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Siedlungs- und Küstenforschung im südlichen Nordseegebiet

37

Settlement and Coastal Research in the Southern North Sea Region



Siedlungs- und Küstenforschung
im südlichen Nordseegebiet

Settlement and Coastal Research
in the Southern North Sea Region

37

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Settlement and Coastal Research in the Southern North Sea Region

37

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Vorwort

Die außergewöhnliche rötliche Farbe einer der auf der Insel Helgoland anstehenden Feuersteinvarietäten hat schon viele Generationen von Archäologen beschäftigt. Vor allem die Verbreitung von Artefakten aus diesem Material in Dänemark, Norddeutschland und den Niederlanden ist oft diskutiert worden. Durch die rote Farbe vermeintlich leicht zu identifizieren, werden sie häufig als Indikatoren überregionaler Kontakte und Netzwerke der in Nordwesteuropa ansässigen vorgeschichtlichen Kulturen gedeutet. Insbesondere die Mitarbeiter der Archäologischen Denkmalpflege sind bei der Betreuung ehrenamtlicher Sammler oder bei der Bearbeitung von Fundmeldungen häufig mit diesem außergewöhnlichen Material befasst. Es gilt dann eine nicht immer einfache Einschätzung vorzunehmen, ob es sich bei den zu begutachtenden Stücken tatsächlich um Artefakte aus Helgoländer Flint handelt oder ob auch eine lagerungsbedingte Einfärbung oder sonstige pyrotechnische oder chemische Faktoren die charakteristische Färbung erzeugt haben könnten.

Vor diesem Hintergrund hat sich in den vergangenen zehn Jahren eine kleine Arbeitsgruppe gegründet, die das Ziel verfolgt, eine systematische Erfassung aller Artefakte aus dem roten Helgoländer Feuerstein durchzuführen und gleichzeitig Methoden zur sicheren und überprüfbaren Identifikation dieses Materials zu entwickeln. Sie besteht im Kern aus den beiden Schleswiger Archäologen Dr. Sönke Hartz (Archäologisches Landesmuseum) und Dr. Martin Segschneider (Archäologisches Landesamt) sowie Jaap Beuker, Hauptkustos am Drents Museum in Assen (Niederlande). Es ist der Arbeitsgruppe jedoch inzwischen gelungen, ein kleines, lose organisiertes naturwissenschaftlich-archäologisches Netzwerk aufzubauen, das das Thema „Helgoländer Flint“ aus unterschiedlichen Perspektiven betrachtet und erforscht und in das auch das Niedersächsische Institut für historische Küstenforschung (NIhK) in Wilhelmshaven eingebunden ist.

Letztendlich als Konsequenz aus dieser Entwicklung entstand 2011 die Idee, ein Netzwerktreffen in Form eines Kolloquiums zu veranstalten, um den Status quo vorzustellen, die unterschiedlichen Ansätze zu diskutieren und Vereinbarungen für die zukünftige Erforschung dieses außergewöhnlichen Werkstoffs zu treffen. Dank des Marschenrats zur Förderung der Forschung im Küstengebiet der Nordsee, der für die Zeit vom 26. bis zum 28. April 2012 zu einem „Marschenratskolloquium“ in den Saal des NIhK nach Wilhelmshaven eingeladen hatte, konnte dieses Vorhaben umgesetzt werden. Der Einladung zu der dreitägigen Veranstaltung zum Thema „Flint von Helgoland – Die Nutzung einer einzigartigen Rohstoffquelle an der Nordseeküste“ waren 25 Mitarbeiterinnen und Mitarbeiter von Museen, Forschungseinrichtungen, Universitäten und Denkmalpflegebehörden aus Schweden, Dänemark, den Niederlanden und Deutschland gefolgt. Im Mittelpunkt des Kolloquiums standen der rote Flint und seine überregionale Bedeutung vom Paläolithikum bis zur Vorrömischen Eisenzeit. Aber auch die anderen, nur auf der Insel Helgoland vorkommenden Flintvarietäten wurden ausführlich thematisiert. Mehrere Teilnehmer hatten Fundstücke aus ihrem Arbeitsgebiet mitgebracht, so dass umfangreiches Studienmaterial in Autopsie genommen werden konnte. Die Veranstaltung war als Diskussionsforum geplant und entsprechend wurden die referierten Themen überaus lebendig erörtert.

Anders als bei ähnlichen Tagungen oder Kolloquien war die Zahl der Teilnehmerinnen und Teilnehmer auf die Vortragenden und Organisatoren beschränkt, so dass dem Wunsch vieler Studierender und Sammler, die sich um eine Teilnahme bemüht hatten, nicht entsprochen werden konnte. Um aber dem großen Interesse am Helgoländer Flint insbesondere bei Amateurarchäologen und Sammlern Rechnung zu tragen, wurde am Rande des Kolloquiums beschlossen, eine reich bebilderte Broschüre in deutscher, niederländischer und dänischer Sprache zu erstellen und allen Interessierten zur Verfügung zu stellen. Sie kann als PDF-Dokument unter www.nihk.de (Publikationen / Downloads) kostenlos aus dem Internet heruntergeladen werden.

Das gesamte Spektrum der während des Kolloquiums gehaltenen Vorträge ist dem nun hier vorgelegten Band zu entnehmen, da nahezu alle Teilnehmerinnen und Teilnehmer ihre Referate für die Publikation zur Verfügung gestellt haben. Diese bieten einen thematisch weit gespannten Überblick, der von der Entstehung der Insel Helgoland und ihren einzigartigen Flintvarietäten, deren spezifischen Eigenschaften und ihrer Identifizierbarkeit bis hin zum gegenwärtig bekannten Fundspektrum reicht. Mit dem nun hier vorgelegten Band, wird somit ein Nachschlagewerk vorgelegt, das nicht nur über den aktuellen Forschungsstand und die methodischen Perspektiven informiert, sondern auch den Kontakt zu nahezu allen, aktuell am „Helgoländer Flint“ forschenden Personen und Institutionen ermöglicht.

Hauke Jöns

Preface

The unusual red colour of a certain variety of flint that is found on the island of Heligoland has intrigued generations of archaeologists. The distribution of artefacts made of this material in Denmark, northern Germany and the Netherlands has been especially often discussed. Because of their supposedly easy to identify red colour, the artefacts are frequently interpreted as an indicator of supra-regional contacts and networks among prehistoric cultures settled in northwestern Europe. In particular, the archaeological heritage officers who supervise volunteer collectors or process find reports have to deal with this unusual material regularly. Then comes the not always simple evaluation of whether the finds in question are indeed artefacts made of Heligoland flint; or whether the colouring could be due to conditions in the soil where they were found, or some other pyrotechnic or chemical factors that could have caused the characteristic red colour.

In view of this situation, a small working group has evolved over the past decade to systematically record all the known artefacts made of red Heligoland flint and to develop methods of identifying the material with certainty. The core members are two archaeologists from Schleswig, Dr. Sönke Hartz (Archäologisches Landesmuseum [State Archaeological Museum]) and Dr. Martin Segsneider (Archäologisches Landesamt [State Archaeological Office]) together with Jaap Beuker, Chief Curator at the Drents Museum in Assen (Netherlands). Meanwhile, the group has been able to build up a small, loosely organised scientific and archaeological network to consider and investigate ‘Heligoland Flint’ from various perspectives: the Lower Saxony Institute for Historical Coastal Research (NIhK) in Wilhelmshaven also belongs to the group.

Finally, in 2011, as a consequence of this development, there arose the idea of organising a network meeting in the form of a colloquium on the current situation, to discuss the various research approaches and to agree on future research on the subject of this unusual raw material. This idea could be realized thanks to the Marschenrat zur Förderung der Forschung im Küstengebiet der Nordsee (Marshland Council for the Promotion of Research in the North Sea Coastal Area), which sent out invitations to a ‘Marshland Council Colloquium’, to be held April 26-28, 2012, in the conference room of the Lower Saxony Institute for Historical Coastal Research in Wilhelmshaven. This invitation to the three-day event, entitled ‘Flint from Heligoland – the exploitation of a unique source of raw-material on the North Sea coast’, was accepted by twenty-five scholars from museums, research institutes, universities and heritage offices in Sweden, Denmark, the Netherlands and Germany. The centre of attention at the colloquium was the red flint and its supra-regional significance from the Palaeolithic to the Pre-Roman Iron Age: but the other varieties of flint that only occur on Heligoland were also discussed in great detail. Several participants had brought finds from their own area of study, so that a large range of material could be subjected to exhaustive examination. The event was planned as a discussion forum so a lively debate ensued on each of the topics presented.

Unlike similar conferences or colloquiums, the number of participants was strictly limited to those presenting papers and, of course, the organisers. It was therefore not possible to accommodate all the requests from students and collectors who would have liked to attend. However, in order to satisfy the great interest expressed in Heligoland flint, especially by amateur archaeologists and collectors, it was decided – on the fringe of the colloquium – to produce a richly illustrated brochure in German, Dutch and Danish and make it available to all interested parties. It can be downloaded from the internet as a PDF file under www.nihk.de (Publications / Downloads), free of charge.

The whole spectrum of topics presented at the colloquium is covered in the present volume since almost all the participants made their papers available for publication. These give a wide-ranging overview of the subjects discussed, from the origins of the island of Heligoland and its unique flint varieties, with their specific characteristics and how they can be identified, to all the known finds made of this material. The present volume is thus a reference book, which not only provides information on the current research situation and methodological perspectives but also allows contact to be made with almost all the persons and institutions currently researching ‘Heligoland Flint’.

Hauke Jöns

Chemical analysis of red and black Heligoland flint – initial results and comparisons with flint from Scandinavia

Chemische Analysen von rotem und schwarzem Helgoländer Flint –
Erste Ergebnisse und Vergleiche mit skandinavischem Flint

Anders Högberg, Richard E. Hughes and Deborah Olausson

With 8 Figures and 1 Table

Abstract: This study presents the results of an initial chemical provenience analysis of black and red Heligoland flint and discusses these results in relation to a previously conducted chemical analysis of a large number of samples of Scandinavian flint. The results show that it is possible to distinguish red and black Heligoland flint from Scandinavian flint.

Key words: Heligoland, Ordovician, Cretaceous, Paleogene, Prehistory, Chemical analysis, Flint.

Inhalt: Der Beitrag legt die Ergebnisse einer ersten chemischen Provenienzanalyse von schwarzem und rotem Helgoländer Flint vor. Sie werden im Vergleich mit früher durchgeführten chemischen Analysen einer großen Zahl von Proben skandinavischem Flints diskutiert. Die Ergebnisse zeigen, dass roter und schwarzer Helgoländer Flint von skandinavischem Flint unterschieden werden kann.

Schlüsselwörter: Helgoland, Ordovizium, Kreide, Paläogen, Urgeschichte, Chemische Analyse, Flint.

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1 Introduction

Heligoland flint is known for its beautiful red color and every summer tourist shops on the island sell jewelry made out of this red flint, calling it ‘Heligoland agate’ (Fig. 1). But not all flint from Heligoland is red. Actually, most of the flint to be found on the beaches and dunes today is honey brown, brown, grey, dark grey or black in color. These visual types are all distinct in color and matrix, as has previously been described (BEUKER 2010; BEUKER et al. 2012).

But the black Heligoland flint has characteristics that are very similar to those found in some types of flint from Denmark or Rügen. This study describes these similarities. It also presents the results of an initial chemical provenience analysis of black and red Heligoland flint and discusses these results in relation to a previous chemical analysis of a large number of samples of Scandinavian flint (HUGHES et al. 2012; HÖGBERG et al. 2012; OLAUSSON et al. 2012 – Fig. 2).

The aim of the present analysis was to investigate specific characteristics of the black Heligoland flint, and to determine whether it would be possible, using contrasts in chemical composition, to distinguish black Heligoland flint from Scandinavian flint types which, based on visual classification, might be mistaken for black Heligoland flint. As we may assume that these flint types were used for toolmaking during prehistory, the results of this research carry clear implications for archaeological research.

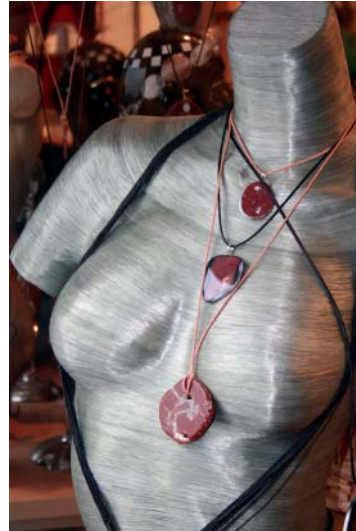


Fig. 1. Jewelry made from red Heligoland flint, so called ‘Heligoland agate’ (Photo: A. Högberg).

2 Flint varieties

2.1 Black Heligoland flint

The black Heligoland flint has its own distinctive visual characteristics. As previously described (BEUKER 2010; BEUKER et al. 2012, 4) it possesses a dark grey to black matrix. If a thin flake is held towards a light source the material is translucent. It typically contains small grey to white spots in the matrix, which call to mind the appearance of a starry sky. Inclusions are occasionally present. When they occur they consist of irregular lighter spots of different sizes which are often surrounded by a thin band of even lighter-colored flint. The cortex is white (Fig. 3). Few other Scandinavian flint types fit this description. But there are a few visual diagnostic features on black Heligoland flint which can be found on two other flint types; specifically, speckled Senonian flint and Rügen flint (HÖGBERG & OLAUSSON 2007).

2.2 Speckled Senonian flint

The numerous characteristic spots which sometimes occur abundantly on black Heligoland flint are also typical of speckled Senonian flint (HÖGBERG & OLAUSSON 2007, 92 ff.), a flint type with white cortex found primarily in the Limfjorden area of northern Jutland, Denmark and named Jutish Senonian flint by C. J. BECKER (1988). It is characterized by numerous light grey spots in a darker black matrix, giving the flint the appearance of a starry sky. Compared to black Heligoland flint, however, speckled Senonian flint lacks the numerous distinctive inclusions of irregular lighter spots in the black matrix (HÖGBERG & OLAUSSON 2007, 92 ff. – Fig. 4).

2.3 Rügen flint

The distinctive inclusions of irregular lighter spots of different sizes present on black Heligoland flint also are typical of Rügen flint. This flint has a black or grey matrix with a white cortex and a unique diving ‘cortex’; that is, the chalk cortex sometimes intrudes (‘dives’) into the flint from the surface, building concavities and tunnels. The flint contains inclusions. These are irregular lighter spots of different sizes which often are surrounded by a thin band of even lighter-colored flint (Fig. 5). Rügen flint is known primarily from the chalk cliffs and in the moraine on the northeastern coast of the German island of Rügen (Fig. 2).

2.4 Attributes which are not always present

The description of the visual attributes of these three flint types shows that, despite certain differences, they also share certain features in common. If one holds a large piece of freshly knapped black Heligoland flint in one hand, and an equally fresh piece of speckled Senonian flint or Rügen flint in the other, these flint types would be easy to distinguish from each other on the basis of published descriptions.

But if the flint pieces are not freshly knapped, and consist of small patinated flakes or debris from an archaeological assemblage, they might be much harder to distinguish. This is because diagnostic attributes like color and composition of the inclusions are often not apparent or distinct on a small or patinated piece (see HÖGBERG & OLAUSSON 2007, 67 ff.; HUGHES et al. 2012, 787 f.). So, the problem is that even though black Heligoland flint has diagnostic characteristics, it may be



Fig. 2. Map of Scandinavia marking places from which Scandinavian flint has been chemically analyzed (from HÖGBERG et al. 2012, 227 Fig. 1).



Fig. 3. Black Heligoland flint.

Fig. 3a shows the dark grey to black matrix. – Fig. 3b shows the typical small grey to white spots and to the lower right in the picture examples of lighter colored spots (Photos: A. Högberg).

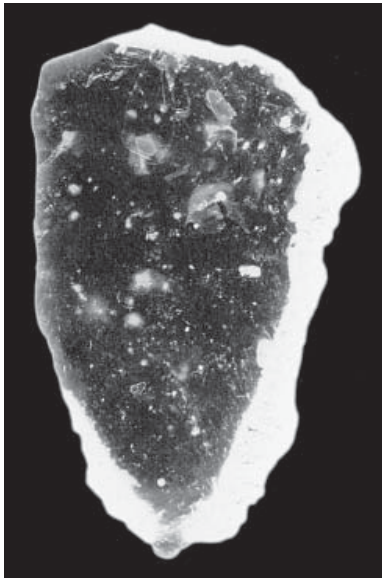


Fig. 4. Speckled Senonian flint
(from HÖGBERG & OLAUSSON 2007, 95).

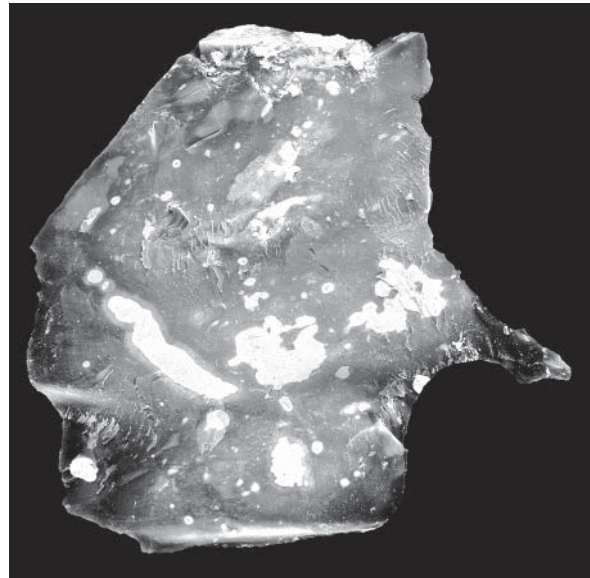


Fig. 5. Rügen flint
(from HÖGBERG & OLAUSSON 2007, 102).

confused with speckled Senonian flint or Rügen flint in those cases where not every diagnostic feature is present or visible.

In light of this problem, we conducted instrumental analysis of a small sample of black Heligoland flint

to determine whether it might have a unique chemical 'signature' which could effectively separate these flint types. We were also curious about the chemistry of the red Heligoland flint and included samples of that in our analysis as well.

3 Chemical analysis

3.1 Description of methods

We analyzed these Heligoland samples using non-destructive energy dispersive X-ray fluorescence (EDXRF) analysis. The laboratory analysis conditions and instrumentation used in the present study have been described elsewhere and those interested in this analytical detail may consult our most recent study (HUGHES et al. 2012). All samples were cleaned with distilled water before analysis to remove any noticeable surface contaminants, and care was taken to avoid directing the X-ray beam on to obvious patinated surfaces or calcareous or fossil inclusions (for reasons discussed in HUGHES et al. 2012). The only other requirement was that each sample be relatively flat, >15-20 mm in diameter, and have a minimum surface size for analysis of >2-3 mm.

3.2 Previous chemical provenience studies on Scandinavian flint

The aim of the analysis we present here is to compare Heligoland flint with results from chemical analysis of Scandinavian flint and, more specifically, to compare

the chemistry of the black Heligoland flint with that of speckled Senonian flint and Rügen flint. We have previously conducted studies to investigate the possibilities for using chemical analysis for provenience analysis on flint from Denmark, Sweden and northern Germany (HUGHES et al. 2010; 2012; HÖGBERG et al. 2012; OLAUSSON et al. 2012). These results show that certain flint types have discrete chemical compositions that make it possible to determine the provenance of many types of south Scandinavian flint.

In this study we focus on two types of Scandinavian flint – the speckled Senonian flint and the Rügen flint – because of visual overlap with the black Heligoland material. Fig. 6 shows a plot contrasting the compositions of these two flint types. As can be seen from the figure speckled Senonian flint, labeled by the sampling location Ellidsøj in the figure and circumscribed by a black oval in the plot, and Rügen flint, labeled by the sampling location Jasmund in the figure and circumscribed by a red oval, have different chemical compositions, thus making it possible to differentiate between these two types. We turn to analysis of black Heligoland flint below.

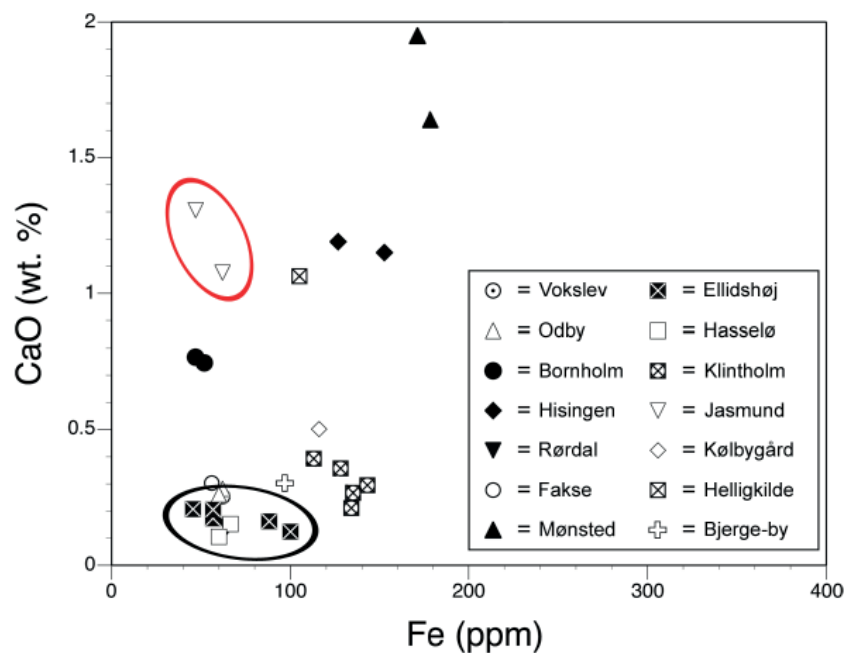


Fig. 6. Results from chemical analysis of a variety of Scandinavian flint types. From these data it is clear that speckled Senonian flint, labeled by the sampling location Ellidshøj in the legend and circumscribed by a black oval in the plot, and Rügen flint, labeled by the sampling location Jasmund in the figure and circumscribed by a red oval, represent two different chemical types (slightly reworked from HÖGBERG et al. 2012, 232 Fig. 5).

3.3 Results for Heligoland samples

Eight pieces of red Heligoland flint and seven pieces of black Heligoland flint were subjected to EDXRF analysis by R. E. Hughes, using the aforementioned instrumentation. Six of these specimens proved suitable for EDXRF analysis (see Tab. 1). All the pieces had been knapped from nodules coming from Heligoland. The results are represented graphically in Figs. 7 and 8.

To begin with, Fig. 7 shows that red Heligoland flint has a unique chemical profile compared to Scandinavian flint. It contains a significant amount of iron which clearly distinguishes it from any other flint we have analyzed. In addition, the data in Fig. 7 show that black and red Heligoland flint are quite different from each other on the basis of Fe composition. The figure also shows that black Heligoland flint plots in the same CaO/Fe range as some types of Scandinavian flint, while red Heligoland flint is unique.

Fig. 8 shows the enlarged area from Fig. 7. In this figure black Heligoland flint plots close to flint samples from Ellidshøj, Stevns, Møns klint and Södra Sallerup. The flint samples from Stevns, Møns klint and Södra Sallerup, which cluster together with the black Heligoland flint, are all of the type Scandinavian Senonian flint from eastern Denmark and south western Sweden.

This flint type has the same white cortex and black or grey matrix as the Heligoland flint, but lacks the small grey to white spots in the matrix with the appearance of a starry sky, and the irregular lighter inclusions of different sizes (HÖGBERG & OLAUSSON 2007, 88 ff.). Therefore, this type of flint can be distinguished visually from black Heligoland flint.

But the sample from Ellidshøj is different. This sample is a speckled Senonian flint from northern Jutland and it is a type which can be mistaken, on the basis of visual criteria, for black Heligoland flint. From the CaO/Fe data we present, speckled Senonian flint and black Heligoland flint are also chemically alike. But if we employ other chemical elements in addition to the ones presented in the figure, it is possible to distinguish between these two flint types. Although Fig. 8 shows that CaO/Fe values for the black Heligoland flint overlap somewhat with those of Ellidshøj, black Heligoland flint is distinguished from this latter flint type by the absence of measurable amounts of Al_2O_3 (see Tab. 1 – cf. HUGHES et al. 2012, Tab. 4).

Rügen flint is chemically distinct from both speckled Senonian flint and black Heligoland flint. This can be seen by comparing Figs. 6 and 7, where it is apparent that the sample from Jasmund has higher levels of CaO than either of the other types.

Sample name	Sample	Run	Al ₂ O ₃		SiO ₂		SO ₃		Cl		K ₂ O		CaO		Ti		Mn		Fe	
			%	error	%	error	%	error	ppm	error	%	error	%	error	ppm	error	ppm	error	ppm	error
Red Heligoland flint	1	1	0		99.44	±0.11	0.024	±0.001	175	±9	0.109	±0.008	0.056	±0.003	62	±13	3	±3	1050	±6
Red Heligoland flint	2	1	0		99.42	±0.11	0.013	±0.001	0		0.03	±0.008	0.036	±0.003	12	±13	2	±3	809	±6
JCh-1* (measured)			0.09	±0.03	98.84	±0.11	0.003	±0.001	0	±11	0.222	±0.008	0.035	±0.003	220	±13	118	±3	2831	±13
JCh-1* (recommended)			0.734		97.81		nr		14		0.221		0.045		189		134		2490	
Black Heligoland flint	3	1	0		99.23	±0.11	0.025	±0.001	63	±11	0.025	±0.008	0.076	±0.003	27	±13	1	±3	65	±3
Black Heligoland flint	3	2	0		99.36	±0.11	0.028	±0.001	106	±11	0.033	±0.008	0.089	±0.003	42	±13	0	±3	72	±3
Black Heligoland flint	3	3	0		99.14	±0.11	0.031	±0.001	140	±11	0.028	±0.008	0.093	±0.003	44	±13	1	±3	78	±3
Black Heligoland flint	3	4	0		99.34	±0.11	0.005	±0.001	0	±11	0.019	±0.008	0.123	±0.003	43	±13	1	±3	92	±3
JCh-1* (measured)			0.12	±0.03	99	±0.11	0.003	±0.001	0	±11	0.228	±0.008	0.039	±0.003	190	±13	112	±3	2845	±13
JCh-1* (recommended)			0.734		97.81		nr		14		0.221		0.045		189		134		2490	
Ellidshøj	29		0.067																	
Ellidshøj	29b		0.173																	
Ellidshøj	30a		0.143																	
Ellidshøj	30 (3.5 mm)		0.206																	

* JCh-1 is an international rock standard of the Geological Survey of Japan. Values for JCh-1 from IMAI et al. (1996). – nr not reported

Tab. 1. Quantitative composition estimates for Heligoland flint samples. Detection limits for each element follow those appearing in HUGHES et al. (2012, 781). For comparison, the quantitative composition estimates for Al₂O₃ taken from the result of five previously analyzed samples from Ellidshøj are shown in table (from HUGHES et al. 2012, 785 Tab. 4).

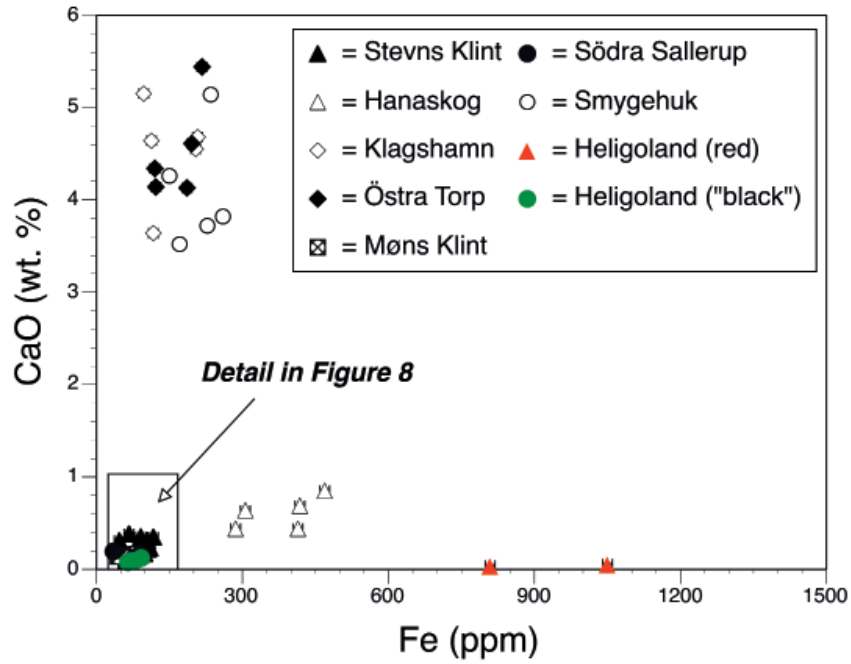


Fig. 7. CaO/Fe plot of Heligoland flint compared to values for flint from Denmark and Sweden (adapted from HUGHES et al. 2012, 789 Fig. 4).

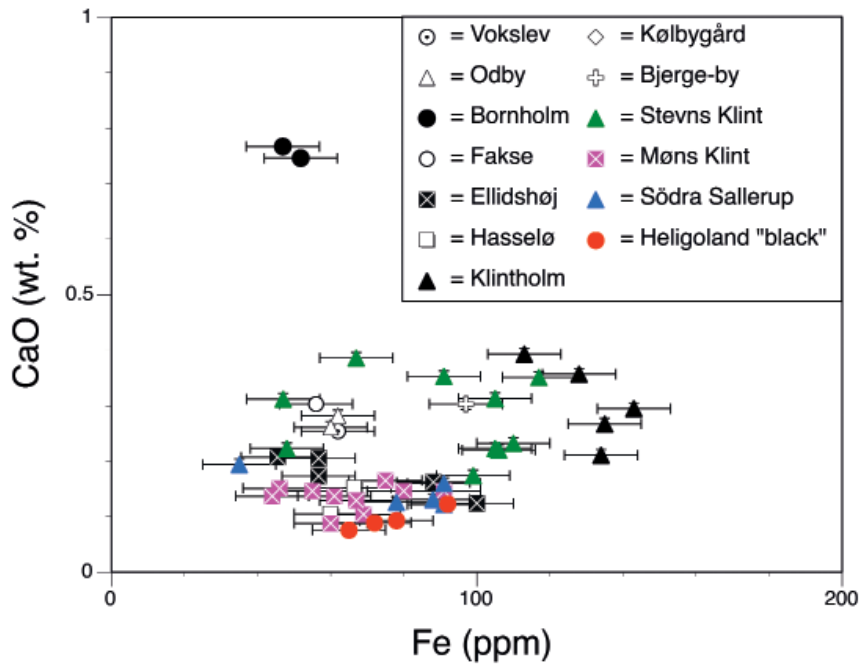


Fig. 8. Detail of CaO/Fe composition for geologic flint specimens containing < 1 % CaO and < 200 ppm Fe. Error bars are 2 σ composition estimates. Data for black Heligoland flint samples (red dots) are plotted from data in Tab. 1, and are in this figure compared to a selection of Scandinavian flint.

4 Conclusion

The results from our study show that red and black Heligoland flint are different in chemical composition and that red Heligoland flint is unique in comparison with other Scandinavian flint. They also show that black Heligoland flint shares some visual characteristics with Rügen flint but that these two flint types have different chemical compositions. The results also show that black Heligoland flint shares visual and some chemical

characteristics in common with speckled Senonian flint from Jutland, Denmark but other chemical elements help to distinguish these two types. These initial results notwithstanding, we emphasize that our study was based on a very small number of geologic samples and further sampling and analysis needs to be done to corroborate or revise our results.

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