be seen very distinctly and therefore gave a good impression of the structure. The seaplane went close along Kongeborgen so that the faults of the basalts could be seen very distinctly.

On Aug. 1st.—The "Gustav Holm" arrived at Ella Ø, and the equipment was discharged.

On Aug. 2nd.—A short voyage by motor boat was made to the foot of Johnstrups Bjerg and Ruths Ø in order to study the relation of the tillites to the Eleonore Bay series.

Aug. 3rd.—WEGMANN flew over Rhedins Fjord, Røhss Fjord, Dicksons Fjord, Kjerulfs Fjord, Isfjord and Kejser Franz Josephs Fjord back to Ella Ø. During this flight he was able to find out whether it would be possible to make a journey to the inner zone of the gneisses in order to study the contact with the Petermann series. On the same day an ascent was made to Bastionen on Ella Ø in order to study the action of the younger folds near the syncline there.

Aug. 4th.—The party left by the travelling boat to Kap Alfred in Narhvalsund. The weather was not good. A few excursions were made in so far as the fog permitted.

Aug. 7th.—They proceeded over Kap Hedlund to Dicksons Fjord and camped near the Fulach valley. There was rain and storm, in Dicksons Fjord fog.

Aug. 8th.—They travelled to Langenthaler Gl, where GANSSER passed the glacier in order to find a road for the ascent. WEGMANN and MASSON worked on the north side of the fjord, but were impeded by rain and fog. The vegetation here was very luxuriant. The shrubs were more than 1 m high.

Aug. 9th.—The motor boat was discharged at Langenthal and was sent back, whereupon the equipment was made ready for the ascent. The three men were to carry altogether nearly 200 kg, including a tent, sleeping bags, provisions, instruments, skis and sticks, ropes, ice axes, cooking utensils and fuel. The skis were very light and well suited if the snow was not too hard. Similar skis had been used in certain Himalayan expeditions. Unfortunately, there proved to be rather much hard snow high up, for which reason the edges of the skis were rather quickly rounded. The cooking utensils were as light as possible, made of aluminium, with a petrol primus stove. They carried a tetraedric tent of waterproof silk with a rubber floor. This type had been used in the Alps, but it proved to be less practical under the Greenland conditions, as in severe cold water dripped from the walls. During later ascents in Greenland light tents of a material which was not waterproof and without a floor were used. The glacier ropes were of a good and light quality. The ice axes were of the most modern sort and proved very satisfactory. The provisions were the most nutritious to be had at that time and weighed as little as possible. Later great progress has been made, so that still lighter and more nutritious provisions can now be had. Each man got two rucksacks for carrying the whole of the equipment, which proved to be very practical. In order to protect the mountain boots covers were used when skiing. They had also overalls made by balloon material. For orientation WEGMANN carried with him a small geologist—"Kippregel" from the firm of Kern & Co in Arrau.

Aug. 10th.—The weather improved, and the party went towards the glacier, which descends to nearly 300 m above the sea. The edge of the glacier could be followed for a distance between the mountain wall and the ice wall of the glacier in a canyon formed by the warmth from the mountain wall. It took a rather long time before a fissure was found in the side of the glacier where an ascent was possible, but they succeeded in finding a place where a small thaw-water brook ran down. In the fissure one could support oneself to both sides while steps were cut with the ice axe, and when a man had worked his way up, the bags were hoisted up by means of the ropes. It was very easy to walk on the surface of the glacier, and they camped at an altitude of 1350 m on the west side of the glacier below Lugano Bjerg. The temperature was 2°C. below zero at midnight.

Aug. 11th.—They ascended Lugano Bjerg (2200 m). The mountain

is a high plateau with very deep snow and there are rather many glacier fissures round the mountain. The view from the top is very instructive, since the development of the morphology here can be seen very distinctly and accordingly the younger tectonic movements. Strange to say, a number of hare tracks were found on the top.

Aug. 12th.—In the vicinity of Lugano Bjerg a depot was made, consisting of three of the six rucksacks with their contents. It was only possible to go skiing at an altitude of more than 1600 m. Farther down there was too much ice, but also higher up than 1600 m the snow was hard and the skis were exposed to great wear. Ideal conditions for skiing were only found above 2000 m. At an altitude of about 1800 m a landscape was passed which was full of large erratic blocks. It had become free of ice not long ago and the blocks were lying rather loose, for which reason it was difficult to pass. In the thaw-water among the blocks there were great quantities of small animals; where there was water, there were much moss and other plants. Skeletons of lemmings were also found. The Buri Søer were passed and the Concordia Plads was reached at an altitude of nearly 1400 m. Here they had a view over large remains of plateaus at this altitude in all directions. Especially down towards Wahlenbergs Gl. and Violingl. one could see mountains with remains of this plateau surface. It was possible here to reconstruct the planes which have been eroded into the higher plateaus. In this 1400 m high plane a still younger one is situated, which is partly filled out by the glacier. These interesting conditions will later be dealt with more thoroughly. The weather was not particularly favourable. It was mostly overcast with a southwesterly wind. The visibility was not always particularly good. The party camped at the ice of the Concordia Plads.

Aug. 13th.—They walked across the Concordia Plads up to Cæcilia Nunatak. The walk took about three hours. The surface of the ice was full of kryokonite holes, often more than 30 cm in diameter and fairly deep. The holes were covered by thin ice, and as it snowed lightly, it was difficult to walk on the ice, since one would get one's feet down these holes every minute and get water into the boots.

The glacier here vaulted 120—130 m. The weather was not fine. There were thick clouds to the west at a height of nearly 2000 m. To the east they were more low-lying. The temperature ruled round 0° C. In the moraine om Cæcilia Nunatak there were mostly crystalline rocks, but also various non-metamorphic blocks, limestone, dolomite, shales and sandstones. In a dark limestone some fossils (determined by POULSEN) were found. Near the moraine there were two skulls of musk-oxen and a reindeer leg. Gneisses with metamorphic ophites were found *in situ*. In the ophites there were large grains of feldspar. Most of the nunatak

is formed by a smooth plane at an altitude of nearly 1400 m, corresponding to the very commonly extended plane to the east and south-east. On the plane there are rounded hills up to 1600 m high. From these hills the inland ice rises to the west, and the nunatak therefore forms a kind of barrier between the higher inner ice plane and the ice of the Concordia Plads which moves down towards the fjord glacier.

Aug. 14th.—The highest point of Cæcilia Nunatak was ascended, but it was still snowing, and the visibility was very limited. Then the party walked back over the Concordia Plads in dense fog and snow-storm. The route which was set a little more northerly had a rise of only about 100 m.

Aug. 15th.—The weather had improved somewhat. GANSSER and MASSON walked over to the depot near Lugano Bjerg in order to fetch the rock samples and the provisions. WEGMANN walked south over land. A number of mylonite zones were found.

Aug. 16th.—The party went to Rigi Nunatak. The rocks were investigated here and they took small collections of plants with them. From here they continued to Vähfreude. The conditions of movement on the glacier were supposed to be very complicated in the vicinity, since there were fissures running in different directions. Finally, there were in several places large rivers in very deep canyons. The land at the foot of Vähfreude was some of the most luxuriant to be found in East Greenland. Plants were collected. While in East Greenland the glaciers would seem to recede almost everywhere, the edge of the glacier here seemed to have made a small advance not long ago. Very distinct traces of terraces from ice-dammed lakes were found, but these were cut across by the present moraine, and many of the terraces were concealed under the ice. In the erratic blocks there are metamorphic dolomites and quartzites with a very distinct sediment structure, but neither non-metamorphic nor Palæozoic limestones as on Cæcilia Nunatak were found. There were many large blocks of non-deformed granite with large grains of felspar.

Aug. 17th.—From the top of the mountain there was a view down towards Agassiz Dal and towards an ice-dammed lake. Nowhere did they see non-metamorphic Petermann series. There was a number of quartzites with all the characteristic sediment structures which are known from the Eleonore Bay quartzites, but these contained granite, biotite and other metamorphic rocks.

Aug. 18th.—The party walked out over the glacier to Appenzeller Nunatak. Here the moraine only extended about 1200 m. In the moraine there were no Palæozoic limestones. From this place the party proceeded to Concordia Plads and to the mountain opposite Niklausdal, whence they had a view to Skræntdal.

Aug. 19th.—The party went partly on skis to the depot near Lugano Bjerg. Here they ate the rest of the provisions, and the rock samples were distributed, whereupon they had again nearly 200 kg in the six rucksacks. By means of the ski-sticks and the skis a sledge was made and by this they could travel down the ice. When large rivers were encountered, everything had of course to be carried over. At the margin of the glacier everything was lowered by ropes; at last the members of the party got down themselves. On land the collections were of course heavy to carry but now the way went downwards.

Aug. 20th.—At 2 a. m. they had got down to the fjord, this date having been fixed beforehand. Towards 6 in the morning the “Gustav Holm” arrived, whereupon the camp was taken onboard, and at noon they were back at Ella Ø.

The next day still another excursion by motor boat was made to Argands Gl. in order to make certain investigations. The weather was however not particularly good. The following day the collections were packed, and it was determined to use the very last days for certain investigations near Forsblads Fjord.

In the night of Aug. 23rd, WEGMANN left in the motor boat for Kap Dufva, Aakerbloms Ø, Segelsällskapets Fjord. It was his intention to draw a panorama from Jägmästarens Ø, but this was not permitted by the weather.

Aug. 24th.—An ascent was made of Skjoldungebræ. A number of erratic blocks of quartz porphyry were found, which probably belongs to the supply canals for the Devonian eruptions. Finally there were basalt veins. Rain and fog obstructed a wider view.

Aug. 25th.—Rain, fog and storm. Investigations on glacier no. 2 on the south side of Segelsällskapets Fjord were made and later in the day also investigations in the moraine near the glacier descending from Murchisons Bjerge. Instructions were received over the radio to stay near Aakerbloms Ø in order to meet the “Gustav Holm” next night.

Aug. 26th.—Storm, snow and rain. The party waited on Aakerbloms Ø, but no ship arrived, on the other hand a seaplane came, reporting that the expedition had been somewhat delayed owing to trouble with a motor boat. They travelled to Kap Lagerberg in order to study the post-Devonian faults there. They proceeded to Kap Peterséns and a new advance was made towards Skjoldungebræ, where a number of rocks with fluorite, indicating younger fumarole activity, were found. Samples were collected in the moraines. The motor boat returned to Aakerbloms Ø in the evening and they kept a lookout for the ship in turn.

Aug. 28th.—At 4 a. m. the ship arrived, and the party was taken on board. The ship now headed south, and after a fairly long stay in

the ice in the mouth of Scoresby Sund in order to fetch a motor boat party there, the ship at last got free of the ice on Sept. 11th, whereupon the return voyage was made via Iceland.

If we look back on the summer of 1934, it may be said in the first place that the equipment was first class in contradistinction to the previous year, but the ice conditions reduced the working time and notably August had very bad weather. Therefore it was not possible to carry through completely the planned programme. It might therefore be asked why another geologist was not set in in the following years of expedition to finish the tasks. This was not the case, since it was not possible to find a man who had Dr. WEGMANN's great experience as regards the work in the most ancient rocks. A new man would also have had to work for a long time in the areas investigated by WEGMANN in order to be able to recognise the different metamorphic facies, and not until he had got acquainted with the whole division of the scale chosen by WEGMANN, would it be possible for him to continue the work. It was regrettable, therefore, that WEGMANN was not able to continue the work in the following years.

Later on the right man was found in Dr. MITTELHOLZER to continue WEGMANN's work farther north, and as MITTELHOLZER had an opportunity as Dr. BÜTLER's assistant during a summer journey in Hudson Land to become familiar with the different metamorphic sediment series there, it was possible for him during a stay on Clavering Ø in 1938—39 to make an investigation of the crystalline here, which however, showed a similar development to that demonstrated by WEGMANN west of the Ella Ø station.

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