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## On the presence of the anchialine shrimp *Calliasmata pholidota* Holthuis, 1973 (Crustacea: Decapoda: Caridea: Barbouriidae) in Shimoji Island, Ryukyu Islands, Japan

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**Abstract.** *Calliasmata pholidota* Holthuis, 1973, a rare anchialine shrimp previously known from the Red Sea, Tuvalu and Hawaii, is recorded for the first time from Japanese waters based on four specimens collected in a near-shore submarine cave of Shimoji Island, Miyako group, Ryukyu Islands. This record significantly extends the geographical range of this species in the northwestern Pacific.

### Introduction

The shrimp genus *Calliasmata* Holthuis, 1973, originally placed in the Hippolytidae (Holthuis 1973, 1993) and once referred to the Lysmatidae by Christoffersen (1987), but recently transferred to the Barbouriidae based on molecular data (De Grave et al. 2014), contains three species, viz. *C. pholidota* Holthuis, 1973 from the Indo-West Pacific, and *C. rimolii* Chace, 1975 and *C. nohochi* Escobar-Briones, Camacho & Alcocer, 1997, from the western Atlantic (Holthuis 1973; Chace 1975; Escobar-Briones et al. 1997). All three species are restricted to crevicular anchialine habitats, such as land-locked pools, deep cracks and near-shore submarine caves (Maciolek 1983; Escobar-Briones et al. 1997). The Indo-West Pacific *C. pholidota* was hitherto known from only three distant localities: Egypt (Sinai Peninsula), Tuvalu (Funafuti Atoll) and the Hawaiian Archipelago (Maui and Hawai'i).

In January and March 2013, the second author collected four adult specimens of *C. pholidota* in a near-shore submarine cave known as Akuma-no-yakata (= Devil's Hole), on Shimoji Island in the Miyako group of the Ryukyu Islands, southwestern Japan. These specimens represent the first record of *C. pholidota* from Japan and also a significant range extension of the species into East Asia. The material is deposited in the Ryukyu University Museum, Fujikan, University of the Ryukyus, Okinawa, Japan (RUMF) and Muséum National d'Histoire Naturelle in Paris, France (MNHN). Postorbital carapace length (pocl, in mm)

was measured along the mid-dorsal line from the postorbital margin to the posterior margin of the carapace.

### Taxonomy

**Family Barbouriidae Christoffersen, 1987**

**Genus *Calliasmata* Holthuis, 1973**

***Calliasmata pholidota* Holthuis, 1973**

[New Japanese name: Irau-mo-ebi]

(Fig. 1)

*Calliasmata pholidota* Holthuis 1973: 37, figs. 12, 13, pl. 1, fig. 2, pl. 2, fig. 1; Hobbs et al. 1977: 16; Maciolek 1983: 607, 609, Table 1; De Grave et al. 2014: 500, 501.

**Materials examined.** Japan, Ryukyu Islands, Shimoji Island, submarine cave "Akuma-no-yakata" (Devil's Hole): 1 male (pocl 7.2 mm), RUMF-ZC-2633, SCUBA diving, bait trap, 1–2 m deep, leg. Y. Fujita, 15 March 2013; 1 female (pocl 8.6 mm), RUMF-ZC-2634, same collection data as for previous specimen; 1 female (pocl 9.0 mm), RUMF-ZC-2635, same collection method as for previous specimens, leg. Y. Fujita, 17 March 2013; 1 female (pocl 9.8 mm), MNHN-IU-2014-4231, SCUBA diving, hand sampling with plastic container, 1 m deep, leg. Y. Fujita, 28 January 2013.

**Description.** For detailed description and illustration of morphology see Holthuis (1973).

**Colouration.** Carapace and abdomen semitransparent with bright red chromatophores concentrated largely in anterior portion of carapace and organized in patches and diffuse bands on abdomen; eyestalks reddish, with conspicuously white corneas; antennular peduncle mostly red, flagellum colourless; antennal basicerite and scaphocerite with red patches; third maxilliped mostly red, especially distally; first pereopod mostly whitish, with some red on distal areas of merus and carpus, chela largely hyaline-white;

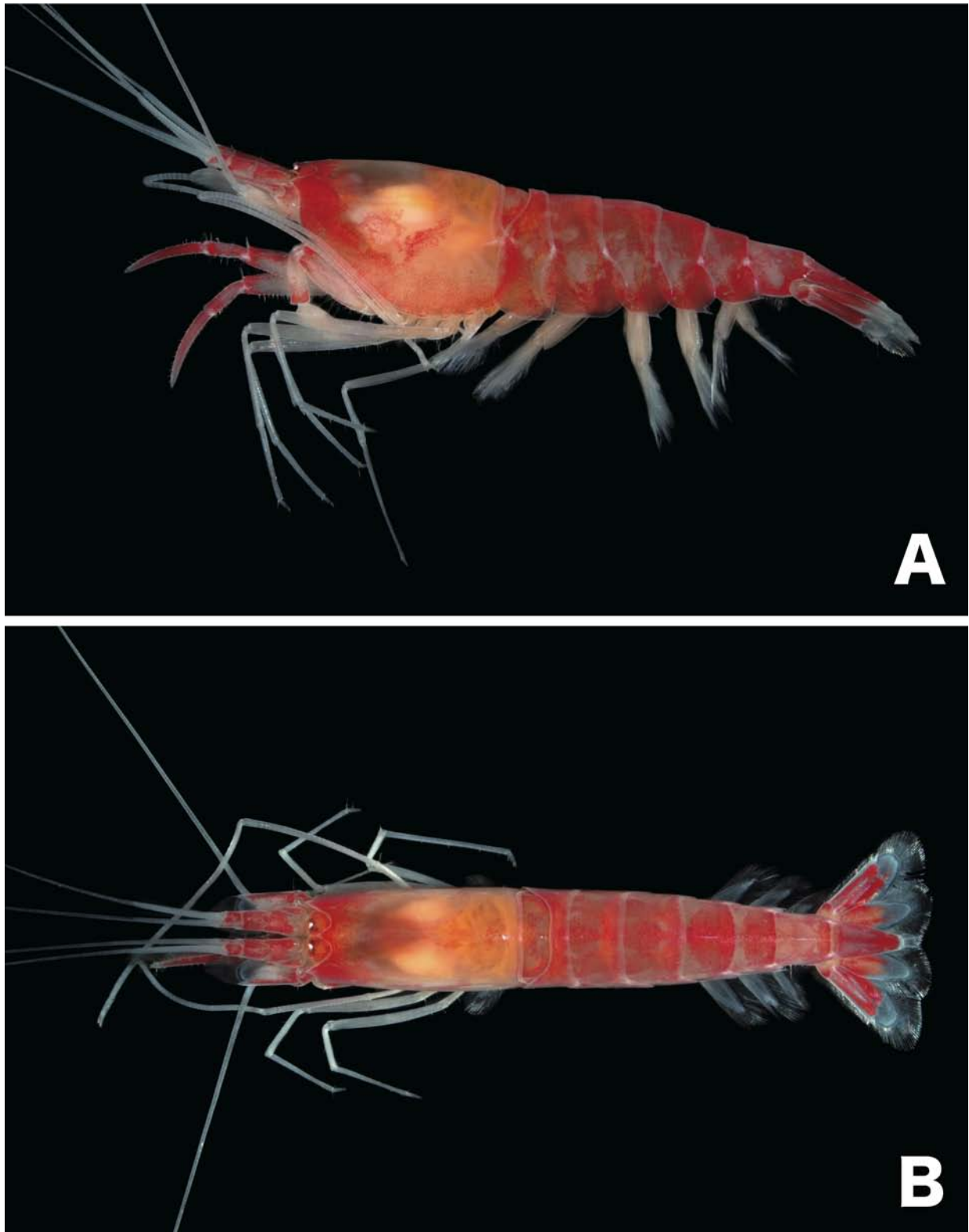


Fig. 1. *Calliasmata pholidota* Holthuis, 1973: female (cl 9.8 mm) from Shimoji Island, Miyako group, Ryukyu Islands, Japan (MNHN-IU-2014-4231). A, entire animal, lateral view; B, same, dorsal view. Photographs by Y. Fujita.

図1. 琉球列島宮古諸島下地島から採集された *Calliasmata pholidota* Holthuis, 1973 (新称: イラウモエビ): 雌 (頭胸甲長 9.8 mm) (MNHN-IU-2014-4231). A, 全体側面; B, 全体背面. 写真: 藤田喜久.

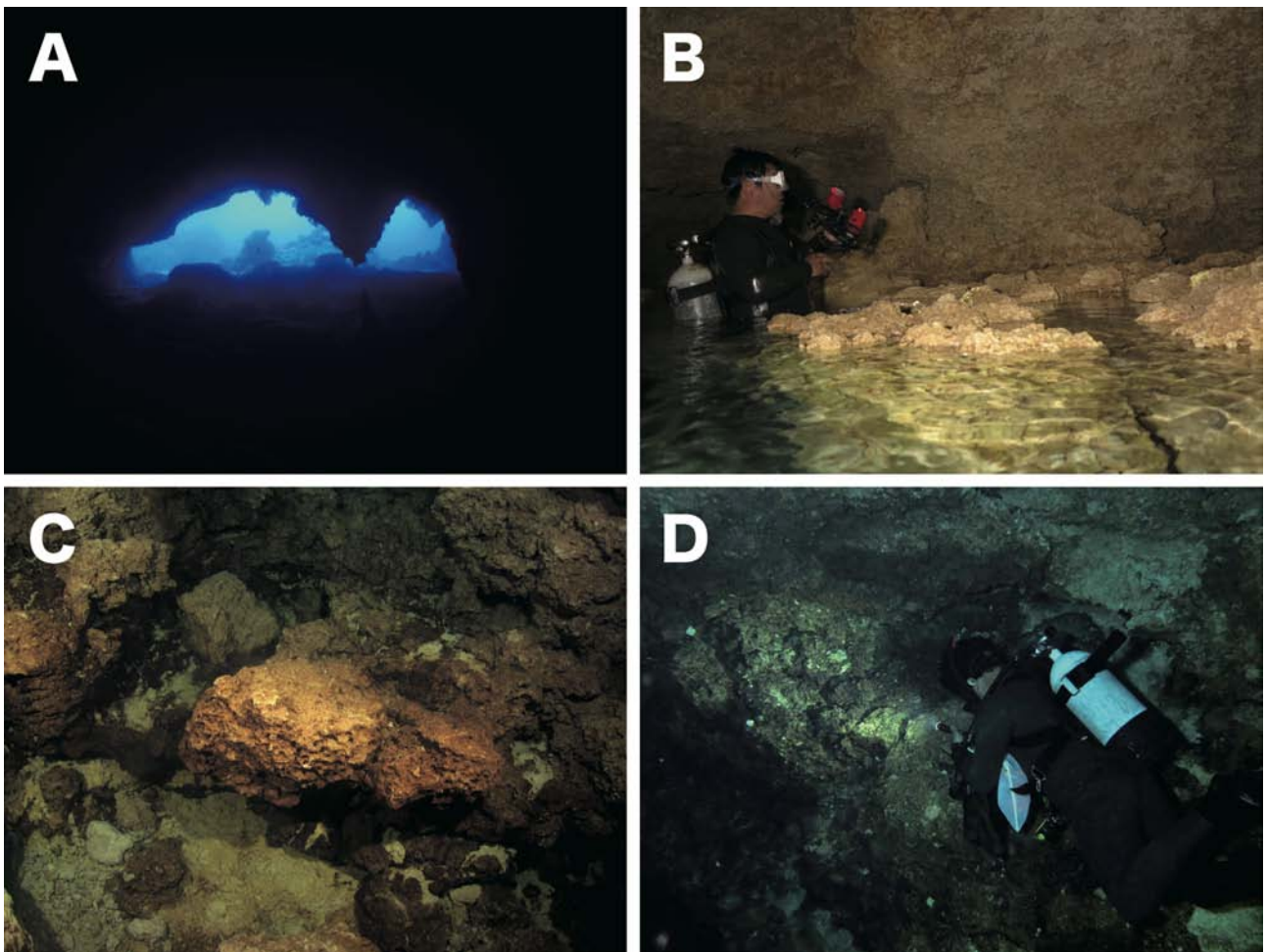


Fig.2. Underwater views of the Akuma-no-yakata submarine cave at Shimoji Island. A, tunnel near entrance; B, innermost part of the cave with a large air pocket; C, substratum at the innermost part of the cave; D, collecting survey in the innermost part of the cave. Photographs by Y. Fujita (A-C) and K. Yokoi (D).

図2. 下地島の海底洞窟（悪魔の館）の水中景観。A, 洞窟入り口付近; B, 洞窟最奥部の空洞域; C, 洞窟最奥部付近の景観; D, 洞窟最奥部における採集風景。写真：藤田喜久（A-C）、横井謙介（D）。

second to fifth pereopods and pleopods colourless, whitish; uropods and telson with well-defined red lines and patches (Fig. 1A, B).

**Habitat.** The submarine cave popularly known as “Akuma-no-yakata” (= Devil’s Hole) is located on a reef slope at Shimoji Island (24°49’22.51”N, 125°08’07.84”E), which almost entirely consists of Ryukyu Limestone. The entrance to the cave lies at a depth of about 35 m (Fig. 2A); it is continued by a stepwise tunnel, about 70–80 m long, without a “frontage road”, and in total darkness. The innermost part of the cave ends in an air pocket (Fig. 2B–D). The water temperature and salinity were not recorded, but the divers noted that the water in the innermost part of the cave was very clear with occasional layers or areas of lower temperature, indicating a thermocline or a halocline (or both), and suggesting that at least the inner parts of the

cave are anchialine in nature. Three of the four shrimp specimens were collected with baited traps in the innermost portion of the cave, while the remaining individual was found walking on the cave bottom. Two uncommon crabs, *Atoportunus gustavi* Ng & Takeda, 2003 (Portunidae) and *Neoliomera cerasinus* Ng, 2002 (Xanthidae), were also found in the cave (Fujita et al. 2013). Other decapods inhabiting various portions of this cave, including four caridean and two stenopodidean shrimps, four lobsters, and several hermit crabs, will be reported upon elsewhere.

**Remarks.** The specimens from Shimoji Island agree very well with the detailed description and illustrations of *Calliasmata pholidota* provided by Holthuis (1973). The largest of the four specimens, a female of pochl 9.8 mm (MNHN-IU-2014-4231), was examined in some detail. This female has a



bilateral variation in the number of segments in the ischium, merus and carpus of the second pereopod (P2), with 8, 25 and 38, respectively, in the right P2, and 3, 23 and 37, respectively, in the left P2. There is also variation in the armature of the merus of the third pereopod (P3), with 2 spines in the right P3 and no spines at all in the left P3. In contrast, the merus of the fourth pereopod (P4) presents 1 spine on each side; the number of spines on the ischium is also stable, namely 1 spine on each the right and left P3 and P4.

The phylogeography and genetic structure of the widely disjunct populations of *C. pholidota* remain to be studied. The species' uncommon and fragile anchialine habitats are increasingly threatened by human activities (mainly development and destruction / pollution of limestone caves). Shimoji Island, where marine and anchialine caves appear to harbour a surprising diversity of rare decapod crustaceans (Fujita et al. 2013; present study; Y. Fujita, pers. obs.), is included within the Irabu Prefectural Natural Park. In Hawaii, *C. pholidota* receives some degree of protection as most anchialine pools known to contain this and other endangered species of anchialine shrimps are found on state land (Hawaii) or within natural area reserves (Maui). Although *C. pholidota* was listed as a candidate for Endangered Species Act Protection by the US Fish and Wildlife Service in 1999, a more recent evaluation concluded that listing is not warranted because there was "insufficient information on the species status throughout its range to determine whether this species warrants protection under the Act" (US Fish and Wildlife Service 2006). Nevertheless, the Center for Biological Diversity ([www.biologicaldiversity.org](http://www.biologicaldiversity.org)) issued a petition to list *C. pholidota* as a federally endangered species.

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**琉球列島下地島から記録されたイラウモ  
エビ (新称) (甲殻亜門: 十脚目: コエビ  
下目: Barbouriidae)**

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**要旨.** アンキアライン (陸封潮溜) 環境に生息することが知られる稀少エビ類の一種, *Calliasmata pholidota* Holthuis, 1973 を琉球列島宮古諸島下地島の海底洞窟から採集された4個体に基づき報告した. 本種はこれまでに紅海 (シナイ半島), ツバル, ハワイ諸島から記録されており, インド太平洋域において飛び石状の分布を示している. 本報告は, 標本に基づく本種の日本からの初めての記録となる. また, 本研究で検討された雌標本 (RUMF-ZC-2635) を基準標本とし, 本種の新標準和名として「イラウモエビ (伊良部島・下地島地域の方名に由来する)」を提唱する.

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