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# The Largest and Oldest Known *Choia hindei* (Dawson), From The Middle Cambrian of the House Range, Western Utah

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## ABSTRACT

A large example of *Choia hindei* (Dawson) was collected from the Middle Cambrian Marjum Limestone at Sponge Gully in the House Range, Utah. The specimen has been vertically flattened so that the ovate, finely spiculed, central disc is clearly defined and surrounded by coarse coronal spicules. A second specimen of *Choia hindei* from the underlying Middle Cambrian Wheeler Shale from near Swasey Spring, is somewhat larger, with coarser and longer coronal spicules. The Wheeler Shale fossil is the largest and oldest specimen of this monactinellid demosponge thus far reported. Unfortunately, because of how it flattened, form of the central disc is uncertain, although it is clearly composed of fine radially arranged monaxial spicules.

## INTRODUCTION

Three species of the monactinellid demosponge *Choia*, as part of moderately diverse Cambrian sponge assemblages, have been previously reported from Middle Cambrian formations in the House Range, in western Millard County, Utah (Walcott, 1920; Robison, 1964; Rigby, 1978; and Rigby, 1983). Specimens of the large species *Choia hindei* (Dawson, 1896) have been previously described from the upper Middle Cambrian Marjum Formation of the House Range (Rigby, 1983). However, these specimens were all laterally flattened and full dimensions of their central discs were not evident. The Marjum Formation sponge described here is the first vertically flattened specimen of the species known from Utah, and it is also among the largest specimens of the species known to date. Additionally, a single specimen of an even larger and coarser *Choia hindei* was recovered from the upper Wheeler Shale near Swasey Springs in the northern part of the House Range during quarry operations in 1982. It was somewhat folded during burial so details of the central disc are not clearly preserved, although the distinctive coarse coronal spicules are very evident. Morphological insights stemming from these specimens are discussed in this paper.

Depositional environments and paleoecology of the upper Wheeler Shale and overlying lower Marjum Formation, at the two quarries where the sponges described here were collected, were the focus of a study by J.C. Rogers (1984). He concluded that rocks of the upper Wheeler Shale, at the Swasey Springs quarry site, and the lower Marjum Formation, at the Sponge Gully quarry site, accumulated largely as fine turbidite-transported debris in a deep basin. That deep-water embayment, which extended eastward from an outer detrital belt into the margin of a carbonate shelf, was earlier defined by Brady and Koepnick (1976). Both quarries where the sponges were collected are in thin-bedded, coarse-to-fine, dark gray, calcareous shale, with minor interbedded, thin bedded, black limestone (Rogers, 1984), and the sponges that were recovered from the quarries (Rigby, 1983) were probably transported westward from the shelf or shelf margin. Their rapid burial by fine sediments probably contributed to their excellent preservation.

## SYSTEMATIC PALEONTOLOGY

Class DEMOSPONGEA Sollas, 1885  
Order MONACTINELLIDA Zittel, 1877  
Family CHOIIDAE de Laubenfels, 1955

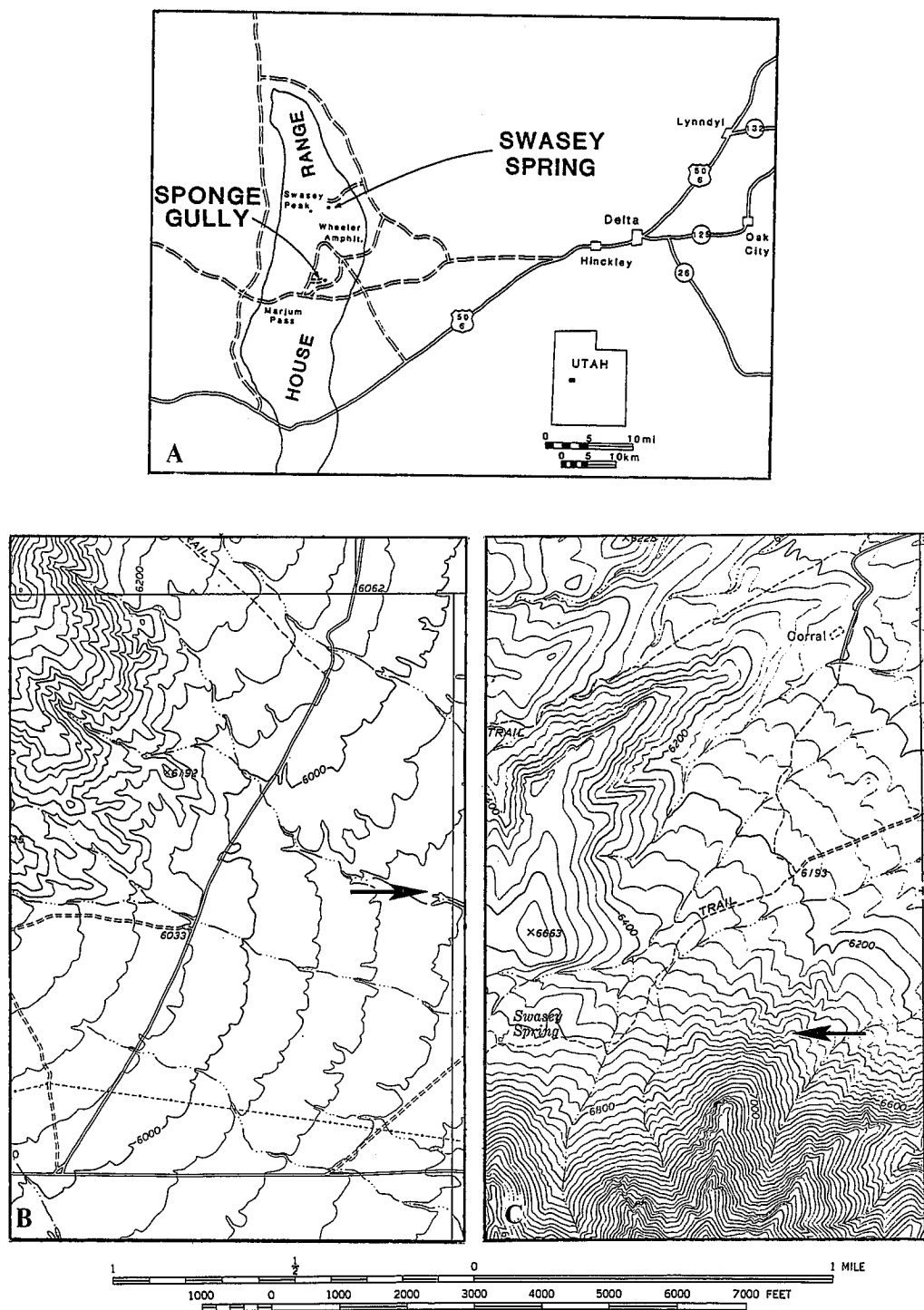


Figure 1. Index maps to the sponge localities in the House Range, Millard County, Utah. (A) Regional map showing positions of the Sponge Gully and Swasey Spring localities in the House Range, west of Delta, Utah. (B) Arrow indicates the location of the Sponge Gully locality, north of the Marjum Pass road, in the southeastern part of Section 4, T. 18 S., R. 13 W., the northeast corner of which is shown by the section line intersection in the upper right; Marjum Pass 7 1/2-minute quadrangle. (C) Arrow indicates the location of the Swasey Spring locality, east of Swasey Spring, in Section 24, T. 16 S., R. 13 W., the northeast corner of which is indicated by the T-shaped mark in the section line along the eastern margin of the figure; Swasey Spring 7 1/2-minute quadrangle. Scales of (B) and (C) are shown below.

Genus *CHOIA* Walcott, 1920  
*CHOIA HINDEI* (Dawson, 1896)

Figs. 2a, 2b

*Stephanella hindei* DAWSON, 1896, p. 117, text-fig. 28

*Choia hindei* (Dawson) WALCOTT, 1920, p. 295–296,

Pl. 76, figs 1, 1a; RIGBY, 1983, p. 253–254, fig. 5B.

**Diagnosis.**—Large choioid sponge with central thatched disc, up to 12 cm in diameter, composed of monaxons (oxeas?) up to approximately 0.16 mm in diameter and 10 mm long. Coronal spicules up to 1.4 mm in diameter, with most 0.6–0.7 mm across at edge of disc and up to 180 cm long, with most 5 to 6 cm long. Coronal spicules smooth, doubly tapering, irregularly placed throughout the low-conical central disc.

**Description.**—Partial counterparts of the large ovoid sponge from the Marjum Formation, USNM 480613, (Fig. 2a) both include much of the finely spiculed central disc and some coronal spicules. The more nearly complete counterpart includes nearly all of the ovoid central disc and part of the surrounding fringe of coronal spicules, while the smaller fragmental counterpart includes only part of the central disc impression and a few coronal spicules.

The flattened ovoid central disc in the large counterpart has a long diameter of 11.3 cm, broken at one end, and a shorter diameter of 7.3 cm. It has faint impressions of the radiating fine spicules of the main thatch, that are 0.05–0.10 mm in maximum diameter within central and peripheral parts of the thatch. These spicules are locally preserved as parallel, closely packed, three-dimensional linear casts and molds that may be coated with a thin film of yellowish iron oxide. Because of their tapering structure and interfingering relationships, their average lengths are difficult to determine, but they range up to at least 5 or 6 mm long.

Large coronal spicules extend from within the central disc to 4–5 cm beyond the disc margin as solitary elements of a spinose fringe. They are probably 7–8 mm long, but because their tips are either covered or obscure in the interior of the disk, and have been broken at their outer ends, their full lengths are uncertain. They have measurable maximum diameters, or widths in their flattened cast-and-mold preservations, of 0.7–0.8 mm, but are commonly 0.5–0.6 mm wide through much of their double-tapering lengths. They range from side-by-side to 4–5 mm apart in the impression, and apparently had proximal tips with origins at various levels within the thatch of the central disc. Like the smaller thatch spicules, these larger elements are also locally coated or defined by thin films of yellow iron oxide.

The older specimen from the Wheeler Shale, USNM 480614, (Fig. 2b) is a somewhat comet-shaped impression

in which the central disc is poorly defined, but the long monaxial coronal spicules produce a prominent flaring structure. Those spicules diverge, fan-like, through approximately ninety degrees and extend up to 16–18 cm from what appears to be the central part of the incomplete, probably folded, central disc. Well-defined doubly tapering segments of the coronal spicules are clearly traceable for 12–14 cm, but their inner ends are commonly buried or broken so their full lengths are uncertain. Most of them are approximately 1.0 mm in diameter at mid-length, although a few flattened impressions range up to 1.4 mm wide.

Segments of much smaller, doubly tapering, monaxial spicules occur in preserved fragments of the central disc and are locally traceable for 5–6 mm, but complete spicules could be twice that long. Most are 0.02–0.03 mm in mid-length diameter, although some range up to 0.10 mm in across. They form a fine-textured parallel fabric and are side-by-side in what is interpreted to be central parts of the disc, but in fragments of the outer disc they may be more widely separated in a less compact structure. These disc spicules are parallel to inner ends of the coronal spicules and locally occur below and above them in the folded and flattened impression.

**Discussion.**—These are the largest known specimens of this large species of *Choia*. As Rigby (1983, p. 253) noted, this species is at least one order of magnitude larger than the smaller *Choia riddlei* Walcott, 1920, and is three to five times larger than *Choia carteri* Walcott, 1920 and *Choia utahensis* Walcott, 1920.

**Figured specimens.**—USNM 480613, part and counterpart, was collected in 1988 by Nancy Meyers, of Plain City, Utah, from the middle Marjum Limestone in the Sponge Gully quarry. The quarry is on the north side of a small gully in NW 1/4, SE 1/4, SE 1/4 of Section 4 (unsurveyed), T. 18 S., R. 13 W., in the *Modocia* beds, 180–200 feet above the base of the Middle Cambrian Marjum Formation, on the eastern slope of the House Range, in the Marjum Pass 7 1/2-minute Quadrangle, Millard County, Utah (Rigby, 1983, p. 243).

USNM 480614, the large specimen from the Wheeler Shale, is also represented by part and counterpart on thick blocks of gray, thin bedded, graded-bedded calcareous shale. They were collected by Val Gunther in 1982 from the Middle Cambrian Wheeler Shale, at the Swasey Spring quarry (Rogers, 1984, p. 98), which is approximately 0.8 of a mile east of Swasey Spring, in the northwestern part of SE 1/4, SW 1/4, NE 1/4, of Section 24 (unsurveyed), T. 16 S., R. 13 W., in Millard County, Utah, on the Swasey Peak 7 1/2-minute quadrangle. The quarry is located 0.65 km (0.4 miles) south and 0.56 km (0.35 miles) west of the northeast corner of section 24, on the brow of a small spur, with light-weathering rock debris on either side so that it is visible from the access road to Swasey Spring. The

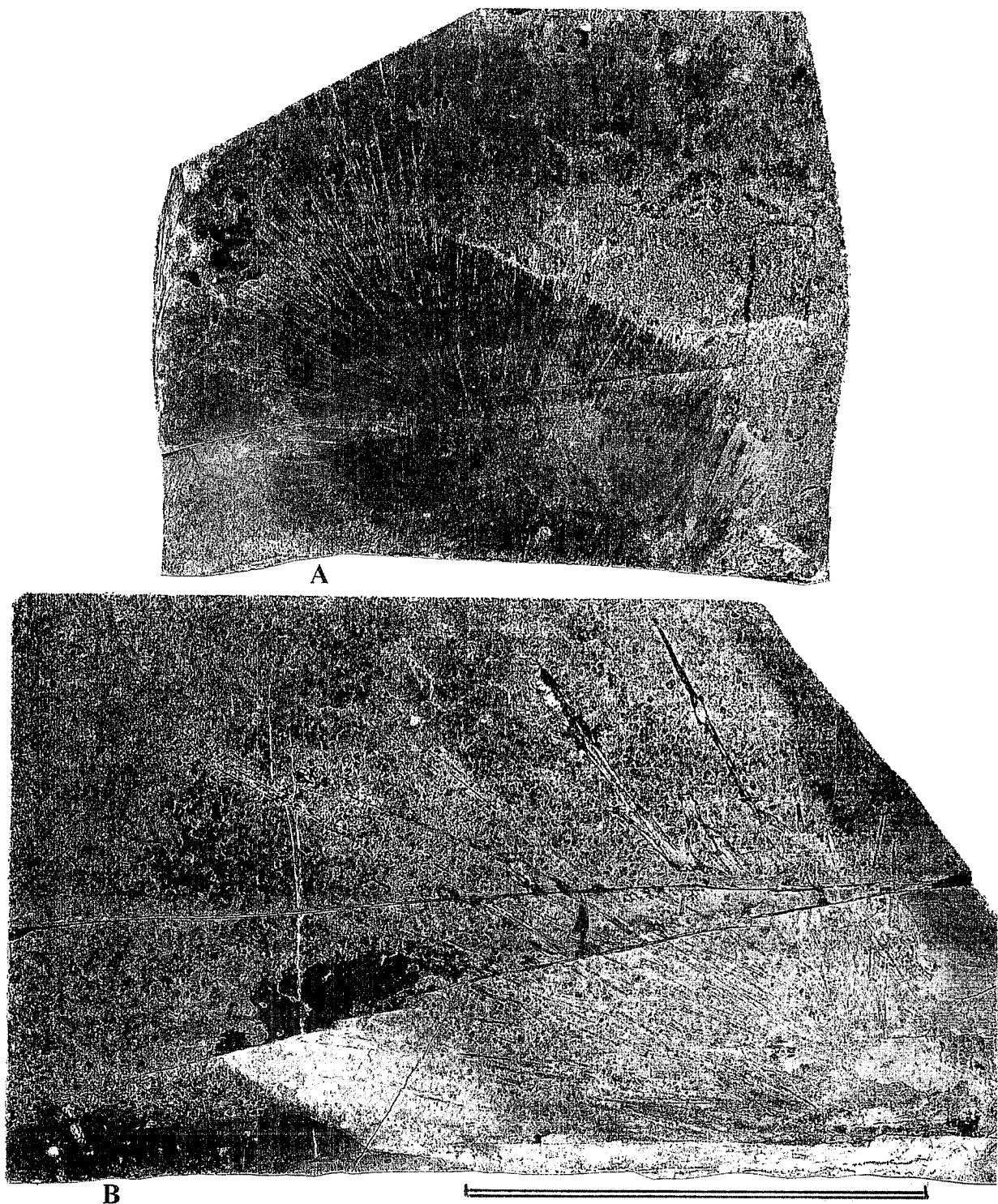


Figure 2. Middle Cambrian specimens of *Choia hindei* (Dawson), from the House Range, Utah. Bar scale at base equals 10 cm. (A) The largely intact central disc is composed of radiating fine monaxial spicules, into which are inserted proximal ends of coarser coronal spicules; light spicules margins are composed of light yellow iron oxide; USNM 480613, from Sponge Gully locality, approximately X 08. (B) Diagonally flattened specimen in which only fragments of the central disc are preserved as darker, finely spiculated, areas in the lower right, from which coarser coronal spicules radiate in the somewhat fan-shaped impression. USNM 480614, from Swasey Spring locality, approximately X 0.8.



sponge came from 1.9 m below the top of the quarry, which is 70 m below the top of the Wheeler Shale and the base of the Marjum Formation.

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Val Gunther collected the specimen from the Swasey Spring quarry in 1982, as part of NSF Project EAR-8201428 by Rigby, on the Cambrian sponges of western Utah. Nancy Meyers, of Plain City, Utah, collected the large *Choia hindei* from the Sponge Gully quarry in 1988. Matthew Mabey, of the Department of Geology at Brigham Young University, assisted in photography of the sponges. Appreciation is also expressed to reviewers of the manuscript for their constructive criticisms and suggestions.

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