



A deep-sea hydrothermal vent community dominated by Stauromedusae

Richard A. Lutz^{a,*}, Daniel Desbruyères^b, Timothy M. Shank^a,
Robert C. Vrijenhoek^a

^aDepartment of Marine and Coastal Sciences, Rutgers University, New Brunswick, NJ 08903, USA

^bDeep Sea Environment Department, IFREMER, Centre de Brest, B.P. 70, 29280 Plouzane, France

Abstract

A dense population of stauromedusan scyphozoans (morphologically similar to previously described species within the genus *Lucernaria*) was encountered in a previously undocumented area of hydrothermal activity along the crest of the East Pacific Rise (Lat. 20°50.304'N; Long. 109°05.422'W; depth of 2605 m). A few galatheid (*Munidopsis subsquamosa*) and bythograeid (*Bythograea thermydron*) crabs and occasional anemones (*Cyananthea* sp.) were the only other vent-associated megafauna observed within the region. This report represents: (1) the first documented occurrence of a biological community dominated by Stauromedusae at an active hydrothermal vent; (2) one of the deepest reported occurrences of Stauromedusae in the world's oceans; and (3) documentation of the existence of a species within a class (Scyphozoa) of organisms that thus far has not been reported from hydrothermal vents or other reducing environments. © 1998 Elsevier Science Ltd. All rights reserved.

1. Introduction

Since the discovery in 1977 of deep-sea hydrothermal vents, over 400 new species have been encountered in these unusual environments throughout the world's oceans (Grassle, 1986; Tunnicliffe, 1991; Desbruyeres et al., 1994; T. Wolff, personal communication). While the biomass and density of constituent organisms at any particular hydrothermal field are high, diversity is generally low, with a few megafaunal species dominating a single vent area. The dominant vent megafauna have included molluscs (e.g. mytilid and vesicomid bivalves, provannid gastropods), decapod crustaceans

* Corresponding author. Tel.: 001 732 932 8959; fax: 001 732 932 6557; e-mail: rlutz@ahab.rutgers.edu.

(e.g. bresiliid shrimp, bythograeid crabs), anthozoans, annelids (alvinellids), and vestimentiferans (Rona et al., 1986; Van Dover, 1990; Hessler and Lonsdale, 1991; Tunnicliffe, 1991; Lutz and Kennish, 1993; Desbruyeres et al., 1994). Herein, we offer the first account of a biological community dominated by stauromedusan scyphozoans at an active hydrothermal vent. Occurring at a depth of 2605 m along the East Pacific Rise, this discovery also represents one of the deepest reported occurrences of Stauromedusae and the first time a representative of the class Scyphozoa (Cnidaria) has been encountered in a hydrothermal vent (or any other reducing) environment.

Stauromedusae have a cosmopolitan distribution, but are most diverse and abundant in shallow, temperate waters of the Northern Hemisphere (Eckelbarger and Larson, 1993). Juvenile and adult stages are polyp-like and entirely sessile, with dispersal being restricted to an unciliated planula stage that creeps along the bottom with a vermiform type of locomotion (Thiel, 1966; Otto, 1976, 1978; Barnes, 1987). Sublittoral forms are frequently found attached to sea grass, algae or rocky substrata, and typically feed upon small crustaceans (Hyman, 1940; Eckelbarger and Larson, 1993). To date, there has been only one report of Stauromedusae in an abyssal habitat (*Lucernaria bathyphila* at a depth of 2800 m in the Northeast Atlantic) (Naumov, 1961).

2. Materials and methods

In June 1990 the submersible *Alvin* (Dive 2231) visited a previously undocumented area of hydrothermal activity along the crest of the East Pacific Rise approximately 20°50.304'N and 109°05.422'W. External cameras mounted on the manipulator arm and sponson of the submersible were utilized to obtain detailed video (recorded on a standard 8 mm format) and 35 mm photographic images of the macrofauna in the vicinity of venting fluids associated with a hydrothermally active fissure within the area. Selected video images of Stauromedusae inhabiting the fissure were frame grabbed using Media Cybernetics Image-Pro Plus software and a Coreco Oculus-TCX/MX capture board in a Dell Optiplex XMT 120 MHz Pentium computer, and printed using Adobe Photoshop software and a Fujix Pictography 3000 printer.

3. Results and discussion

Hydrothermal activity at the newly discovered vent site appeared to be restricted to a single small fissure (approximately 2 m in length) from which emanated a large quantity of cloudy, shimmering water. A dense cluster (> 100 individuals m^{-2}) of white, translucent stalked scyphozoans was observed within the fissure, and isolated organisms were present up to a distance of several meters from the opening (Fig. 1a). A size spectrum of animals was present, with maximum dimensions (proximal end of stalk to tip of tentacles) of individual organisms (discernible in video images) ranging from approximately 1–10 cm (Fig. 1b) (it should be noted that 10 cm is an unusually

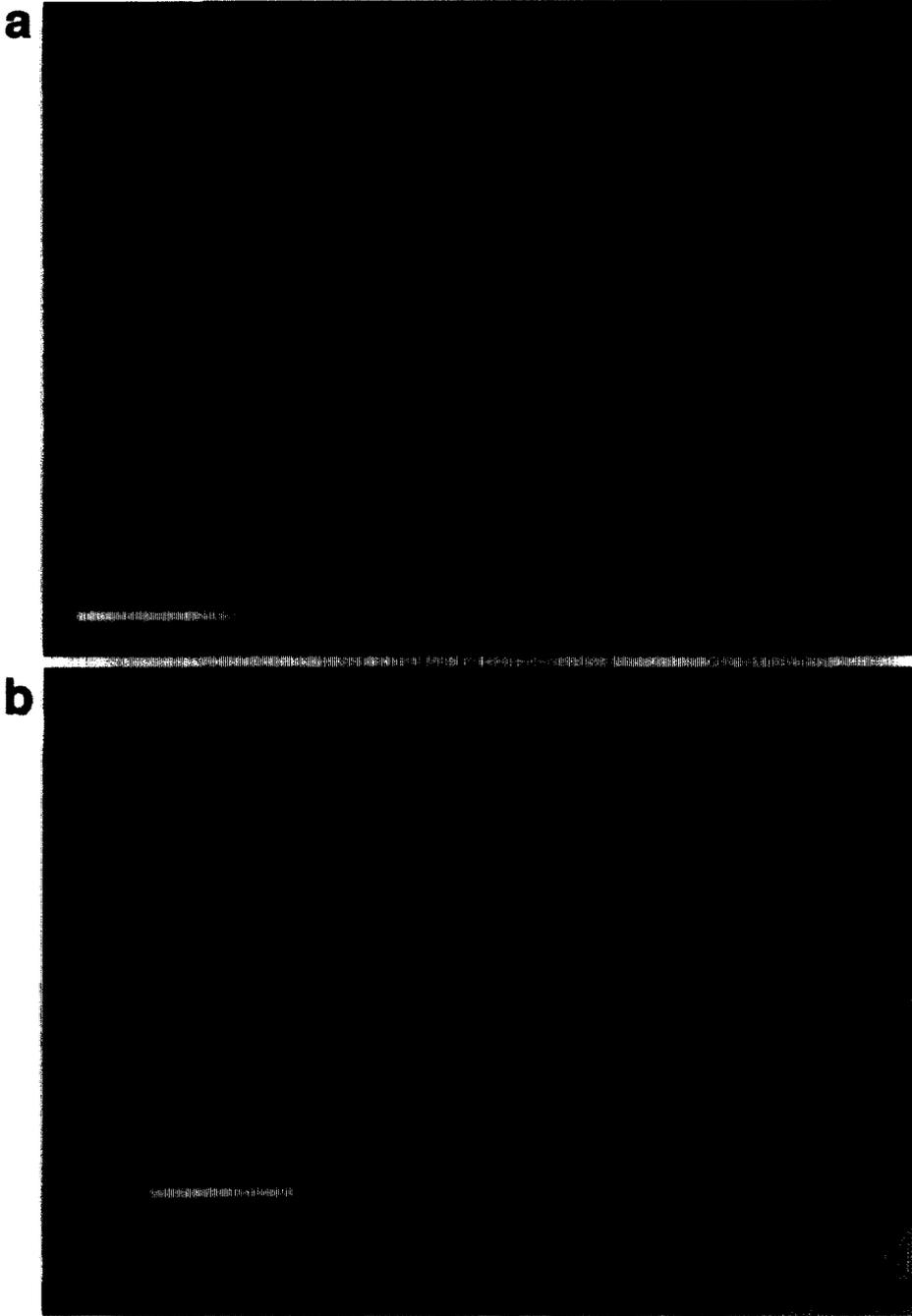


Fig. 1. (a) A dense population of stauromedusan sycphozoans clustered on bare basalt around a small fissure from which cloudy, shimmering water was emanating at a deep-sea hydrothermal vent along the crest of the East Pacific Rise (Lat. $20^{\circ}50.304'N$; Long. $109^{\circ}05.422'W$) at a depth of 2605 m. Scale bar, 10 cm. (b) Higher magnification image depicting individual polyps within the population. Scale bar, 3 cm. Prints produced from 8 mm video images taken using the deep-diving submersible *Alvin*.

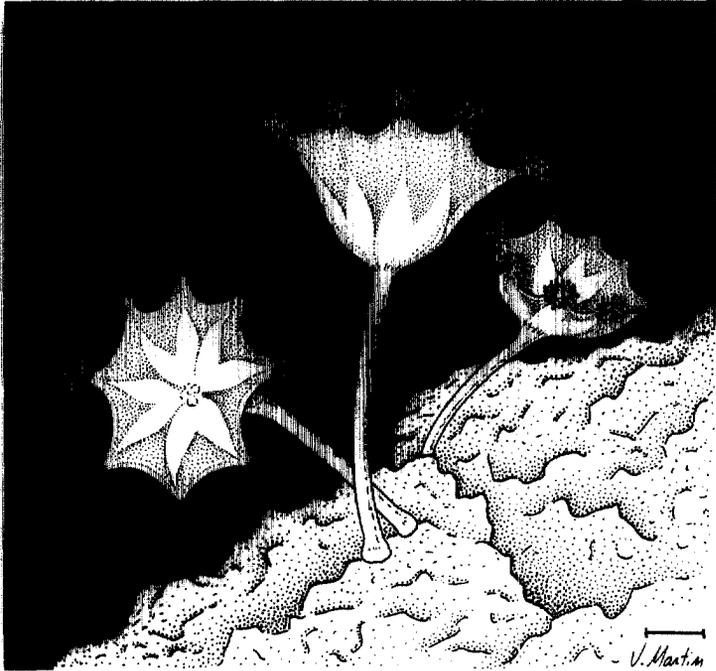


Fig. 2. Composite drawing prepared from examination of video footage taken of the dense population of stauromedusan scyphozoans depicted in Fig. 1. Note the four paired gonads, the broad concave shape of the subumbrella, and the arrangement of 8 adradial lobes, each tipped with a cluster of short capitate tentacles, all of which suggest a close affinity with previously described species of the genus *Lucernaria*. Scale, 1 cm.

large size for stauromedusae). Several distinct morphological characteristics, such as the lack of rhopaloids, broad concave shape of the subumbrella, paired gonads, and the arrangement of eight adradial lobes, each tipped with a cluster of short capitate tentacles, suggest a close affinity with previously described species of the genus *Lucernaria* (Fig. 2).

We did not encounter the stauromedusan population until the end of a very long dive and, due to power constraints, we were unable to sample organisms or obtain temperature measurements at the vent site. Detailed video and 35 mm photographic imaging within several meters of the active hydrothermal venting in the area revealed a few galatheid (*Munidopsis subsquamosa*) and bythograeid (*Bythograea thermydron*) crabs and occasional anemones (*Cyananthea* sp.) as the only other vent-associated megafauna within the region and small, swimming crustaceans (probably amphipods), which may represent one of the primary food sources of the Stauromedusae. Other typical vent-associated mega- and macrofaunal organisms (*Riftia pachyptila*, *Calypptogena magnifica*, peltospirid and lepetodrilid limpets and coiled gastropods) were locally absent, despite being abundant at nearby vent sites less than a kilometer south of the present site. The absence of these organisms may reflect unusual chemical characteristics of the venting fluids or predation by Stauromedusae on the early life history stages of vent-endemic species.

It has been suggested that certain vent-endemic species may be Paleozoic or Mesozoic relics (Newman, 1985). The cnidarians are considered primitive organisms, and the Stauromedusae have been viewed as close to the ancestral scyphozoan stem form (Hyman, 1940; Thiel, 1966; Eckelbarger and Larson, 1993). Stauromedusae belong to a scyphozoan order characterized by unciliated planulae and are thought to have a highly restricted dispersal capability. While morphological similarities exist between these Stauromedusae and shallow-water species belonging to the genus *Lucernaria*, taxonomic placement awaits subsequent collection of the organism from the site. Despite the present taxonomic uncertainty, the presence of these organisms at a deep-sea hydrothermal vent site raises many intriguing questions concerning: (1) their biogeography and mechanisms of dispersal between discrete deep-sea hydrothermal systems; and (2) evolution of the Cnidaria, which has been termed one of the “essential phyla” in “the discussion on the origin of metazoan phylogeny” (Thiel, 1966). Given the fact that the species is one within a class (Scyphozoa) that thus far has not been reported from hydrothermal vents or other reducing environments, collections and further ecological and physiological studies of these highly unusual deep-sea inhabitants at this unique hydrothermal site are clearly warranted.

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