GGU

Open File Series No. 89/7

Gold mineralisation in the Skaergaard intrusion

Troels F.D. Nielsen

November 1989

GRØNLANDS GEOLOGISKE UNDERSØGELSE
The Geological Survey of Greenland
ØSTER VOLDGADE 10, 1350 KØBENHAVN K, DANMARK

Open File Series

The Open File Series consists of un-edited reports and maps that are made available quickly in limited numbers to the public. They are a non-permanent form of publication that may be cited as sources of information. Certain reports may be replaced later by edited versions.

Citation form

Open File Series Grønlands Geologiske Undersøgelse

conveniently abbreviated to:
Open File Ser. Grønlands geol. Unders.

GGU's Open File Series består af uredigerede rapporter og kort, som publiceres hurtigt og i et begrænset antal. Disse publikationer er midlertidige og kan anvendes som kildemateriale. Visse af rapporterne vil evt. senere blive erstattet af redigerede udgaver.

ISSN 0903-7322

GRØNLANDS GEOLOGISKE UNDERSØGELSE
Open File Series No. 89/7

Gold mineralisation in the Skaergaard intrusion

Troels F. D. Nielsen

November 1989

Abstract

The well-known Tertiary gabbroic Skaergaard intrusion in East Greenland has been shown to a host a gold and platinum group metal mineralization. Platinova Resources Ltd./Corona Corporation Joint Venture have worked in the intrusion since 1986 and have reported gold concentrations up to 5 g/ton.

In this report ten independent gold results from the mineralized horizon are compared to the results obtained by the Joint Venture. It is evident that the Joint Venture results can be duplicated. Further the results show that large concentration variations occur in the mineralized horizon and it is indicated that gold is not concentrated in the mafic parts of the rythmic layering but in the melanocratic to leucocratic layers.

Contents

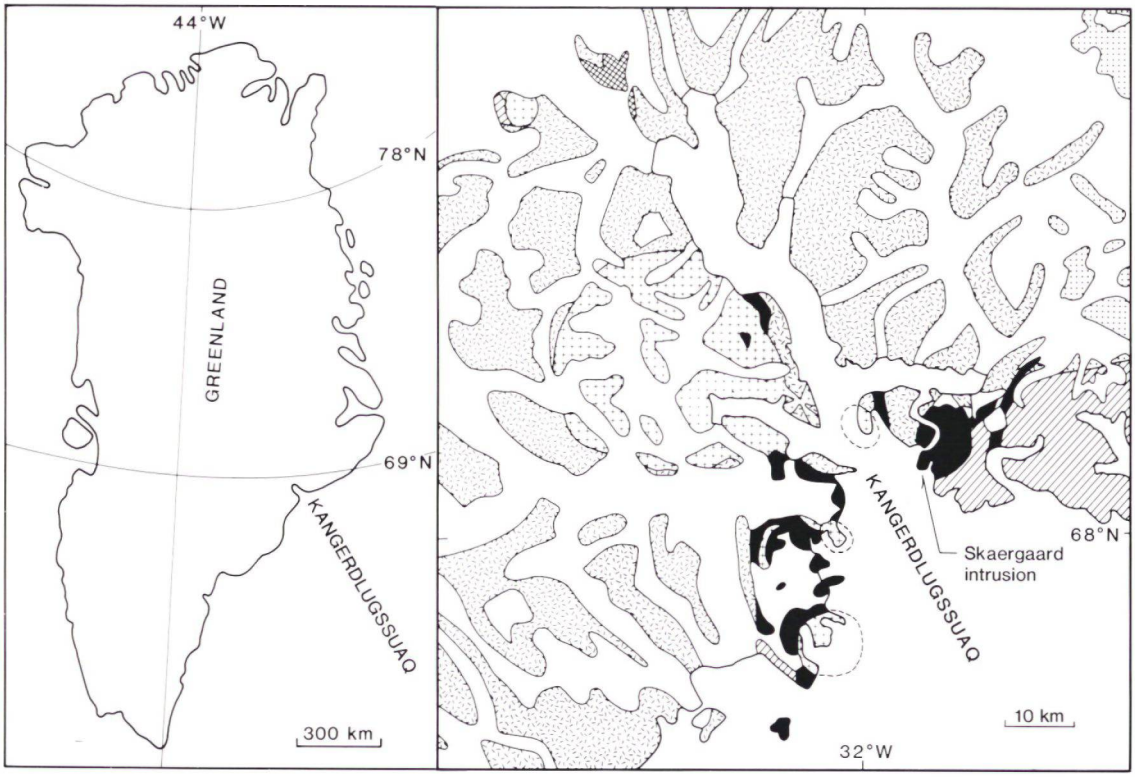


Fig. 1. Outline of the Kangerdlugssuaq area with the location of the Skaergaard intrusion. Stippled: Archaean basement; dotted: Cretaceous to Tertiary sediments; ruled: Tertiary lavas; cross hatched: Caledonian intrusion; black: Tertiary gabbro intrusions and crosses: Tertiary alkaline intrusions.

1. Introduction

The Tertiary Skaergaard intrusion is one of a group of large layered tholeiitic gabbro bodies formed 55 Ma ago at the continental margin of the North Atlantic (Brooks & Nielsen, 1982). Since the earliest description (Wager & Deer, 1939) the intrusion has been studied in great detail and is probably the most studied gabbro body on Earth. The intrusion has now been shown to host a stratabound gold and platinum group metal (PGM) mineralization. Analytical results from gold-rich parts of the stratabound mineralization are presented here and are compared with the results obtained by the Joint Venture of Platinova Resources Ltd. and Corona Corporation.

2. The Skaergaard intrusion

The Skaergaard intrusion is located in an arctic alpine terrain in East Greenland on the eastern shore of the mouth of Kangerdlugssuaq fjord (68^{o}N) (fig. 1). The intrusion is oval in surface exposure, about 7 x 10 km across, and with a surface area of c. 55 km^2 (fig. 2). A reconstruction from the field exposures shows it to be a thick sill-like body, possibly thinning inland to the north (fig. 3). The body is slightly tilted with dips of 10-20^{o} to the south.

The intrusion is divided into three main rock units (figs 2 and 3): the Marginal Border Group, the Upper Border Group and the Layered Series. The Marginal Border Group crystallised from the margins inwards, the Upper Border Group from the roof downwards and the Layered Series up through the intrusion. The latest basic rocks to form in the complex compose the socalled sandwich horizon at the interface between the downwards crystallizing Upper Border Group and the upwards crystallizing Layered Series.

The Layered Series is subdivided into 3 units (fig. 2): The Lower Zone of olivine bearing gabbros, the Middle Zone of olivine-free gabbros and the Upper Zone of olivine-bearing ferro-diorites. These zones are further subdivided on the basis of the cumulative phases and cryptic variations in the mineral chemistry.

The systematic development in the composition of the fractionating phases through the layered gabbros and the apparent continuity of the rock succession has led to the favoured conclusion that the intrusion formed

from a single batch of tholeiitic liquid of common MORB-type. The liquid crystallised under closed or nearly closed conditions along a trend of iron enrichment (e.g. Brooks & Nielsen, 1978 and 1989).

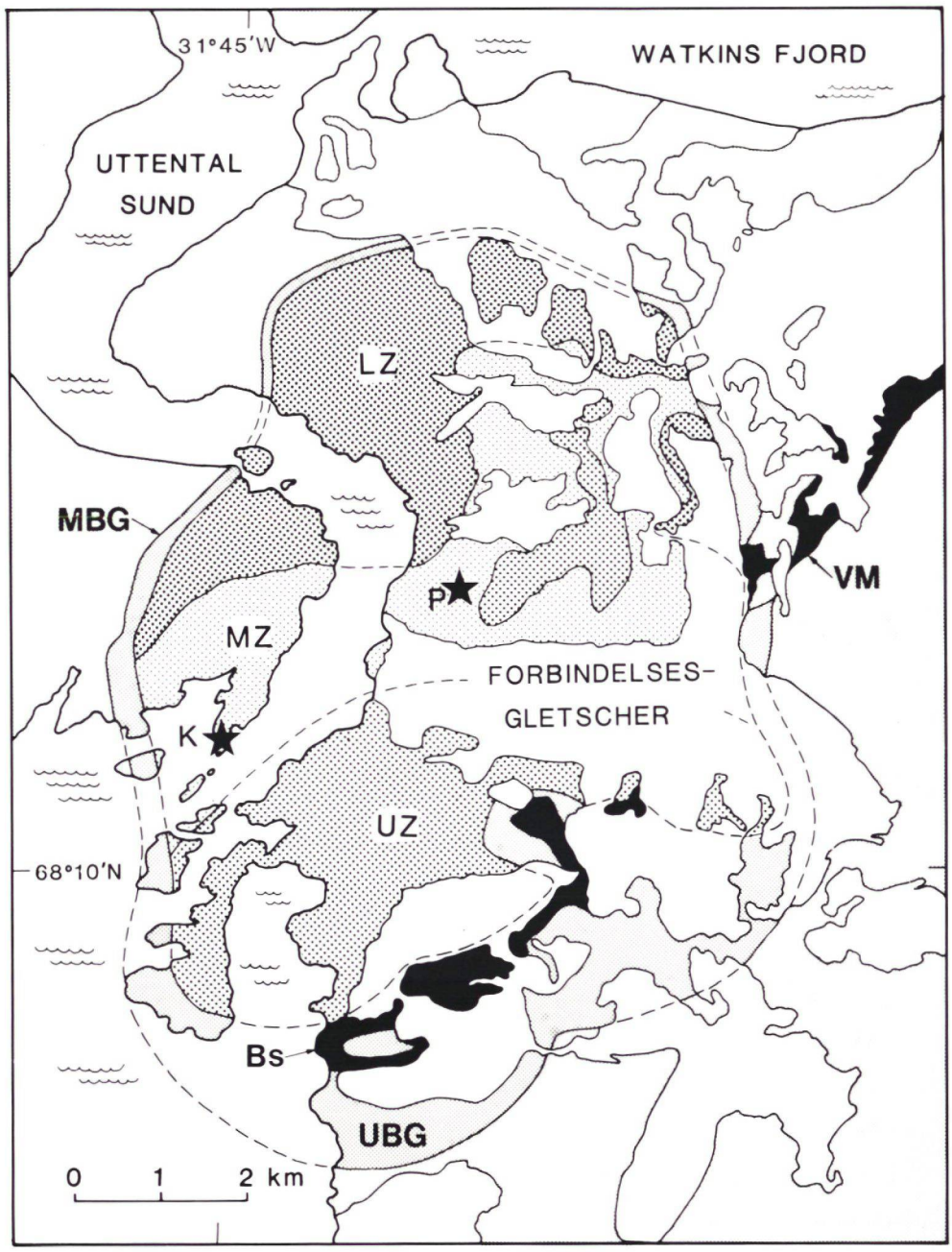


Fig. 2. The main divisions of the Skaergaard intrusion. MBG: Marginal Border Group; UBG: Upper Border Group; LZ: Lower Zone; MZ: Middle Zone; UZ: Upper Zone; Bs: Basistoppen sheet; VM: Vandfaldsdalen Macrodyke; P: Puku locality; K: Kræmer Ø locality.

3. Au and PGM mineralizations

The apparent similarities between the Skaergaard intrusion and PGM mineralized tholeiitic intrusions such as Bushveld (RSA) and Stillwater (USA) and the possibility of logistic back-up from a joint Geological Survey of Greenland and Geodetic Institute operation prompted the Toronto based prospecting company Platinova Resources Ltd. to initiate in 1986 an exploration programme on the Skaergaard intrusion and the related gabbro bodies on the East coast of Greenland. Further incitament was given by Turner (1987) who from a study of the distribution of the sulphides in the Skaergaard intrusion suggested a level of sulphur saturation in the upper part of the Middle Zone of the intrusion. Since 1988 the exploration has been conducted as a Platinova Resources Ltd./Corona Corporation Joint Venture.

The progress of the investigation is described in the Annual Reports to the share holders of Platinova Resources Ltd. for the years 1987 and 1988. It is here stated:

> " The surface expression of the Skaergaard intrusion measures 10 km by 7 km and individual layers within the intrusion have a surface area of approximately 40 km^2. One of these layers has been found to host ore grade gold, platinum and palladium mineralization. This layer is 2 to 5 m thick and has been traced over an 8 km strike exposure. The mineralization increases systematically in grade and thickness towards the centre of the intrusion. Grades up to 0.17 oz/ton gold, 0.11 oz/ton palladium and 0.05 oz/ton platinum have been recorded within the mineralized layer. Currently, the most central point sampled is 2 km from the centre of the intrusion. At this location the mineralized layer dips gently below sea level."

and

> " ...over 1600 rock samples were collected from 26 different locations. Sampling methodes included short-hole drilling, rock saw cuts, and in the more inaccessible locations, chip sampling."

The sketch (fig. 4), reproduced from the 1988 Annual report of Platinova Resources Ltd. shows the surface trace of the mineralized layer.

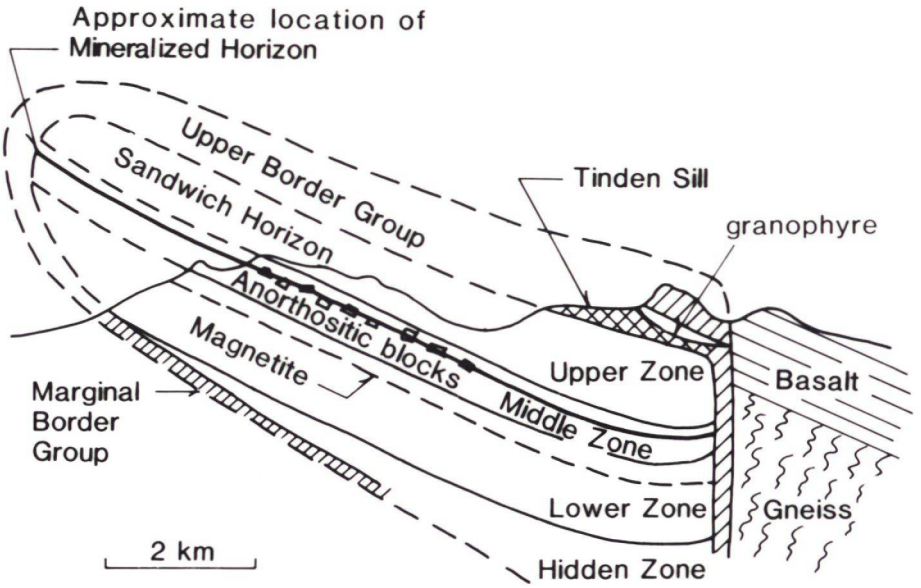


Fig. 3. Recontructed cross section of the Skaergaard intrusion after Irvine (1987). The mineralized horizon is located in accordance with figure 4.

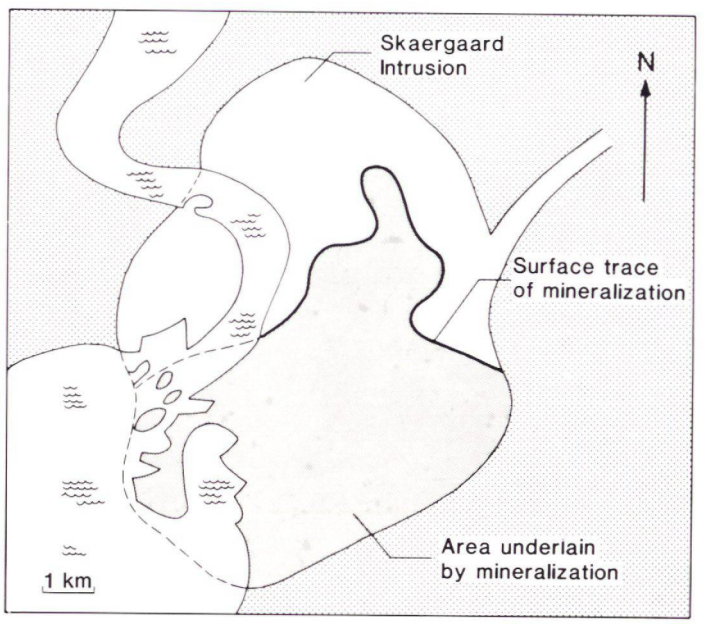


Fig. 4. Sketch to show the surface trace and the probable unexposed extend of the mineralized layer in the Skaergaard intrusion. Redrawn from the Annual Report of Platinova Resources Ltd., 1988.

4. Sampling programme

The samples discussed below were collected during an inspection visit by the Geological Survey of Greenland (GGU). The samples stem from two sections investigated in detail by Platinova Resources Ltd. The GGU programme was initiated to:

1) Test the reproducability of Au results in chip samples and saw cut channel samples;

2) Test whether Au was concentrated together with other heavy phases in the mafic units of rythmic layers;

3) Provide information on the small scale distribution of gold within the mineralized horizon.

The PGM concentrations within the investigated part of the mineralization is low with up to 0.5 ppm Pd and 0.1 ppm Pt, and will not receive further attention in this report. The PGM results are included in Appendix 1. The two localities from which the samples described below originate are shown in fig. 2.

5. Au results

Ten chip and grab samples were analysed for Au, Pt and Pd. The results from Bondar-Clegg & Company Ltd., Ottawa, Canada are shown in Appendix 1. Three of the 10 samples are chip samples collected adjacent to profiles sampled by Platinova Resources Ltd. One of the three chip samples (348817) (Table 1) covers an identical section of the layering, whereas two samples (348806 and 348807) are together equivalant to the upper half of one Platinova sample (fig. 5). It must be emphasised that the samples discussed below only represent selected sections and spot samples from the mineralized horizon and that the given information does not allow a meaningful calculation of the average grades or tonnages of the mineralization. The results and the corresponding analytical data from the prospecting companies are compiled in Table 1.

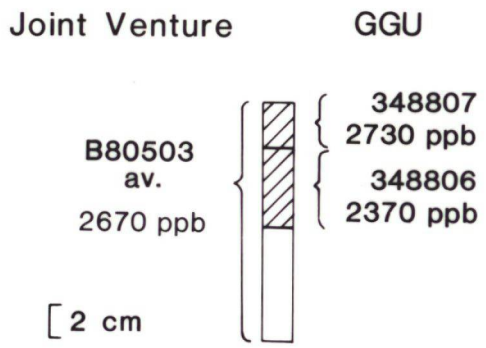


Fig. 5. Illustration of the correlation between Platinova Resources Ltd./Corona Corporation Joint Venture chip sample B80503 (15 cm true width) and GGU chip samples 348806 (3 cm true width) and 348807 (5 cm true width). The ruled area shows the possition of the GGU samples relative to the Platinova Resources Ltd. sample (blank and including the GGU samples). To the left the Au result obtained by Platinova Resources Ltd./Corona Corporation Joint Venture and to the right the Au results from the GGU samples.

Table 1. Chip samples

GGU no.	true width cm	Au ppb	Equivalent Platinova Res. no.	true width cm	Au ppb
348817	30	2540	T82301	30	2300
348806	3	2370			
			B80503	15	2670*
348807	5	2730			

* average of two analyses of the same sample.

It is apparent from Table 1 that the results of Platinova Resources Ltd. are reproducable, apparently within about 10 %. Sample 348817 was

collected in the saw cut channel C 7. The prospectors initially reported 2300 ppb and the re-chip gave 2540 ppb, a relative difference of about 10 %. The small GGU chip sample 348806 and 348807 cover the upper half of the Platinova Resources Ltd./Corona Corporation Joint Venture channel sample B80503 (fig. 5). The results are very similar (Table 1) and a weighted average suggests a reproducability within 5 %. This shows that the results of the companies are entirely reproducable and that the gold over short horizontal distances is rather equally distributed within specific layers of the mineralization. This is not surprising as both sulphides and gold phases occur as very small disseminated grains. No gold or sulphide grains were observed megascopically in the analysed samples.

The grab samples, which represent spot checks equivalent to ca. 5 cm true width gave the results shown in Table 2.

Table 2. Grab samples

GGU no.	true width cm	Au ppb	Equivalent Platinova Res. sample	true width cm	Au ppb
348811	5	380	none	-	-
348815	5	3620	T82307	35	2100
348816	5	4530	T82307	35	2100
348837	5	190	T81103	34	95
348838	5	406	T81011, 012	82	av. 400
348839	5	406	X81016, T81105-6	169	av. 189
248840	5	31	T81107, 108	95	av. 28

Sample 348811, with 380 ppb Au, was collected from a mafic layer separating saw cut samples with averages of 2690 ppb and 1390 ppb Au, respectively (see fig. 6a). Had Au been concentrated together with dense phases such as Mg-Fe silicates and oxides (magnetite and ilmenite) it would have been expected to contain considerable more Au than 380 ppb.

Samples 348815 and 348816, which are melanocratic average gabbros, represent the lower 10 cm of saw cut sample C 7 with 2100 ppb Au (see fig. 6b). The high values in the GGU samples suggests that Au is concentrated in the lower part of the section and the remaining part of C 7 should have an Au-average content significantly below the overall average of 2100 ppb.

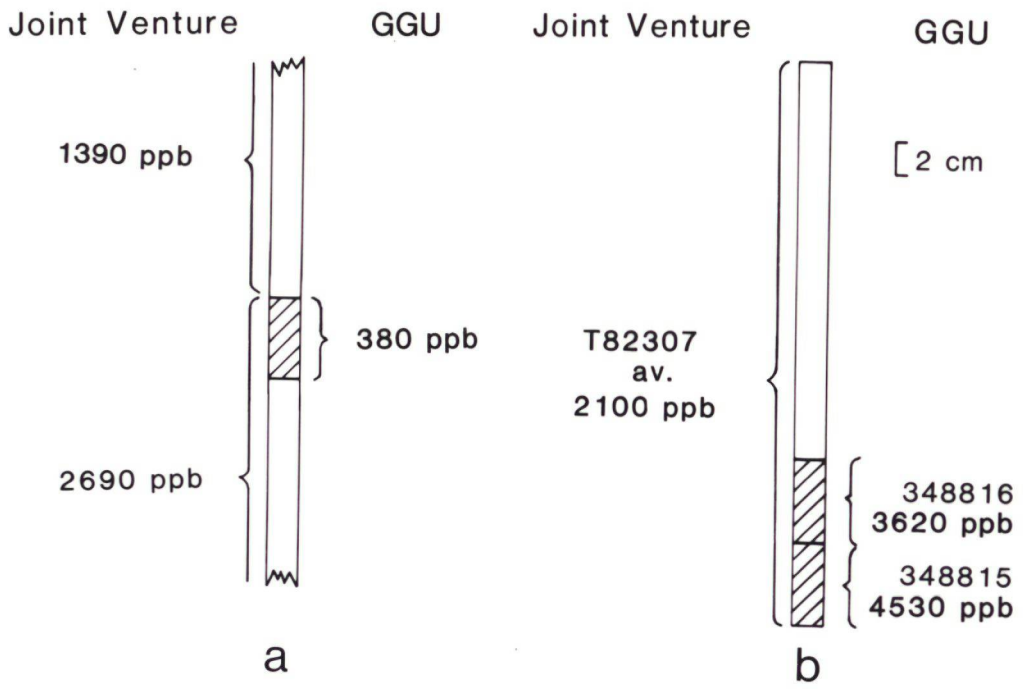


Fig. 6. Illustration of the correlation between Platinova Resources Ltd./Corona Corporation Joint Venture channel samples and GGU grab samples:

a: Possition of GGU sample 348811 (5 cm true width) between two Platinova Resources Ltd./Corona Corporation Joint Venture channel samples. The GGU sample is a mafic gabbro at the base of a rythmic layer.

b: Correlation between channel sample T82307 (35 cm true width) and GGU grab samples 348815 and 348816 (both 5 cm true width).

Samples 348811, 348815 and 348816 seem to indicate that the Au concentration varies considerably within the selected parts of the mineralized horizon, with a probable range of c. 400 to 5000 ppb Au.

The last four samples (348837 - 348840) were collected from gabbros surrounding the Au mineralisation. The samples represent 5 cm true width and show a reasonable agreement with the saw cut samples, even though variations by a factor of 2 are normal at low Au concentrations.

6. Conclusions

The independent GGU sampling and commercial analyses of the Au-mineralization in the Skaergaard intrusion show that the reported Au concentrations are reproducable. Within the mineralized horizon variations between c. 400 and 5000 ppb Au are observed. The sulfides and gold phases appear not to be concentrated in the very mafic parts of rythmic layers. It is thus not obvious that sulphides and gold separated from the silicate liquids and accumulated due to a gravity process.

7. Note

Data quoted from confidential reports prepared by Platinova Resources Ltd./Corona Corporation Joint Venture are included in this report with the authorization of the companies.

8. References

Brooks, C. K. & Nielsen, T. F. D. 1978: Early stages in the differentiation of the Skaergaard magma as revealed by a closely related suite of dike rocks. *Lithos* 11, 1-14.

Brooks, C. K. & Nielsen, T. F. D. 1982: The Phanerozoic development of the Kangerdlugssuaq area, East Greenland. *Meddr Grønland Geosci.* 9, 30 pp.

Brooks, C. K. & Nielsen, T. F. D. 1989: "The differentiation of the Skaergaard Intrusion" by R. H. Hunter and R. S. J. Sparks: a discussion. *Contrib. Mineral. Petrol.*, in press.

Irvine, T. N. 1987: Layering and related structures in the Duke Island and Skaergaard Intrusions: Similarities, differences, and origins. *In*: I. Parsons (ed.), *Origin of igneous layering*, 185-245. Reidel Publishing Company.

Turner, P. A. 1986: Sulphide mineralogy and the behavior of S and certain transition elements in the Skaergaard intrusion, East Greenland. Master's Thesis, Dartmouth College, unpublished.

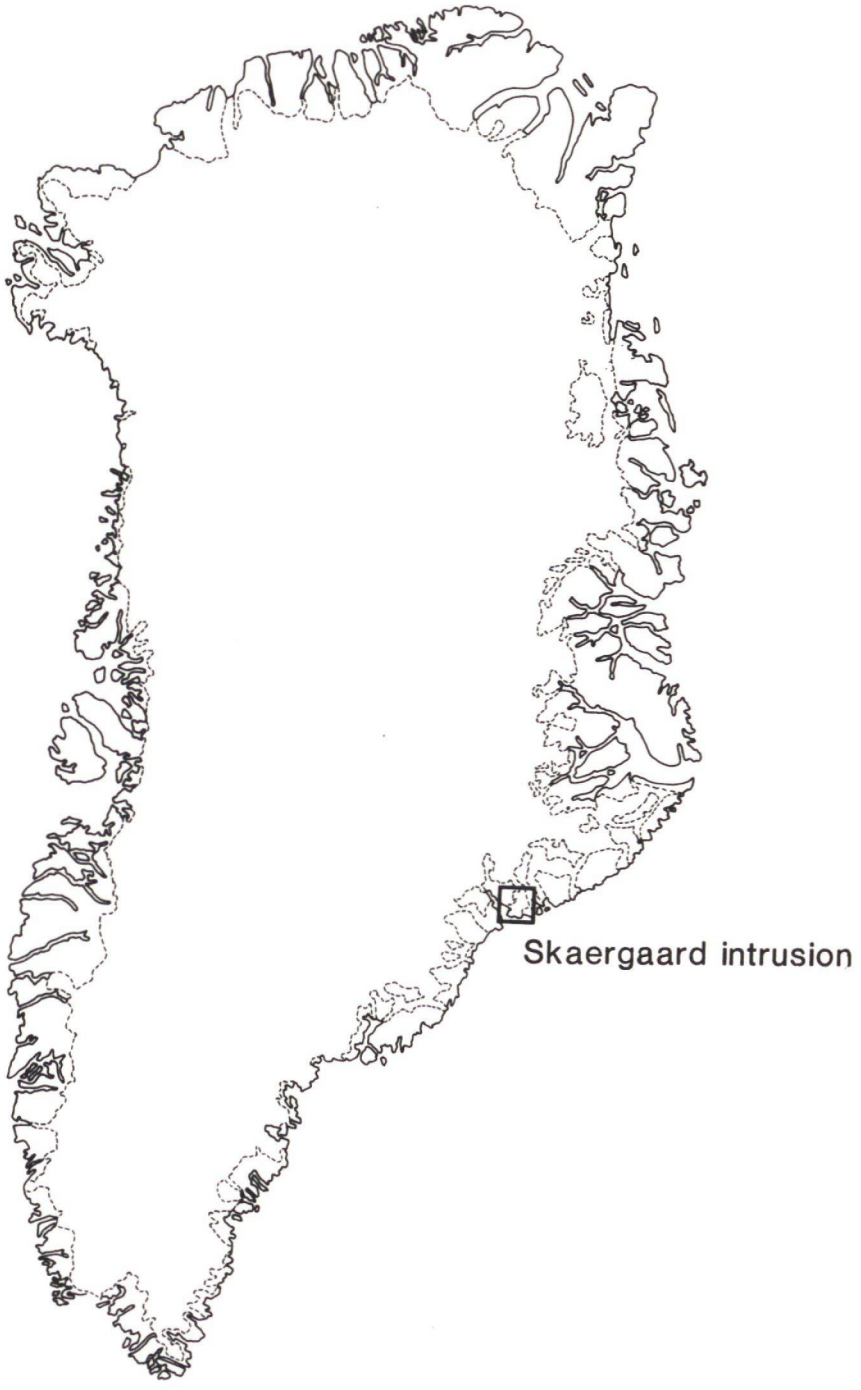
Wager, L. R. & Deer, W. A. 1939: Geological investigations in East Greenland, Part III. The petrology of the Skaergaard Intrusion, Kangerdlugssuaq, East Greenland. *Meddr Grønland* 105(4) 352 pp.

9. Appendix 1

Palladium, Platinum and gold analyses (ppb) of the investigated samples.

Sample no.[1]	Type	Palladium	Platinum	Gold
GGU 348806	chip	313	38	2370
GGU 348807	chip	415	41	2730
GGU 348811	grab	566	34	380
GGU 348815	grab	396	30	3620
GGU 348816	grab	379	40	4530
GGU 348817	chip	365	37	2540
GGU 348837	grab	567	43	150
GGU 348838	grab	590	41	406
GGU 348839	grab	293	70	406
GGU 348840	grab	22	<5	31
Detection limits		1	5	1

The analyses were performed by Bondar-Clegg & Co. by aqua regia extraction and fire assay with DC plasma finish.



ISSN 0903-7322