Chloé Morales et al., 2017, Glendonites track methane seepage in Mesozoic polar seas: Geology, doi:10.1130/G38967.1.

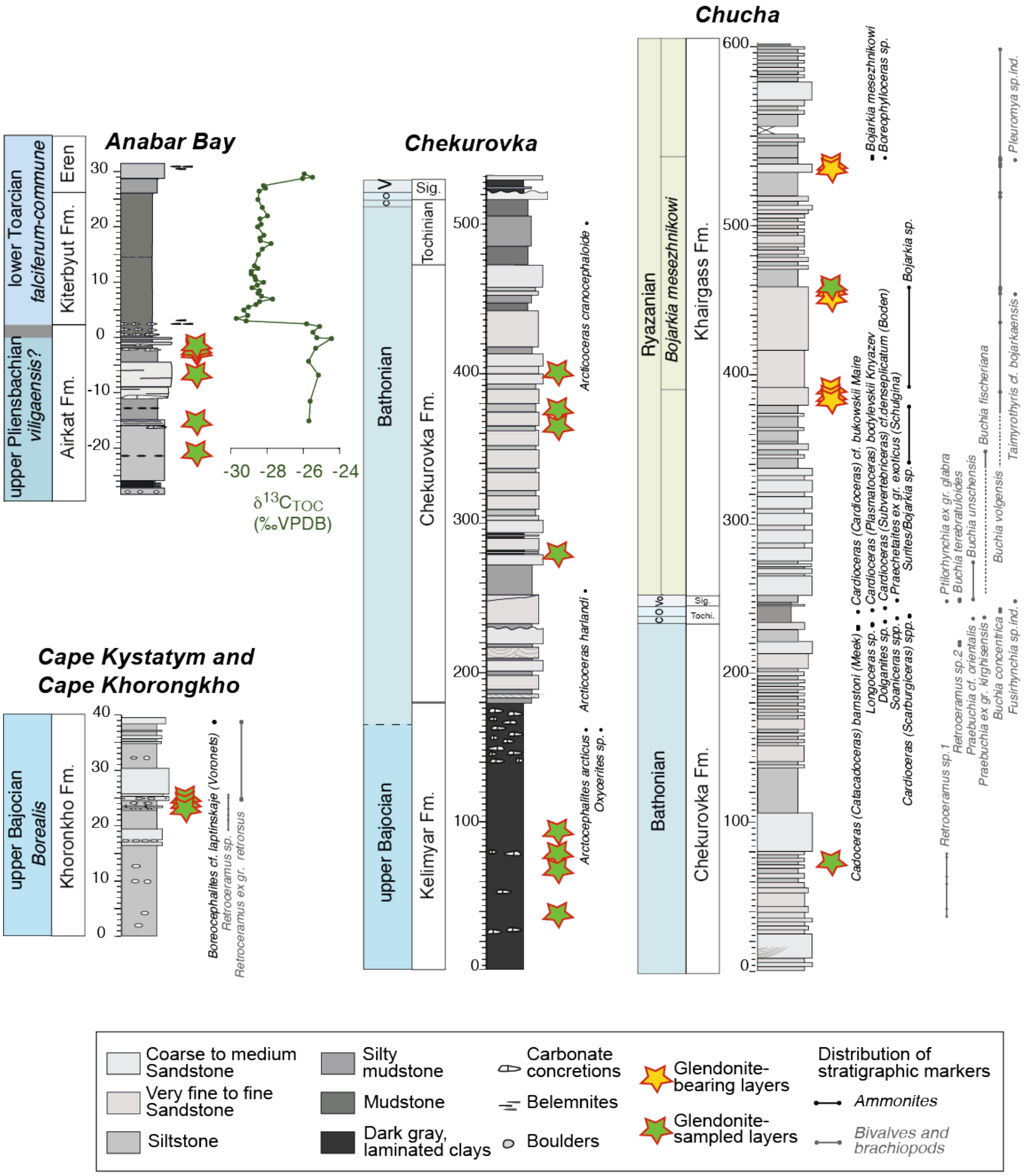
Supplemental Information 1: Calculated palaeolatitudes for all studied sections, derived through http://palaeolatitude.org (van Hinsbergen et al., 2015; paleomagnetic reference frame after Torsvik et al., 2012)

Locality	Age	Coordinates (current)	Palaeolatitude
Anabar Bay	Late Pliensbachian	73.386854936347 N; 113.322601318359 E	82.7 N
Cape Kystatym	Late Bajocian	67.363129011005 N; 123.180084228515 E	84.52 N
Cape Khorongkho	Late Bajocian	67.273103809385 N; 123.120346069335 E	84.49 N
Chekurovka	Late Bajocian - Early Bathonian	70.997741629904 N; 127.55092620849 E	84.95 N
Cape Chucha	Early Bathonian	70.788717462945 N; 127.591781616210 E	85.07 N
Cape Chucha	Late Berriasian	70.788717462945 N; 127.591781616210 E	71.64 N

References:

van Hinsbergen, D. J. J., L. V. de Groot, S. J. van Schaik, W. Spakman, P. K. Bijl, A. Sluijs, C. G. Langereis and H. Brinkhuis (2015). "A paleolatitude calculator for paleoclimate studies." PloS one **10**(6): e0126946.
Torsvik, T. H., R. Van der Voo, U. Preeden, C. Mac Niocaill, B. Steinberger, P. V. Doubrovine, D. J. J. van Hinsbergen, M. Domeier, C. Gaina and E. Tohver (2012). "Phanerozoic polar wander, palaeogeography and dynamics." Earth-Science Reviews **114**(3): 325-368.

Supplemental Information 2: Stratigraphic logs and position of the glendonite-bearing layers



Supplemental Information 3: Stratigraphy of glendonite-bearing layers, and precisions on correlation between the Boreal and International Time Scales

The Anabar Bay[1], Cape Kystatym[2], Cape Khorongkho[2], Chekurovka[3] and Chucha[2] sections expose marine sandstone, siltstone and mudstone from the Lower and Middle Jurassic, and from the Early Cretaceous. The sedimentary successions were deposited in shallow to deep continental shelf settings (corresponding to shoreface to offshore environments), near the North Pole. Macrofossils include abundant wood debris and bivalves, as well as a few belemnites rostra, gastropods, brachiopods, and ammonites. The latter assign glendonite-bearing layers to a relatively accurate stratigraphic framework.

1. Upper Pliensbachian: Anabar Bay

The Lower Jurassic section of Anabar Bay is characterized by a set of biostratigraphic and geochemical tools[4,1]. Ammonites are very uncommon and poorly preserved in this succession. Although the index species of the *Amaltheus viligaensis* ammonite zone have not been recorded here, an upper Pliensbachian *Amaltheus* sp. age assignation is nevertheless attributed by correlation with dinocyst and bivalve stratigraphies, which nearly corresponds to the *Spinatum* zone of the Geological Time Scale.

2. Upper Bajocian: Cape Kystatym, Cape Khorongho and Chekurovka

In the north of Siberia, the upper Bajocian is marked by the first appearance datum of the ammonite family *Cardioceratidae*. The lower boundary of the ammonite zone *Cranocephalites borealis* is considered as nearly equivalent of the lower-upper Bajocian boundary because: (1) the ammonite *Sphaeroceras (Defonticeras)*, which is considered as ancestor of *Cranocephalites*, is known from the uppermost zone of the Lower Bajocian[5]; (2) Strontium isotope values derived from deposits belonging to the *Cranocephalites borealis* ammonite zone in East Greenland, (basal part of the Pelion Formation), support an early late Bajocian age[6,7].

In Cape Kystatym, the occurrence of the ammonite *Boreocephalites* cf. *laptinskaje* (Voronets) is reported 13 m above the glendonite-bearing layer[8]. In a recent revision of the evolution of the ammonite genera *Cranocephalites* of East Greenland[9], the specie *Morrisiceras laptinskaje Voronets* has been considered as corresponding to *Cranocephalites borealis* trans. β, which is the index species of the second horizon of the *Borealis* ammonite zone.

In Chekurovka, the ammonites *Arctocephalites arcticus* and *Oxycerites*[3] have been recognized ~60 m above the oldest glendonite-bearing beds belonging to the Kelimyar Formation. Age of the *Arcticus* ammonite zone can either be attributed to the uppermost Bajocian or to the lowermost Bathonian. An upper Bajocian age of glendonites is however suggested by comparison with other glendonite-bearing layers of the region (cf. Cape Kystatym).

3. Lower-middle Bathonian: Chucha, Chekurovka

In the Chekurovka section, the ammonite *Arcticoceras harlandi* (found ~75 m above the base of the Chekurovka Formation, respectively) typify the *Ischmae* ammonite zone. In addition, the ammonite *A.* cf. *ischmae* has been found at the top of the Chekurovka Fm in a nearby section (Chekurovka-North), indicating that most of the formation is ascribed to the *Ischmae* zone. A lower Bathonian age for at least part of the *Ischmae* zone has been evidenced in the Russian Platform (Saratov region), by the joint presence of the ammonites *Oraniceras* and *Arcticoceras*[10].

In the Chucha section, the occurrence of the ammonite *Cadoceras (Catacadoceras) barnstoni (Meek)* 4 m below the top of the Chekurovka Formation indicate a middle to upper Bathonian age. In the Chekurovka section, the record of the ammonite *Arcticoceras* *cranocephaloide* 5 m below the top of the Chekurovka Formation indicates the middle Bathonian.

4. Upper Ryazanian: Chucha

In the Chucha section, the thick sandstone-dominated Ryazanian succession of the Khairgass Formation (~400 m) has delivered numerous bivalves *Buchia*[11]. All glendonite-bearing units belong to the *Bojarkia mesezhnikowi* zone, as they yield ammonites of the genus *Bojarkia*. This zone corresponds to the middle part of the *Subthurmannia boissieri* zone of the Tethyan zonal succession[12,13].

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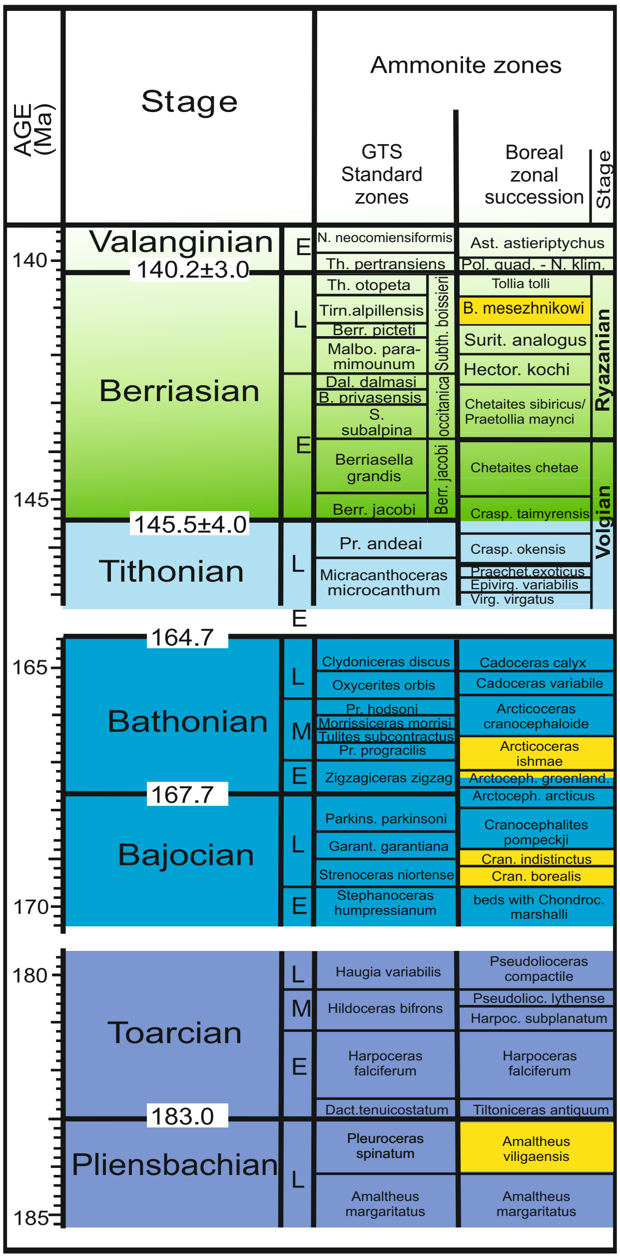
Supplemental Information 4: Correlation of Boreal ammonite zones to the Geologic Time Scale (GTS)



Supplemental Information 5: Methods

A total of 33 glendonite samples have been collected: 11 in Anabar Bay, 11 in Cape Kystatym, 3 in Cape Khorongkho, 5 in Chekurovka, and 3 in Chucha. All samples (glendonites, nodules and enclosing sediment) have been subjected to petrological, and carbon and oxygen isotope measurements. Rock-Eval analyses were performed on a representative set of 29 samples (glendonites and sediment), and compound-specific isotope analyses (CSIA) on 5 selected glendonite samples (see Supplementary Information for details on methods). Thin sections of 20μm have been made for all samples and petrographic microscopy analyses have been performed on a Leica DM600B equipped by a lamp CTR 6500 and a camera DFC350FX (from Leica, Wetzlar, Germany) and fitted with polarised and UV light.

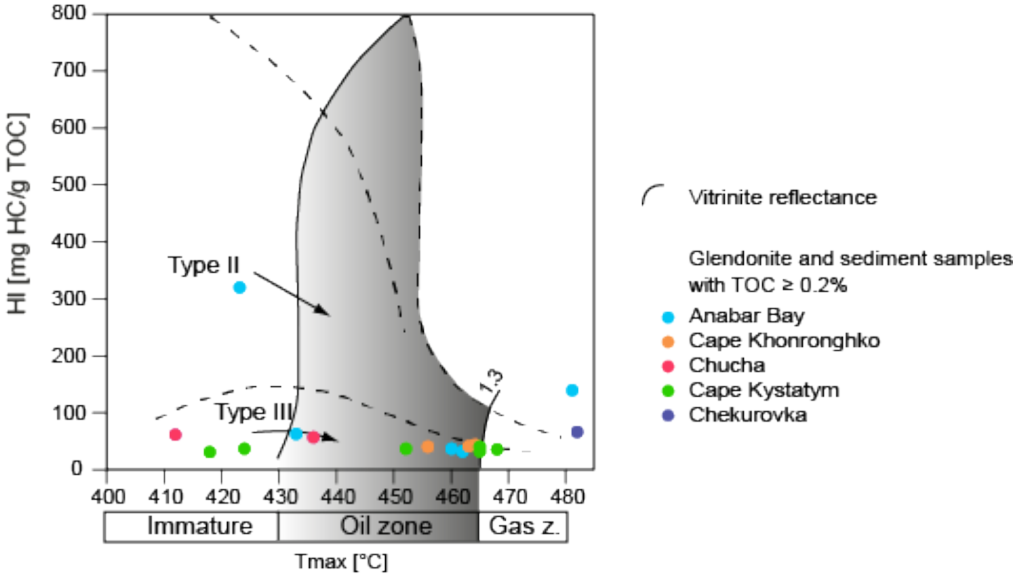
Bulk-rock glendonites, carbonate nodules and host sediment isotope measurements have been performed on powder samples collected using a micro-drill on clean surfaces of rock slabs. The isotope measurements were carried out 1) in Utrecht University using an ISOCARB common acid bath carbonate preparation device linked on-line to a VG SIRA24 mass spectrometer; and 2) in Frankfurt University, using a Gas Bench II (Thermoquest) directly coupled to the continuous flow inlet system of the Finnigan MAT 253 mass spectrometer (Thermo Fisher Scientific, Waltham, MA, USA). Ratios of carbon and oxygen isotopes are reported in the delta (δ) notation as per mil (‰) deviation relative to the Vienna–Pee Dee belemnite standard (VPDB). Analytical precision was determined by replicate analyses and by comparison to international (IAEA-CO1 and NBS19 in Utrecht University; NBS18 and NBS19 in Frankfurt University) and in-house (NAXOS in Utrecht University; Carrara Marble in Frankfurt University) carbonate standards, showing standard deviations of <0.06‰ and <0.1‰ for $\delta^{13}C$ and $\delta^{18}O$, respectively.

Total organic carbon (TOC), T_{max}, and hydrogen and oxygen indices (HI and OI) were measured with a Rock-Eval 6 pyrolysis device with an instrumental precision of <2%. The T_{max} values (°C) indicate thermal maturity of the organic matter and allow the assessment of the diagenetic overprint (Espitalié et al., 1985). The peaks S2, S3 and S4 are used to calculate the amount of total organic carbon (TOC) and the amount of mineral carbon (MINC). The peaks S2 and S3 correspond to the pyrolysis phase (e.g. to the amount of kerogen and CO_2 released during cracking of organic-matter between 600 and 800 °C), and the peak S4 to the oxidation phase (residual TOC). In addition, the hydrogen index (HI =S2/TOC) and oxygen index (OI = S3/TOC) are calculated. The HI and OI indices are proportional to the H/C and O/C ratios of the organic matter, respectively, and are used for organic matter classification in Van-Krevelen-type diagrams (Espitalié et al., 1985, 1986). The analyses were calibrated by analysing the standard reference material IFP-160000 (Institut Français du Pétrole).

Compound Specific Isotope Analysis of the gas inclusions were measured using a custom build rock crusher interfaced with a GC-IRMS system. Around 1 gram of rock sample is introduced in the crusher, which after closing was flushed with Helium to remove air. During crushing a force of 30 MPa was applied to a plunger and the released gases were transported out of the crusher using a continuous Helium flow and subsequently trapped on a PLOT column dipped in liquid Nitrogen. At the start of the analysis the trap was heated and the components were injected into a HP 7890 GC. The components were separated on a PoraPLOT Q-HT column. The effluent of the GC was converted to CO_2 in a combustion furnace and injected in a MAT 253 mass spectrometer. The results of the IRMS were calibrated using reference CO_2, which was introduced in pulses during the analysis. An accuracy of at least +/- 0.5‰ was obtained.

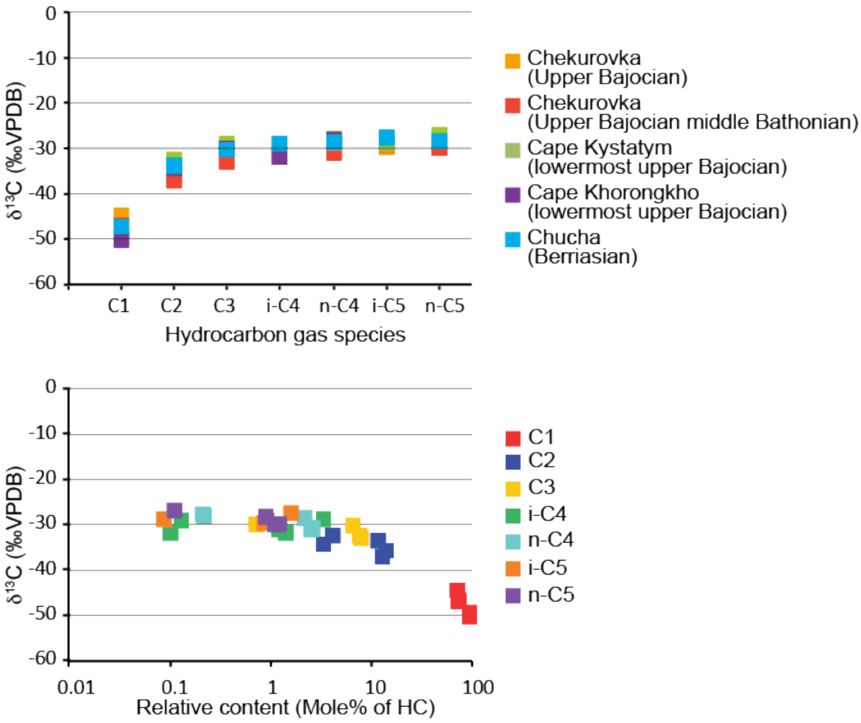
Supplemental Information 6: Pseudo Van Krevelen diagram (Espitalier et al., 1985).

Tmax values (x axis, in °C, corresponding to the cracking temperature of the sedimentary organic matter and representating its degree of maturity) are plotted again the HI index (y axis, in mg HC/g TOC, indicative of the type of organic matter). For reliability sake, only data showing TOC ≥ 0.2 % (e.g. in the detection limit) are shown.



Supplemental Information 7: Details on CSIA performed on glendonites gas inclusions.

The diagrams show the molecular composition (in % of hydrocarbons) and carbon stable isotope values (in ‰ V-PDB) of hydrocarbon gas species trapped in bulk-glendonites.



Raw carbon and oxygen stable isotope data of bulk-glendonites, nodules, and diagenetic carbonates of enclosing sediments

SECTION	TYPE OF SAMPLE	AGE	AMMONITE ZONE (when determined)	SAMPLE NUMBER	δ13C (‰ VPDB)	δ18O (‰ VPDB)	LAB OF ANALYSIS
Annabar Bay	Glendonite	Upper Pliensbachian	Amaltheus stokesi-A. viligaensis	B1G	-15.1	-5.2	Utrecht
Annabar Bay	Glendonite	Upper Pliensbachian	Amaltheus stokesi-A. viligaensis	B1G	-15.6	-7.2	Utrecht
Annabar Bay	Glendonite	Upper Pliensbachian	Amaltheus stokesi-A. viligaensis	B2G	-20.4	-2.0	Utrecht
Annabar Bay	Glendonite	Upper Pliensbachian	Amaltheus stokesi-A. viligaensis	B2G	-19.0	-3.3	Utrecht
Annabar Bay	Glendonite	Upper Pliensbachian	Amaltheus stokesi-A. viligaensis	B3G	-12.6	-9.9	Utrecht
Annabar Bay	Glendonite	Upper Pliensbachian	Amaltheus stokesi-A. viligaensis	B3G	-19.1	-7.1	Utrecht
Annabar Bay	Glendonite	Upper Pliensbachian	Amaltheus stokesi-A. viligaensis	B4G	-16.9	-8.1	Utrecht
Annabar Bay	Glendonite	Upper Pliensbachian	Amaltheus stokesi-A. viligaensis	B4G	-16.6	-7.2	Utrecht
Annabar Bay	Glendonite	Upper Pliensbachian		W13G	-23.3	-7.0	Utrecht
Annabar Bay	Glendonite	Upper Pliensbachian		W13G	-21.2	-9.4	Utrecht
Annabar Bay	Glendonite	Upper Pliensbachian		W14G	-37.31	-2.64	Frankfurt
Annabar Bay	Glendonite	Upper Pliensbachian		W15G	-30.25	-7.18	Frankfurt
Annabar Bay	Glendonite	Upper Pliensbachian		W15Gtop	-30.6	-7.5	Utrecht
Annabar Bay	Glendonite	Upper Pliensbachian		W16G	-31.2	-7.1	Utrecht
Annabar Bay	Glendonite	Upper Pliensbachian		W16G	-32.8	-5.3	Utrecht
Annabar Bay	Glendonite	Upper Pliensbachian		W17 G	-21.71	-5.87	Frankfurt
Annabar Bay	Glendonite	Upper Pliensbachian		W17G	-21.3	-4.9	Utrecht
Annabar Bay	Glendonite	Upper Pliensbachian		W17G	-22.0	-3.2	Utrecht
Annabar Bay	Glendonite	Upper Pliensbachian		W18G	-19.53	-7.17	Frankfurt
Annabar Bay	Glendonite	Upper Pliensbachian		W18Gbase	-21.0	-5.6	Utrecht
Annabar Bay	Glendonite	Upper Pliensbachian		W18Gtop	-17.4	-9.1	Utrecht
Annabar Bay	Glendonite	Upper Pliensbachian		W19G	-17.80	-7.08	Frankfurt
Annabar Bay	Glendonite	Upper Pliensbachian		W19G	-17.6	-8.1	Utrecht
Annabar Bay	Sediment	Upper Pliensbachian	Amaltheus stokesi-A. viligaensis	B2S	-9.69	-8.04	Frankfurt
Annabar Bay	Sediment	Upper Pliensbachian	Amaltheus stokesi-A. viligaensis	B2S	-18.1	-2.6	Utrecht
Annabar Bay	Sediment	Upper Pliensbachian	Amaltheus stokesi-A. viligaensis	B3S	-4.17	-10.17	Frankfurt
Annabar Bay	Sediment	Upper Pliensbachian	Amaltheus stokesi-A. viligaensis	B3S	-4.5	-10.8	Utrecht
Annabar Bay	Sediment	Upper Pliensbachian	Amaltheus stokesi-A. viligaensis	B4S	-3.39	-9.40	Frankfurt
Annabar Bay	Sediment	Upper Pliensbachian	Amaltheus stokesi-A. viligaensis	B4S	-3.3	-10.0	Utrecht
Annabar Bay	Sediment	Upper Pliensbachian		W13S	-10.2	-18.9	Utrecht
Annabar Bay	Sediment	Upper Pliensbachian		W16S	-8.4	-18.6	Utrecht
Annabar Bay	Sediment	Upper Pliensbachian		W17S	-5.06	-11.37	Frankfurt
Annabar Bay	Sediment	Upper Pliensbachian		W17S	-3.7	-10.8	Utrecht
Annabar Bay	Sediment	Upper Pliensbachian		W17Smicrite	-3.7	-11.1	Utrecht
Chekurovka	Glendonite	Upper Bajocian	not younger than Arctocephalites arcticus	W3G	-16.0	-7.8	Utrecht
Chekurovka	Glendonite	Upper Bajocian	not younger than Arctocephalites arcticus	W3G	-5.7	-11.3	Utrecht

SECTION	TYPE OF SAMPLE	AGE	AMMONITE ZONE (when determined)	SAMPLE NUMBER	δ13C (‰ VPDB)	δ18O (‰ VPDB)	LAB OF ANALYSIS
Chekurovka	Glendonite	Upper Bajocian	not younger than Arctocephalites arcticus	W10G	-18.57	-5.14	Frankfurt
Chekurovka	Glendonite	Upper Bajocian	not younger than Arctocephalites arcticus	W10G	-13.1	-10.3	Utrecht
Chekurovka	Glendonite	Upper Bajocian	not younger than Arctocephalites arcticus	W10G	-19.6	-4.9	Utrecht
Chekurovka	Glendonite	uppermost lower-middle Batho.	Arcticoceras harlandi-A. cranocephaloide interval	W11G	-14.5	-10.7	Utrecht
Chekurovka	Glendonite	uppermost lower-middle Batho.	Arcticoceras harlandi-A. cranocephaloide interval	W11G	-17.2	-8.3	Utrecht
Chekurovka	Glendonite	uppermost lower-middle Batho.	Arcticoceras harlandi-A. cranocephaloide interval	W1G	-30.6	-5.5	Utrecht
Chekurovka	Glendonite	uppermost lower-middle Batho.	Arcticoceras harlandi-A. cranocephaloide interval	W1G	-28.4	-4.9	Utrecht
Chekurovka	Glendonite	Upper Bajocian-Middle Bathonian	*block not in place*	W12G	-12.8	-8.2	Utrecht
Chekurovka	Glendonite	Upper Bajocian-Middle Bathonian	*block not in place*	W12G	-16.4	-5.8	Utrecht
Chekurovka	Nodule	uppermost lower-middle Batho.	Arcticoceras harlandi-A. cranocephaloide interval	W1N	-30.4	-4.0	Utrecht
Chekurovka	Sediment	Upper Bajocian	not younger than Arctocephalites arcticus	W10S	-2.04	-8.24	Frankfurt
Chekurovka	Sediment	Upper Bajocian	not younger than Arctocephalites arcticus	W10S	-3.0	-9.1	Utrecht
Chekurovka	Sediment	Upper Bajocian	not younger than Arctocephalites arcticus	W2 S	19.17	-6.93	Frankfurt
Chekurovka	Sediment	Upper Bajocian	not younger than Arctocephalites arcticus	W2S	21.3	-6.0	Utrecht
Chekurovka	Sediment	uppermost lower-middle Batho.	Arcticoceras harlandi-A. cranocephaloide interval	W1S	-29.45	-3.74	Frankfurt
Chucha	Glendonite	Lower Bathonian?	Arcticoceras ishmae?	W6G	-21.6	-6.7	Utrecht
Chucha	Glendonite	Lower Bathonian?	Arcticoceras ishmae?	W8G	-21.5	-6.0	Utrecht
Chucha	Glendonite	Berriasian	Mesezhnikovi or Analogus zone	W35G	-22.8	-8.8	Utrecht
Chucha	Glendonite	Berriasian	Mesezhnikovi or Analogus zone	W35G	-19.7	-7.9	Utrecht
Chucha	Nodule	Berriasian	Mesezhnikovi or Analogus zone	W35N	-24.0	-3.4	Utrecht
Chucha	Sediment	Lower Bathonian?	Arcticoceras ishmae?	W6S	-2.87	-17.77	Frankfurt
Chucha	Sediment	Lower Bathonian?	Arcticoceras ishmae?	W6S	-5.0	-18.6	Utrecht
Chucha	Sediment	Lower Bathonian?	Arcticoceras ishmae?	W7S	-2.69	-17.82	Frankfurt
Cape Kystatym	Glendonite	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W22bG	-18.3	-2.3	Utrecht
Cape Kystatym	Glendonite	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W23a-1G	-22.6	-1.6	Utrecht
Cape Kystatym	Glendonite	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W23a-1G	-20.4	-1.9	Utrecht
Cape Kystatym	Glendonite	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W23a-1G	-23.9	-1.8	Utrecht
Cape Kystatym	Glendonite	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W23a-2G	-23.8	-1.9	Utrecht
Cape Kystatym	Glendonite	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W23a-2G	-24.9	-0.8	Utrecht
Cape Kystatym	Glendonite	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W23b-1G	-15.9	-4.2	Utrecht
Cape Kystatym	Glendonite	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W23bG	-16.4	-3.9	Utrecht
Cape Kystatym	Glendonite	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W24G	-7.0	-10.8	Utrecht
Cape Kystatym	Glendonite	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W24G	-0.4	-14.7	Utrecht
Cape Kystatym	Glendonite	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W25G	-22.3	-2.4	Utrecht
Cape Kystatym	Glendonite	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W25G	-9.6	-10.1	Utrecht
Cape Kystatym	Glendonite	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W25Gd	-18.4	-4.5	Utrecht

SECTION	TYPE OF SAMPLE	AGE	AMMONITE ZONE (when determined)	SAMPLE NUMBER	δ13C (‰ VPDB)	δ18O (‰ VPDB)	LAB OF ANALYSIS
Cape Kystatym	Glendonite	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W27G	-23.6	-1.6	Utrecht
Cape Kystatym	Glendonite	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W27G	-23.9	-1.5	Utrecht
Cape Kystatym	Glendonite	lowermost upper Bajocian?	*block not in place*	W20G	-12.9	-8.2	Utrecht
Cape Kystatym	Glendonite	lowermost upper Bajocian?	*block not in place*	W30b	-44.2	-3.9	Utrecht
Cape Kystatym	Glendonite	lowermost upper Bajocian?	*block not in place*	W30b	-44.5	-1.3	Utrecht
Cape Kystatym	Glendonite	lowermost upper Bajocian?	*block not in place*	W31G	-27.7	-5.8	Utrecht
Cape Kystatym	Glendonite	lowermost upper Bajocian?	*block not in place*	W31G	-39.6	-2.5	Utrecht
Cape Kystatym	Nodule	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W23b-2N	-17.65	-2.73	Frankfurt
Cape Kystatym	Nodule	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W23b-1N	-16.4	-3.3	Utrecht
Cape Kystatym	Sediment	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W24S	13.77	-18.46	Frankfurt
Cape Kystatym	Sediment	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W24S	9.7	-19.4	Utrecht
Cape Kystatym	Sediment	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W24Smicrite	11.0	-16.7	Utrecht
Cape Kystatym	Sediment	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W25S	11.89	-15.52	Frankfurt
Cape Kystatym	Sediment	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W25S	11.6	-14.6	Utrecht
Cape Kystatym	Sediment	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W27S	-18.1	-3.3	Utrecht
Cape Kystatym	Sediment	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W29S	13.75	-18.98	Frankfurt
Cape Kystatym	Sediment	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W29S	15.4	-17.9	Utrecht
Cape Kystatym	Sediment	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W30S	-12.3	-13.5	Utrecht
Cape Kystatym	Sediment	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W22bS	14.98	-16.57	Frankfurt
Cape Kystatym	Sediment	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W22bS	15.4	-16.1	Utrecht
Cape Kystatym	Sediment	lowermost upper Bajocian	lower part of Boreiocephalites pseudoborealis	W22bS	15.0	-16.2	Utrecht
Cape Kystatym	Sediment	lowermost upper Bajocian?	*block not in place*	W20S	12.52	-14.83	Frankfurt
Cape Kystatym	Sediment	lowermost upper Bajocian?	*block not in place*	W20S	11.4	-14.8	Utrecht
Cape Khorongkho	Glendonite	lowermost upper Bajocian	Boreiocephalites pseudoborealis?	W32G	-18.6	-4.6	Utrecht
Cape Khorongkho	Glendonite	lowermost upper Bajocian	Boreiocephalites pseudoborealis?	W32G	0.0	-9.8	Utrecht
Cape Khorongkho	Glendonite	lowermost upper Bajocian	Boreiocephalites pseudoborealis?	W32G	-9.9	-9.4	Utrecht
Cape Khorongkho	Glendonite	lowermost upper Bajocian	Boreiocephalites pseudoborealis?	W32G	-5.8	-8.0	Utrecht
Cape Khorongkho	Glendonite	lowermost upper Bajocian	Boreiocephalites pseudoborealis?	W33G	-22.6	-2.9	Utrecht
Cape Khorongkho	Glendonite	lowermost upper Bajocian	Boreiocephalites pseudoborealis?	W33G	-16.7	-5.9	Utrecht
Cape Khorongkho	Glendonite	lowermost upper Bajocian	Boreiocephalites pseudoborealis?	W34G	-12.1	-6.4	Utrecht
Cape Khorongkho	Glendonite	lowermost upper Bajocian	Boreiocephalites pseudoborealis?	W34G	-13.1	-5.7	Utrecht
Cape Khorongkho	Sediment	lowermost upper Bajocian	Boreiocephalites pseudoborealis?	W32S	12.24	-16.13	Frankfurt
Cape Khorongkho	Sediment	lowermost upper Bajocian	Boreiocephalites pseudoborealis?	W32S	12.2	-16.1	Utrecht
Cape Khorongkho	Sediment	lowermost upper Bajocian	Boreiocephalites pseudoborealis?	W32S	10.3	-20.6	Utrecht
Cape Khorongkho	Sediment	lowermost upper Bajocian	Boreiocephalites pseudoborealis?	W33S	10.94	-17.94	Frankfurt
Cape Khorongkho	Sediment	lowermost upper Bajocian	Boreiocephalites pseudoborealis?	W33S	11.6	-18.1	Utrecht
Cape Khorongkho	Sediment	lowermost upper Bajocian	Boreiocephalites pseudoborealis?	W34S	12.39	-15.83	Frankfurt
Cape Khorongkho	Sediment	lowermost upper Bajocian	Boreiocephalites pseudoborealis?	W34S	11.6	-16.3	Utrecht

Raw Rock-Eval data

Samples	Type	Section	TOC [%]	HI [mg HC/g TOC]	OI [mg CO2/g TOC]	Tmax [°C]	S1 [mg HC/g]	S2a [mg HC/g]	S2b [mg HC/g]	S3
B1	Glendonite	Anabar Bay	0.37	63	211	433	0.01	0.23	0.00	0.78
B2	Sediment	Anabar Bay	0.55	37	172	460	0.02	0.20	0.00	0.94
B4	Sediment	Anabar Bay	0.02	320	2532	423	0.01	0.06	0.00	0.46
W17	Glendonite	Anabar Bay	0.35	33	459	462	0.01	0.12	0.00	1.63
W18	Glendonite	Anabar Bay	0.08	140	830	481	0.01	0.12	0.00	0.69
W2	Sediment	Chekurovka	0.78	67	112	482	0.09	0.53	0.00	0.88
W20	Sediment	Cape Kystatym	0.25	31	368	418	0.01	0.08	0.00	0.94
W23B1	Glendonite	Cape Kystatym	0.52	37	355	452	0.01	0.20	0.00	1.86
W23B	Nodule	Cape Kystatym	0.41	36	376	468	0.01	0.15	0.00	1.54
W24	Sediment	Cape Kystatym	0.33	41	190	465	0.01	0.14	0.00	0.63
W25	Sediment	Cape Kystatym	0.35	37	221	424	0.01	0.13	0.00	0.77
W29	Sediment	Cape Kystatym	0.61	32	245	465	0.01	0.20	0.00	1.49
W32	Sediment	Cape Khorongkho	0.39	41	271	456	0.01	0.16	0.00	1.05
W33	Sediment	Cape Khorongkho	0.46	44	163	464	0.01	0.21	0.00	0.75
W34	Sediment	Cape Khorongkho	0.56	42	206	463	0.01	0.23	0.00	1.15
W35	Glendonite	Chucha	0.30	62	239	412	0.03	0.19	0.00	0.72
W8	Sediment	Chucha	0.24	57	66	436	0.03	0.14	0.00	0.16

Raw CSIA data performed on bulk-glendonites gas inclusions

AGE	SECTION	SAMPLE	Gas composition [mole%] (Total hydrocarbons = 100%)						
			C1	C2	C3	i-C_4	n-C_4	i-C_5	n-C_5
upper Bajocian	Chekurovka	W10	72.4	14.1	7.7	1.2	2.6	0.86	1.1
up. Baj.-mid. Bathonian	Chekurovka	W12	73.4	12.8	7.8	1.4	2.5	0.93	1.2
upper Bajocian	Cape Kystatym	W23a2	94.3	4.2	0.89	0.13	0.21	0.087	0.11
upper Bajocian	Cape Khorongkho	W33	95.3	3.3	0.72	0.1	0.22	0.074	0.1
Berriasian	Chucha	W35	73.6	11.9	6.5	3.3	2.2	1.6	0.9

AGE	SECTION	SAMPLE	Carbon isotope ratios (δ13C ‰ VPDB)						
			C1	C2	C3	i-C_4	n-C_4	i-C_5	n-C_5
upper Bajocian	Chekurovka	W10	-44.7	-35.7	-32.5	-31.2	-30.8	-29.7	-30.1
up. Baj.-mid. Bathonian	Chekurovka	W12	-46.9	-37.2	-33.0	-32.0	-31.2	-29.3	-30.0
upper Bajocian	Cape Kystatym	W23a2	-49.6	-32.5	-28.9	-29.3	-27.7	-29	-27
upper Bajocian	Cape Khorongkho	W33	-50.3	-34.4	-30.0	-32	-28		
Berriasian	Chucha	W35	-47.2	-33.7	-30.3	-29.0	-28.7	-27.6	-28.4