OPLOPHORID SHRIMP (DECAPODA, CARIDEA) FROM AN ARCTIC HYDROTHERMAL VENT

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ABSTRACT

Two specimens of the caridean family Oplophoridae are reported from dredging activity on the recently discovered hydrothermal vent fields of the Arctic Ocean's ultra-slow-spreading Gakkel Ridge. This is the first report of any decapod crustacean from Arctic Ocean vents and the first record of this species (*Hymenodora glacialis* (Buchholz, 1874)) from the vicinity of marine hydrothermal vents.

RÉSUMÉ

Deux spécimens de la famille des Oplophoridae (Decapoda, Caridea) ont été observés, provenant de dragages réalisés sur les sites hydrothermaux récemment découverts dans l'océan Arctique à la hauteur de la ride Gakkel. C'est la première trouvaille de crustacés décapodes dans ce type de milieu de l'océan Arctique et la première observation de l'espèce *Hymenodora glacialis* (Buchholz, 1874) au voisinage de sources hydrothermales marines.

INTRODUCTION

The majority of shrimp specimens reported from hydrothermal vent areas belong to the caridean family Alvinocarididae (or the recently-established and closely related family Mirocarididae; Vereshchaka, 1997), all members of which are obligate associates of hydrothermal vents or cold seeps (e.g., see Christoffersen, 1986; Vereshchaka, 1997; Martin & Davis, 2001; Shank & Martin, 2003). Reports of shrimps from other caridean families are known but are uncommon. For example, the oplophorid *Acanthephyra purpurea* A. Milne-Edwards, 1881, has been reported from the Lucky Strike vent sites on the Mid-Atlantic Ridge (see Desbruyères & Segonzac, 1997: 189), *Systellaspis braueri* Balss, 1914 (another oplophorid), is known from the East Pacific Rise (Tunnicliffe, 1991), and two

species of *Lebbeus* (Hippolytidae) have been reported from vents in the Pacific (Desbruyères & Segonzac, 1997: 197-198).

Recent petrological sampling and geophysical surveys along the Gakkel Ridge in the Arctic Ocean have disclosed the presence of a surprisingly high number of hydrothermal vent fields, the first known hydrothermal vents in the Arctic Ocean (Edmonds et al., 2003). These vents are particularly interesting because of their relative isolation with regard to other vent fields and because they are in an area of ultra-slow-spreading tectonic plates, where hydrothermal venting was not expected to be common (Edmonds et al., 2003). Among the specimens collected during the dredging activity were two specimens of the caridean shrimp family Oplophoridae. The two specimens were sent to me for identification by Timothy Shank, Woods Hole Oceanographic Institution.

MATERIALS AND METHODS

Shrimp were collected by dredging during the maiden voyage of the U. S. Coast Guard icebreaker "Healy" as part of a joint U. S.-German expedition (see Edmonds et al., 2003; and the web site "Fire and Ice: Exploring for Volcanoes Beneath the Artcic" at http://www.earthscape.org/r1/hea01/). Both specimens were transferred to the Crustacea collections of the Natural History Museum of Los Angeles County (LACM). Collection data are as follows: LACM CR 2001-027.1: Vial 1F, sample HLY 01-02-D36, "Moss Landing sample", collected 24 August 2001, dredge, Arctic Ocean, USCGC "Healy", 4365-4456 m depth. LACM CR 2002-028.1: Vial 2F, sample HLY 01-02-D22, "Moss Landing sample", collected 17 August 2001, dredge, Arctic Ocean, USCGC "Healy", 3132-3282 m depth. Illustrations were made with the aid of a Wild M5APO dissecting stereoscope with attached camera lucida.

SYSTEMATICS

Order PLEOCYEMATA

Infraorder CARIDEA

Family OPLOPHORIDAE

Genus *Hymenodora* Sars, 1877

Hymenodora glacialis (Buchholz, 1874)

Abbreviated synonymy. —
Pasiphaë glacialis Buchholz, 1874: 279.

Hymenodora glacialis, G. O. Sars, 1877: 241; 1885: 275, pl. 4; Smith, 1885: 501; 1886: 678, pl. 15 figs. 3, 10, pl. 16 fig. 5; Faxon, 1895: 168; Rathbun, 1904: 27; 1929; Welsh & Chace, 1937; Vinogradov, 1950; Sivertsen & Holthuis, 1956: 15, figs. 11, 12; Crosnier & Forest, 1973: 84, fig. 25b; Wasmer, 1972: 87-91; 1986: 48, figs. 10b-c, 11; Butler, 1980: 72-73; Chace, 1986: 41, fig. 22 (key); Holthuis, 1993, fig. 14; Hendrickx & Estrada Navarrete, 1996: 117, fig. 72; Wicksten, 2002: 136.

Notes on the specimens. — Both specimens appear to be males. One is in relatively poor condition, with the carapace slightly damaged and with several appendages missing.

The larger specimen (fig. 1A-F) has a carapace length (including the short rostrum) of 21. 7 mm and a total length of approximately 55.1 mm; the broken telson and bend of the body make exact measurement of total length difficult. Because of the broken tip of the telson in the larger specimen, the figure of the telson (fig. 1G) is taken from the smaller specimen.

Both of the Gakkel Ridge specimens agree closely with the description of *H. glacialis* by Butler (1980) and by Hendrickx & Navarrete (1996). Differences include the fact that the "crescent-shaped sulcus" of the carapace, a feature that in part distinguishes *H. glacialis* from the similar *H. gracilis* Smith, 1887, is not as clear in our specimens as depicted by Butler (1980: 69), but it is present, and together with the abbreviated rostrum confirms the identity of these specimens. The unusual mandible matches closely the figures of Chace (1986, fig. 22) based on a 20 mm male *H. glacialis* taken off England, as do other mouthparts (see Chace, 1986, figs. 21k-m, 22a-c). The tip of the telson (fig. 1G), distally truncate and bearing 5 spines flanked by a pair of spines slightly anterior to and elevated from the spines of the tip, is also diagnostic of *Hymenodora* species except for *H. acanthitelsonis* Wasmer, 1972 (see Wasmer, 1972). Chace (1986) presented a lucid discussion of generic characters and range of the genus.

REMARKS

Edmonds et al. (2003) noted that the isolation of the Gakkel Ridge vent sites (there is no known connection with any other mid-oceanic ridge system south of Iceland) would make them a prime candidate for hosting undescribed species of vent fauna. This is undoubtedly true, yet the only specimens I have seen to date belong to a known species, *H. glacialis*, that has not been found previously in association with hydrothermal vents.

Hymenodora glacialis has been reported from the Sea of Okhotsk and the Bering Sea, south to the Gulf of Panama in the Pacific, and from the Arctic

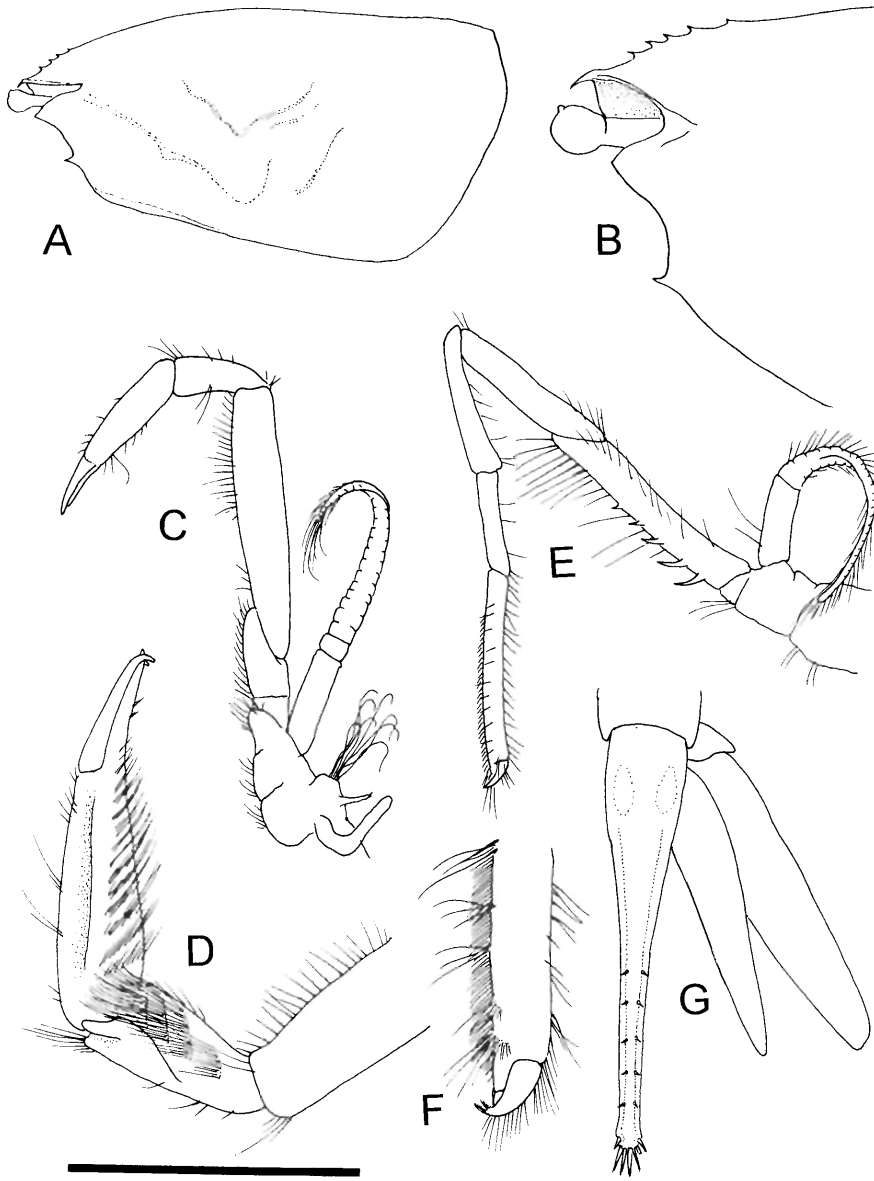

Fig. 1. *Hymenodora glacialis* (Buchholz, 1874) from the Gakkel Ridge, A-F, LACM CR 2001-027.1; G, LACM CR 2002-028.1. A, carapace, lateral view; B, front of carapace and eyestalk, lateral view; C, left first pereiopod (cheliped); D, higher magnification of left chela, carpus, and distal extremity of merus; note thumb-like extension coming off distal end of carpus; E, left pereiopod 5; F, higher magnification of dactylus and propodus of left pereiopod 5; G, telson and right uropods, dorsal view. Scale bar = 10.0 mm for A; 5.0 mm for B, C, E, G; 2.5 mm for D, F.

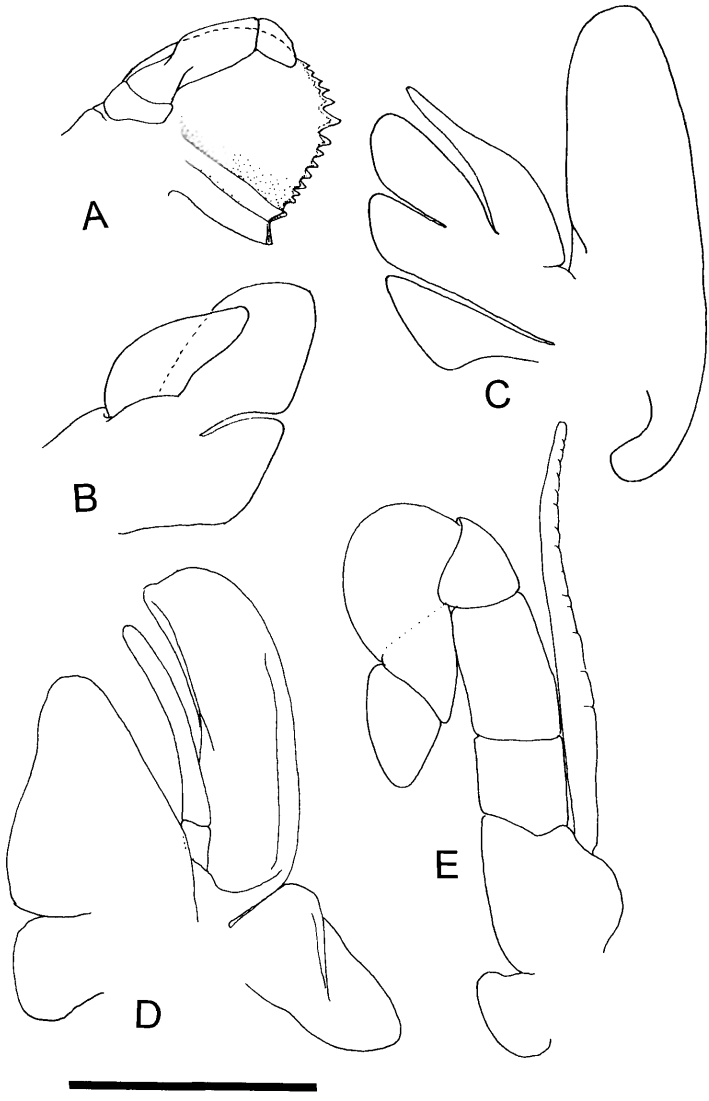

Fig. 2. *Hymenodora glacialis* (Buchholz, 1874) from the Gakkel Ridge, LACM CR 2001-027.1. A, left mandible, "inner" view; B, left first maxilla; C, left second maxilla; D, left maxilliped 1; E, left maxilliped 2. Scale bar = 2.0 mm for all figs.

Ocean and North Atlantic in the Atlantic; recorded depths range from near the surface in polar seas to 5610 m in the Pacific and to approximately 3900 m in the Atlantic (Havens & Rork, 1969; Butler, 1980; Hendrickx & Estrada Navarrete, 1996; Wicksten, 2002). Rathbun (1904) reported records further south, including off Ecuador in the Pacific, but it is unclear if these reports were discounted by Butler (1980), who noted that this species has been confused often in the past with

H. gracilis (see Wasmer, 1972; Butler, 1980). Wicksten (2002) additionally lists the western South Atlantic, Chile, the subantarctic Pacific, and the southwestern Indian Ocean. Apparently, not much is known about the biology of the species. It has been described as being "blood red" in life (Rathbun, 1929; Butler, 1980). The light pigmentation of the eye (our specimens appeared to have no pigmentation in the eye) has given rise to the common name "northern ambereye" used by Williams et al. (1989) (updated in McLaughlin et al., in press). The known size range prior to this report was 16.2 mm carapace length (approximately 48 mm total length) for males, and 16.8 mm carapace length (approximately 45 mm total length) for females (Butler, 1980). Thus, the larger Gakkel Ridge specimen, at approximately 55.1 mm total length, is the largest known for the species. The depth range for the species appears to be approximately 5,707 m (2,949 fathoms), reported by Smith (as cited by Rathbun, 1904: 27) off the east coast of North America. The deeper of the Gakkel Ridge specimens was collected between 4365 and 4456 m.

Butler (1980), in discussing the genus *Hymenodora*, noted that "all species are fragile, particularly *H. glacialis* and *H. gracilis*, and almost without exception, specimens are damaged during capture and occasionally to such an extent that identifications are difficult". This, coupled with the fact that the cuticle is very thin and malleable, might explain why Faxon (1895: 169) stated "it should be noted that the identity of Buchholz's specimen with those more lately obtained rests on the assumption of error in Buchholz's figure, in which the abdominal pleurae present a very different outline from that exhibited by the examples subsequently secured".

According to the biology page associated with the Gakkel Ridge web site (http://www.earthscape.org/r1/hea01/), apparently written by L. Kuhnz, "a surprising number of dredges yielded sponges and shrimp". Additionally, from the table of biological specimens on that same web page, it is apparent that at least two "forms" of shrimp were recognized, listed simply as shrimp sp. A and B. There is a photograph on the web site labeled "bathypelagic egg-carrying shrimp" that does not appear to be a specimen of *Hymenodora glacialis* (and neither of the specimens sent to me was ovigerous). The whereabouts of these additional specimens is currently unknown to me.

Although this report is the first record of *H. glacialis* in association with hydrothermal vent activity, there is an unpublished report on the web (at http://dev.www.nerc.ac.uk/funding/marineplan/documents/cd128cruisereport.pdf) that mentions finding specimens of *Hymenodora* (the species name is not given) on the "Charles Darwin" cruise 128 to the Kairei and Edmond Hydrothermal plumes at the Rodriguez Triple Junction, Indian Ocean (May to June, 2001). Thus, although not constrained to hydrothermal vent sites as apparently are the alvinocarids and mirocarids, oplophorids may be widely distributed at or near hydrothermal vent sites.

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