

Review of Survey activities 2003

Edited by

Martin Sønderholm and A.K. Higgins

Geological Survey of Denmark and Greenland Bulletin 4

Keywords

Geological Survey of Denmark and Greenland, survey organisations, current research, Denmark, Greenland, Faroe Islands.

Cover photographs from left to right

1. Field work in West Greenland. Photo: Jakob Lautrup.
2. Petroleum geological field work in the Song Ba Trough, a Cenozoic rift-lake basin in central Vietnam (see article on page 97). Photo: Henrik Ingermann Petersen.
3. Fossil hunting following the major rock fall at Store Stejlebjerg, Møn, Denmark in 2003 (see article on page 89). Photo: Peter K. Warnemoors.
4. Installation of an automatic mass balance station on the Greenland Inland Ice. The station carries out ablation measurements that are transmitted by satellite every 6 hours to the Survey (see article on page 81). Photo: Carl Egede Bøggild.

Frontispiece: facing page

Preparation of field equipment for a sampling and ground magnetic survey of a large kimberlitic dyke in the Maniisq region, southern West Greenland. Approximately 1.1 tonnes of kimberlitic rock was collected along the 2.5 km long dyke and subsequently tested for diamond content by a Canadian laboratory (see article on page 69). Photo: Jakob Lautrup.

Chief editor of this series: Peter R. Dawes

Scientific editors: Martin Sønderholm and A.K. Higgins

Editorial secretaries: Esben W. Glendal and Birgit Eriksen

Illustrations: Jette Halskov

Lay-out and graphic production: Annabeth Andersen and Henrik Klinge Pedersen

Printers: Schultz Grafisk, Albertslund, Denmark

Manuscripts submitted: 3 December 2003 – 23 March 2004

Final version approved: 12 May 2004

Printed: 20 July 2004

ISBN 87-7871-132-0

ISSN 1603-9769

Geological Survey of Denmark and Greenland Bulletin

The series *Geological Survey of Denmark and Greenland Bulletin* replaces *Geology of Denmark Survey Bulletin* and *Geology of Greenland Survey Bulletin*.

Citation of the name of this series

It is recommended that the name of this series is cited in full, viz. *Geological Survey of Denmark and Greenland Bulletin*. If abbreviation of this volume is necessary, the following form is suggested: *Geol. Surv. Den. Green. Bull.* 4, 100 pp.

Available from

Geological Survey of Denmark and Greenland (GEUS)

Øster Voldgade 10, DK-1350 Copenhagen K, Denmark

Phone: +45 38 14 20 00, fax: +45 38 14 20 50, e-mail: geus@geus.dk

or

Geografforlaget ApS

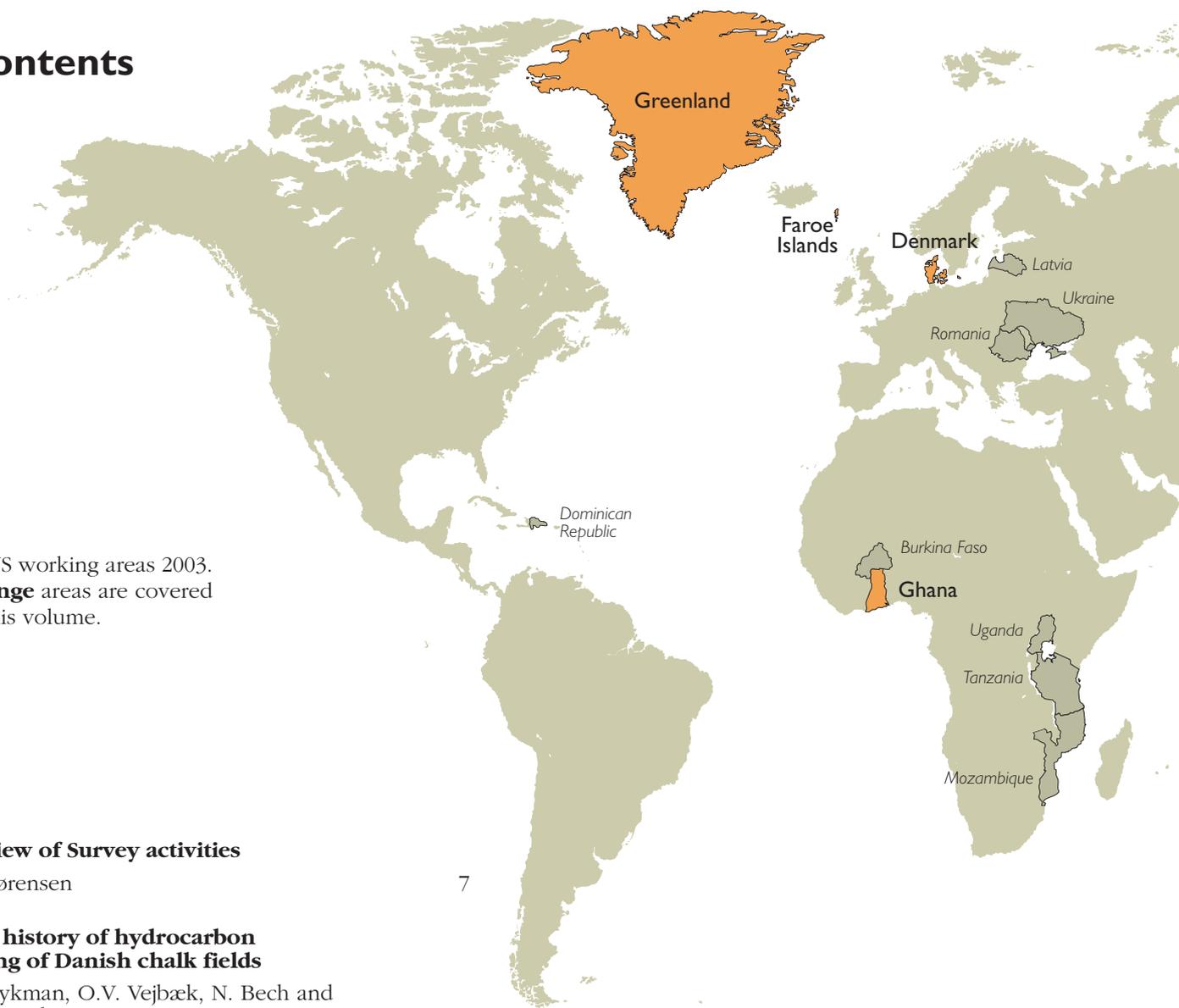
Rugårdsvej 55, DK-5000 Odense C, Denmark

Phone: +45 63 44 16 83, fax: +45 63 44 16 97, e-mail: go@geografforlaget.dk



Contents

GEUS working areas 2003.
Orange areas are covered
 in this volume.



Review of Survey activities

K. Sørensen 7

The history of hydrocarbon filling of Danish chalk fields

P. Frykman, O.V. Vejbæk, N. Bech and C.M. Nielsen 9

Assessing the European potential for geological storage of CO₂: the *GESTCO* project

N.P. Christensen and M. Larsen 13

Geothermal energy in Denmark

L.H. Nielsen, A. Mathiesen and T. Bidstrup 17

The Billund delta: a possible new giant aquifer in central and western Jutland

E.S. Rasmussen, K. Dybkjær and S. Piasecki 21

Pesticide leaching in Danish groundwater: identification of vulnerable areas

E. Nygaard, V. Ernstsen, C.S. Jacobsen, O.H. Jacobsen, R.K. Juhler, P. van der Keur, S.E. Olesen, J. Rasmussen, P. Rosenberg and H. Vosgerau 25

Immunological analysis of pesticides: a new tool in groundwater testing

J. Aamand, L. Bruun and C.B.V. Christensen 29

Direct analysis of microbial populations in soil and freshwater aquifers by using nucleic acid based techniques

C.S. Jacobsen, J.R. de Liphay, M. Bender, L. Fredslund, A.R. Johnsen and K. Johnsen 33

Using the geological record to assess the changing status of Danish lakes

E.G. Bradshaw and P. Rasmussen 37

Sediment distribution and transport in the shallow coastal waters along the west coast of Denmark

J.O. Leth, B. Larsen and D. Anthony 41



Environmental data and the Internet: openness and digital data management

J. Tulstrup 45

Age of oils in West Greenland: was there a Mesozoic seaway between Greenland and Canada?

J.A. Bojesen-Koefoed, H.P. Nytoft and F.G. Christiansen 49

Seismic and petrophysical properties of Faroe Islands basalts: the *SeiFaBa* project

P. Japsen, M.S. Andersen, L.O. Boldreel, R. Waagstein, R.S. White and M. Worthington 53

Geohazard studies offshore the Faroe Islands: slope instability, bottom currents and sub-seabed sediment mobilisation

T. Nielsen and A. Kuijpers 57

Exploring for extended continental shelf claims off Greenland and the Faroe Islands – geological perspectives

C. Marcussen, F.G. Christiansen, T. Dahl-Jensen, M. Heinesen, S. Lomholt, J.J. Møller and K. Sørensen 61

Gold in central West Greenland – known and prospective occurrences

A. Steinfeldt, H. Stendal, B.M. Nielsen and T.M. Rasmussen 65

Investigating the diamond potential of southern West Greenland

S.M. Jensen and K. Secher 69

Low-pressure metamorphism during Archaean crustal growth: a low-strain zone in the northern Nagsugtoqidian orogen, West Greenland

A.A. Garde, M.S. Christiansen, J.A. Hollis, S. Mazur and J.A.M. van Gool 73

Epithermal gold and massive sulphide mineralisation in oil impregnated Palaeogene volcanic rocks of Ubekendt Ejland, West Greenland

S. Bernstein and C. Knudsen 77

Towards an assessment of the balance state of the Greenland Ice Sheet

C.E. Bøggild, C. Mayer, S. Podlech, A. Taurisano and S. Nielsen 81

Jakobshavn Isbræ, West Greenland: the 2002–2003 collapse and nomination for the UNESCO World Heritage List

A. Weidick, N. Mikkelsen, C. Mayer and S. Podlech. 85

Prediction and risk evaluation of chalk cliff collapse: the *PROTECT* project

S.A.S. Pedersen and I. Møller 89

Co-operation with the Geological Survey Department of Ghana

F. Kalsbeek, B. Hermansen, C. Knudsen, L. Thorning and M. Thorsen 93

Petroleum potential of sedimentary basins in Vietnam: long-term geoscientific co-operation with the Vietnam Petroleum Institute

L.H. Nielsen and I. Abatzis 97

Review of Survey activities

Kai Sørensen

Director

One of the last visible relics of the pre-fusion history of the Geological Survey of Denmark and Greenland (GEUS), the two separate Bulletin series for Greenland and Denmark, respectively, ceased to appear in late 2003. Almost a decade after the merging of the Geological Survey of Denmark (DGU) and the Geological Survey of Greenland (GGU), the two Bulletin series were merged to form the *Geological Survey of Denmark and Greenland Bulletin*, the first issue of which is the monumental *The Jurassic of Denmark and Greenland*. With the closure of the two old series, a long-standing tradition of publishing an annual *Review of Greenland activities* was brought to an end. Everyone in GEUS, not least those who grew up within the former DGU, agree that the *Review of Greenland activities* was a high-quality, enjoyable-to-read review of the new Survey's Greenland activities. It was therefore a natural progression to publish a review volume covering the full spectrum of activities of the entire institution, a *Review of Survey activities* intended for a professional, but not specialist, readership. In order to keep the volume to a manageable size, all articles have been restricted to a four-page limit.

Thanks to the diverse geology of Denmark and Greenland, and the reliance of society on resources hosted in the subsurface, GEUS as a survey has been generously endowed by nature. However, as for many other geological surveys in western Europe direct financial government appropriations

for GEUS have decreased significantly during the past several years. Increasing funding from external scientific foundations and commercial sources has proved to be a partial compensation. Furthermore, the Survey has extended the traditional scope of its activities to also include capacity-building projects in several developing countries within the fields of institutional development, geological mapping, petroleum geology, mineral exploration and hydrogeology. Despite recent hardships, including an inevitable loss of personnel, the size, relevance and quality of the geological output of the Survey are still undergoing a healthy development.

The articles contained in this bulletin review many of the principal activities of the Survey in 2003; they reflect the diversity of our Survey, from the microbial to the plate tectonic level. Of the 23 articles, 20 measure directly the extent to which the Survey's activities have been driven by external demand, inasmuch as they describe activities which have been undertaken for external customers or rely on external sources for a significant funding contribution. Funding for these 20 projects has come from national and international research funds, from the petroleum industry, from ministries and counties, from the Bureau of Minerals and Petroleum of the Greenland Home Rule Government, and from national and international funds for aid to developing countries. It is expected that the focus on applied geological projects will also be reflected in future volumes of *Review of Survey activities*.