



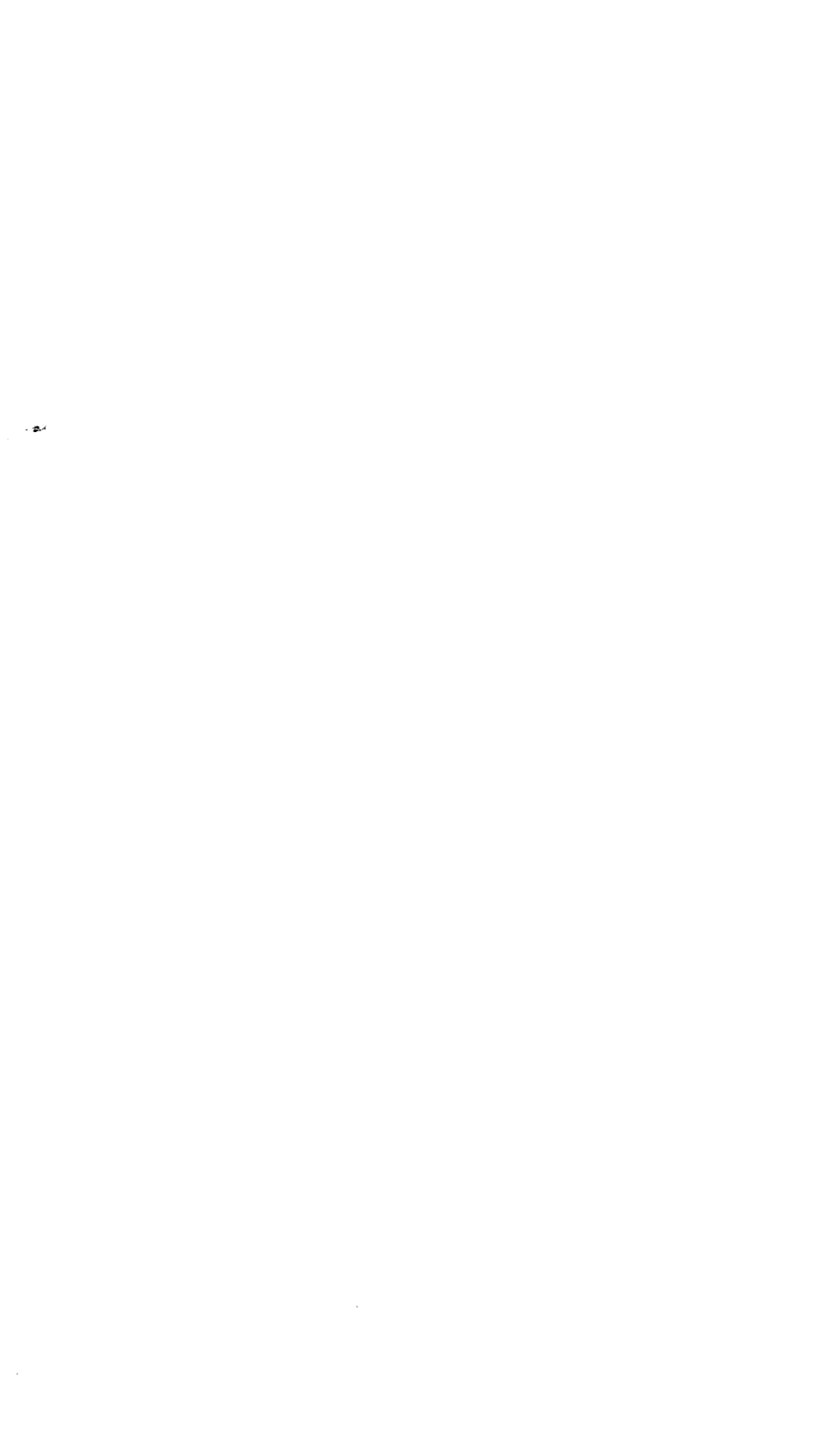
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# FIELDIANA Botany

Published by Field Museum of Natural History

Volume 38, No. 3

June 28, 1976

## Notes On *Calvatia* (Lycoperdaceae), II *Calvatia cretacea* (Berk.) Lloyd, An Arctic Montane Plant

PATRICIO PONCE DE LEON

ASSOCIATE CURATOR  
CRYPTOGAMIC HERBARIUM  
FIELD MUSEUM OF NATURAL HISTORY

The presence of *Calvatia cretacea* (Berk.) Lloyd in the mountains of western North America opens the door to one of the most interesting problems in plant distribution. Its range is a discontinuous area, reduced today to the boreal circle and the mountains of northern Europe and western North America. This is an example of circumboreal disjunction of species with narrow amplitudes of ecological tolerance (Porsild, 1951), a characteristic shared with the oceanic species, such as the lichen *Platismatia norwegica* (Ling.) Culb. & Culb., and the dicotyledonous flowering plant, *Oxyria digyna* L. (alpine sorrel).

The area of distribution of *Calvatia cretacea* includes the mountains of northern Europe, Arctic Europe, Greenland, Iceland, Arctic Canada, Alaska, the Rocky Mountains, and the mountains west to California. It is most interesting that this species does not appear in the eastern part of North America as do several species of mushrooms, mosses, and flowering plants with intercontinental distribution, although this may be because of the lower altitude of the eastern mountains. In Europe it is always associated with *Dryas* (Rosaceae) on calcareous rocks (Eckblad, 1971). According to L. Lange (1974), the northern record of this species is 78°57' N., which is also the northernmost record for higher fungi registered by her. The southernmost record of this species in Europe is 61°N.

Library of Congress Catalog Card Number: 75-25180

US ISSN 0015-0746

Publication 1233

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Among the lichens with an area comparable to that of *C. cretacea* is *Stereocaulon groenlandicum* (Path.) Lamb, which occurs in continental North America and in Iceland, but not on the European continent. The distribution of *C. cretacea* shows remarkable parallelism with that of *Ranunculus pygmaeus* Wahlenb., but the latter occurs in Asia as well. Other plants, such as *Thalictrum alpinum* L. and *Salix herbacea* L., have a similar distribution in the north, but they are represented in eastern America.

Three notable examples of similar distribution in the Lycoperales are: (1) *Lycoperdon lambinonii* Demoulin, with an oceanic, subboreal distribution in Europe and in western and eastern continental North America; (2) *L. frigidum* Demoulin, from the alpine zone of Europe and Canada, with one collection from Alaska (Demoulin, 1972); and (3) *Calvatia tatrensis* Hollos, which has been collected in Greenland, in the mountains of western North America, and in the Tatra Mountains (central Carpathians) of Europe.

In the Agaricales, *Russula nigrodisca* Peck is also arctic-montane, i.e., has been found (and material critically studied) in the arctic zone of Europe, Asia, and North America, but likewise in mountains isolated from the arctic belt, such as the Alps, Tatra, Caucasus, Altai, and in the Rocky Mountains as far south as Colorado (Singer, 1975, pers. comm.). The only difference in the distribution of this species and that of *C. cretacea* is that *R. nigrodisca* has been collected in the Caucasus and Altai Mountains (Central Asia).

The specific name *cretacea* has been applied to many specimens collected in the American Northwest, from Alaska to California as far south as San Francisco. With the aid of the collections in the University of California at Berkeley, I was able to identify most of the material from the area, finding that only a small portion of it had been correctly named. The plants with this distribution (Arctic montane plants — Hultén, 1937) form two zones, one as a continuous ring around the North Pole and another concentric, but intermittent ring on the mountains south of the Arctic region. They probably lived along the border of the glacier in the Pleistocene, and when the glacier retreated, they survived only in the circumpolar region and in the southern mountains, disappearing from warmer places such as the valleys. Today they are found in the steppes, on heaths, above the northern limits of the coniferous forest, or near the timberline of the southern mountains. It has been very difficult to establish this range due to incomplete label data and numerous misidentifications.



In this paper, *Calvatia arctica* Ferd. & Winge and *C. borealis* Th. C. E. Fries are considered synonyms of *C. cretacea*. This species was collected first on Bellot Island, North America, by Captain Feilden in the Arctic expedition (1876) and named by Berkeley as *Lycoperdon cretaceum*. Then Ferdinandsen and Winge (1910) described *C. arctica* from Norway, and Fries (1914) described *C. borealis*, also from Norway. The latter has been considered a synonym of *C. cretacea* by all authors. Lloyd (1917), working with material collected by Dearness from Key Point, Canada, transferred Berkeley's species from *Lycoperdon* to *Calvatia*, as *C. cretacea* (Berk.) Lloyd, and placed *C. arctica* in synonymy with *C. cretacea*. Later, Zeller (1947) collected several specimens on Baffin Island (Lake Harbor) and Lange (1948) collected several from Norway.

In recent times, *Calvatia cretacea* has been reported from Alaska and the Rocky Mountains to California by Copeland, Morse, and Llano (Alaska), McClure (Manitoba, Canada), Miller, Morse, and Bonard (California), and Nash (Labrador). Although for a long while it was thought not to occur in Iceland, Christiansen collected two specimens from there, determining them as *C. arctica*. However, his description of them was questioned by Lange, and I have now determined that the one from Egilstadir is indeed *C. cretacea*.

*Calvatia cretacea* (Berk.) Lloyd, Myc. Notes 46: 650-661, 1917. *Lycoperdon cretaceum* Berkeley, Journ. Linn. Soc. 17 (98): 15. 1878. *C. arctica* Ferd. & Winge, Medd. om Gronl. 43: 142. 1910. *C. borealis* Th. C. E. Fries, Svensk Botanisk Tidskrift 8: 238-239. 1914.

Basidiocarps 10-12 cm. high and broad, subglobose, depressed or pear-shaped, plicate beneath, base pinched to a small point, attached by a white mycelium; exoperidium white, then brownish gray, 2-3 mm. thick, firm, composed of prominent polygonal warts with clusters of spines in the upper part and becoming smoother downward, cracking into irregular areas or groups of warts which fall away by degrees to expose the endoperidium; endoperidium papery, thin, shining, silvery brown or horn-gray, falling away in flakes from above downward; subgleba from rudimentary to well developed, chambered, dark olive, brownish; gleba white, then golden olive and finally dark brown; spores pale cinnamon to brown, 4-5.5 $\mu$  diameter, globose, warted, with a hyaline envelope, one guttulated, pedicel present, short, many broken pedicels in the mount; capillitium threads 5-7 $\mu$  thick, fragmented in short segments, tapered with few aborted branches (not thorns), Y-shaped branches abundant, septate, septa frequent, walls encrusted with debris, pitted, pits round, small, abundant.

Type collection: *Feilden s.n.* Bellot Island, Canada. (K).

*Habitat:* On grassland or shrub areas of the arctic region; in mountain meadows of northern Europe and western North America.

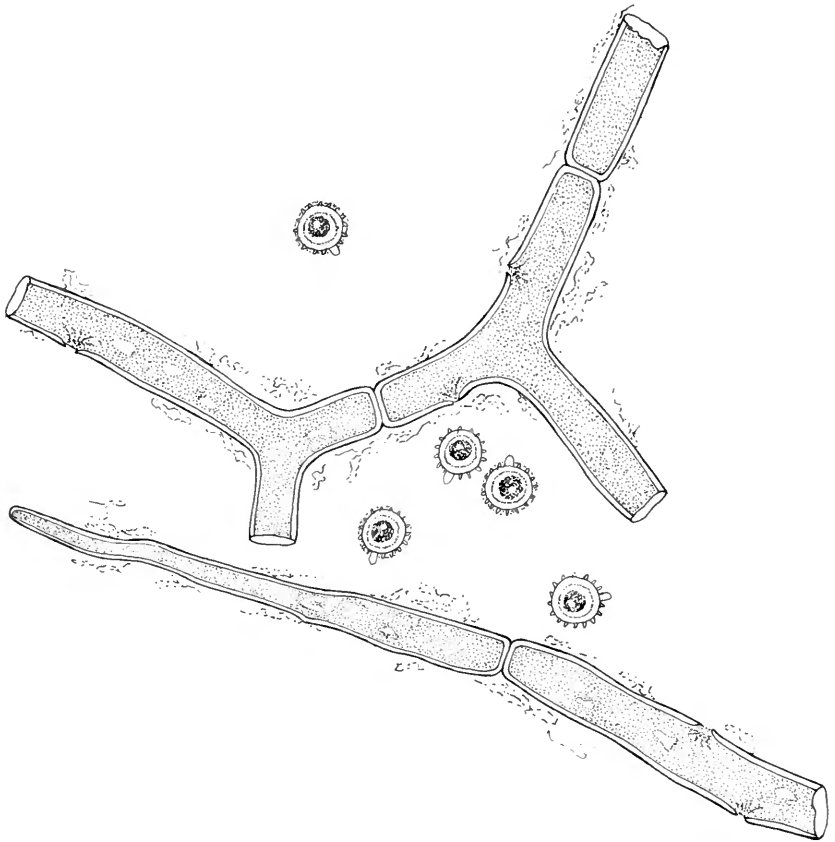


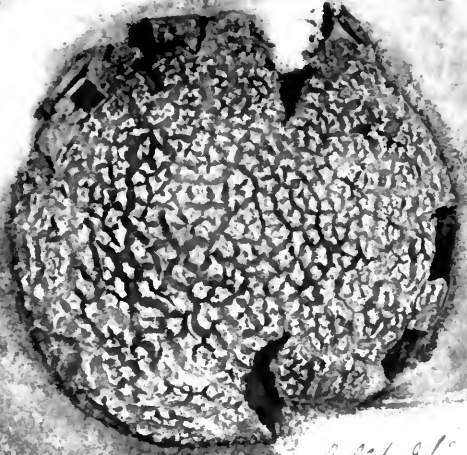
FIG. 1. Spores and capillitium of *Calvatia cretacea*, greatly enlarged.

*Distribution:* Scandinavian peninsula, Iceland, Greenland, Arctic Canada, Alaska, Rocky Mountains in Canada and the United States.

*Specimens examined:*

**CANADA.** BRITISH COLUMBIA: *G. Skelly s.n.* (BPI).  
**MANITOBA:** Churchill, *E. Elliott and MacClure s.n.* (2 specimens) (BPI).  
**NORTHWEST TERRITORIES:** Bellot Island, *Capt. Feilden s.n.*, type of *C. cretacea* (Berk.) Lloyd (Presented at Kew by Rev. M. Berkeley, 1879) (K); Prince Patrick Island, *C. O. Handley, Jr. s.n.* (BPI); Crusoe River, Alex Heiberg Isl., *M. Kuc* (F22) ex Myc. Herb. Pl. Res. Inst. Ottawa No. 124727 (BPI); Key Point, Arctics, *J. Dearness* (mentioned by Lloyd, Myc. Writ. 5: 650. 1917, f. 929 [not seen] ). (BPI); Bernard Harbor (near Arctic Circle),

HERBARIUM MYCOLOGICUM BERKELEYANUM  
Presented by the Rev. M. J. BERKELEY, 1857.



Berk. & Lloyd  
1876



Berk. & Lloyd  
1876

*Calvatia cretacea*, Berk. & Lloyd

FIG. 2. *Calvatia cretacea* (Berk.) Lloyd (Holotype of *Lycoperdon cretaceum* Berk.).  
Courtesy Royal Botanic Gardens, Kew.

*J. Dearness 17c* (UC 506796) (UC). QUEBEC: Port Burwell, Labrador, *N. Polunin 1114-a-31* (FH); Wakeham (Stupart's Bay), South shore of Hudson Strait, *N. Polunin 1471a-5* (FH); Keewatin Dist. Carol Harbour, Southampton Isl., *D.B.O. Savile et al. 3987* (K).

GREENLAND. Thule, *J. W. Marr s.n.*, as *C. fragilis* (Vitt.) Morg. (BPI); West Greenland, 69° Lat. N. Sydostbugten, *W. Hawk AH9*, (C); Liverpool Kyst., Huiry Gulet, *C. Krause s.n.*, *C. arctica* F & W. by Ferdinandsen, *C. sp.* by Hollos (C); Sondre Stromfjord, 66°-67° Lat. N. (West Greenland), *Lange 1106* (C); *M. Lange 284* (C); I Kar (Greenland Bor.-Orient.), *A. Lundanger 241* (Alc. Coll. F269A), type of *C. arctica* F. & W. (C).

ICELAND. Egilstadir, *M. P. Christiansen s.n.* (C).

NEWFOUNDLAND. Labrador: *E. R. Nash s.n.* (BPI).

NORWAY. Several localities in the mountains (fide Eckblad, 1974).

SWEDEN. Lapland, *C. E. Fries s.n.* (Lloyd 34258) (as *C. borealis* Th. C. E. Fries), type of *C. borealis* Th. C. E. Fries (BPI).

U.S.A. ALASKA: Alaska, *E. Morse s.n.* (U.C. 513510) (UC). CALIFORNIA: *Cooke 32580* (as *Calvatia sp.*) (MICH); Rock Creek, Mt. Langley, 10,500 ft. alt., Sequoia Nat'l. Forest, *H. P. Bracelin 2891* (BPI); *R. A. Harper s.n.* (NY). IDAHO: *Zeller s.n.* (MICH) (NY); *Smith 58882* (MICH); *Trueblood 2717* (as *C. arctica* F. & W.) (MICH).

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