

Middle and Late Devonian sponge spicules of the Holy Cross Mountains and Silesian Upland

HELENA HURCEWICZ



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Calcareous octactinellid sponge spicules are abundant in the Givetian and early Frasnian organic buildups in the Holy Cross Mts and Siewierz anticline, Silesian Upland. Monaxone-bearing siliceous Demospongea (or ?lyssakid Hyalospongea) occupied coeval quiet-water basin habitats. Significant reorganization within these generally deeper-water associations occurred late in the Frasnian (a local rise of the lithistids associated with dictyids and lyssakids) and early in the Famennian (profusion of Hyalospongea).



Key words: sponges, Octactinellida, Triaxonia, Devonian, Poland.

Helena Hurcewicz, Katedra Geologii, Uniwersytet Łódzki, Aleja Kościuszki 21, 90-418 Łódź, Poland.

Introduction

Sponges in the Devonian of the Holy Cross Mountains have been reported for some time from the thick and widespread Givetian to Frasnian stromatoporoid-coral series Kowala Formation and overlying marly-detrital beds (Rigby *et al.* 1981; Racki *et al.* 1985; Racki 1993). Recently, whole demosponge specimens have been described (Hurcewicz 1985, 1986) from the Middle to Late Devonian boundary beds, but the findings were limited to essentially non 'reef' deposits of the more northern sites.

The present paper deals primarily with loose, dispersed skeletal elements, some varieties of which occur frequently in some Givetian to early Frasnian limestones in the Holy Cross Mountains and Silesian Upland; new data on the Famennian sponges are also presented.

Spicule-bearing sections are localized mostly in the SW part of the Holy Cross Mountains, particularly in the Gałęzice syncline (Kielce facies region), the Jurkowice-Budy Quarry situated in the easternmost part of the region, and Brudzowice-Dziewki hill near Siewierz in the Silesian Upland (see Racki this 1993 locality register). The early Famennian spicules were

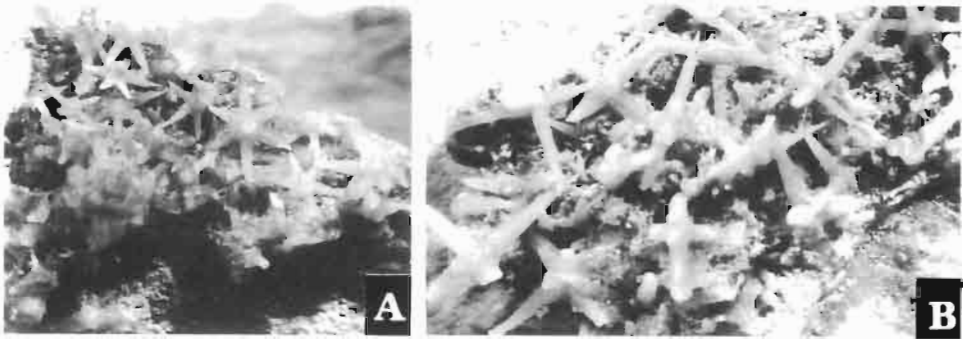


Fig. 1. Two fragments of an octactinellid sponge with articulated spicules in the wall, $\times 5$ (A) and $\times 8.5$ (B). Sowie Górki, set C. Late Givetian.

derived from radiolaria-rich marly limestone at Wola Quarry near Kowala, and from loose blocks of waste at Wola Murowana hill, southwest of the village.

The described material is housed in the Chair of Geology, Łódź University, Łódź.

Calcareous octactinellid sponges

Most conspicuous components of the association studied are robust octactine spicules of large sizes (Figs 2, 3). They are calcitic and generally well preserved, although some overgrowths were observed. Wendt (*in* Hartman *et al.* 1980) claimed that their original skeletal mineralogy was aragonitic.

Interestingly, a fragment of a thick walled (ca. 1 cm) *astraeospongiid* with articulated large spicules (Fig. 1) was found at Sowie Górki.

The 'axial' (vertical) rays are usually modified in the spicules. In some forms, like *Astraeospongium*, both rays are shortened, up to complete reduction. Bending or splitting of tips in elongated vertical ray characterizes another kind of octactinellid spicules (*cf.* octactine type 1b of Langer 1991), known to occur (see Rigby 1991: Fig. 5) in *Ensferites*.

Minute octactinellid spicules (up to 2 mm) are usually thin-rayed. In larger spicules (above 2 mm) rays may be strongly thickened, fusiform in shape; these pillar-like polyactines develop a strongly thickened (up to 8 mm) proximal ray (Fig. 3C-E).

Spicules with reduced axial rays are the most numerous and widespread. Pillar-like varieties occur in a limited number of localities, e.g. in Kadzielnia, Siewierz (set C) and Jaźwica (set I). These calcareous sponges occur in abundance in the Paleozoic of the North American Midcontinent and Europe, being reported from many Middle Devonian localities (Hinde 1888; Rietschel 1968; Rigby 1979).

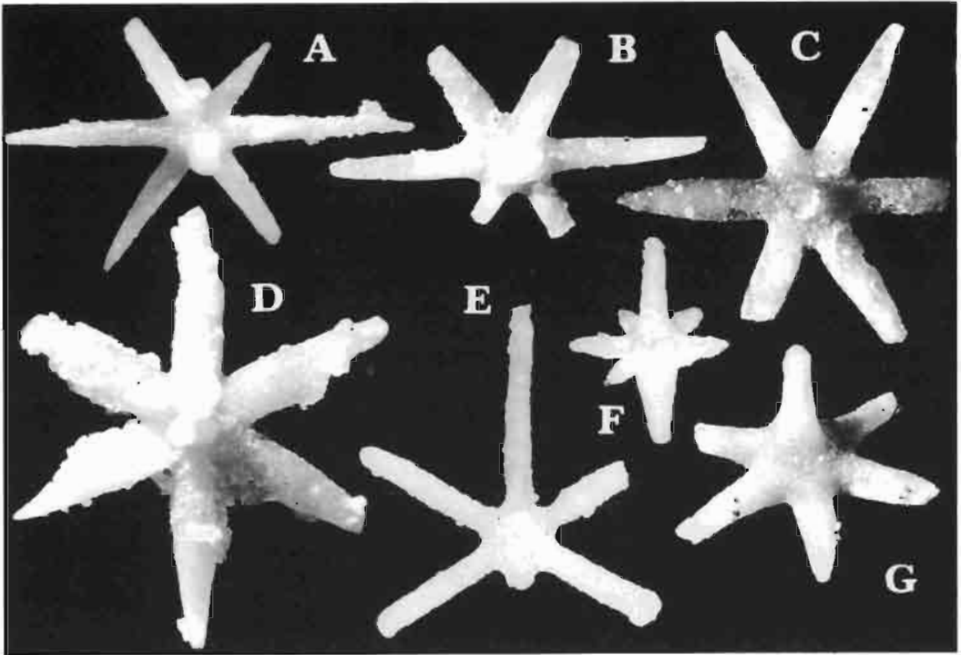


Fig. 2. Octactinellid spicules with pointed axial rays from the Givetian (A-E, G) and Early Frasnian (F). Regular octactines from Siewierz (set C; A-D, G; set B, E), Kowala railroad cut (set C, F). All $\times 20$ except for A that is $\times 30$, B and F $\times 15$.

Siliceous sponges

Monactines.— The uniaxial elements displaying different tips are most frequent in samples from the Jazwica site (set B). Straight elements with one tip blunt and another one sharply pointed (styles) predominate, but curved (amphistyle) and spinose (acanthostyle) varieties, as well as monactines showing one tip rounded, and another one sharp (tylostyle) were found also.

Diactines.— The commonest are smooth, straight elements with both ends pointed (oxea; Fig. 4A) and their arched variant (amphioxea). The spicules are different-sized in particular localities, e.g. 3 to 6.25 mm at Posłowiec, 1.2 to 4 mm at Sitkówka, and up to 4.5 mm at Góra Zamkowa.

Rounded (smooth tylote, spined acanthotylote) and blunt-ended (strongyle) diactines are infrequent. Minute variant (microoxea), ranging below 0.1 mm, occurs sporadically.

Tetraxones.— Several varieties (e.g. acanthotriactine with one ray reduced, Fig. 4C) were recovered from the Early Famennian deposits. Only protriaenes (displaying long proximal ray and three smaller transversal, anteriorly directed rays; Fig. 4B, D) have been found also in the Late Givetian of the Jazwica section, as well as single smooth tetraclone recorded in a sample from Sitkówka.

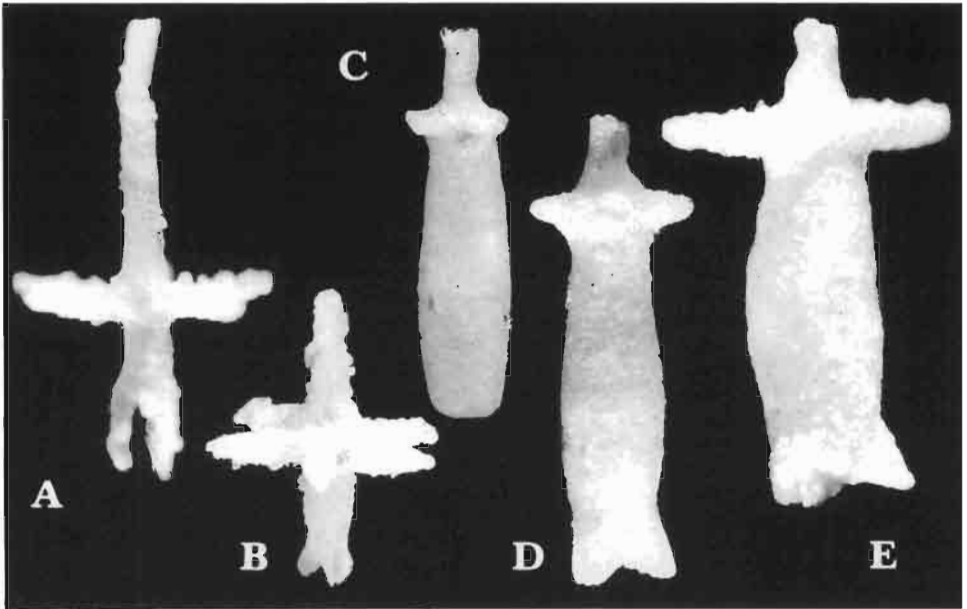


Fig. 3. Octactinellid spicules with bifurcated proximal ray from the Givetian (A) and Lower Frasnian (B-E). □A-B. Octactines with bifurcated proximal ray from Siewierz (set C; A) and Jaźwica (set J; B); both $\times 30$. □C-E. Pillar-like varieties from Kadzielnia; all $\times 20$.

Triaxones.— These spicules are common in the early Famennian association. Differentiated six-rayed (hexactines, acanthohexactines), five-rayed (pentactines; acanthopentactines, Fig. 4F; plagiopentactines; anapentactines, Fig. 4G) and four-rayed (stauractines; Fig. 4E) elements are most characteristic. Diactines of a triaxone and uncinates are relatively rare.

Stratigraphic and facies relationships

A prolific development of calcareous octactinellids was typical of the vast late Givetian to early Frasnian sea-shelf of the Holy Cross Mountains and Silesia regions. They were a common accessory component of different biostromes and related biotas, but the most extensive accumulations of the spicules are found in the *Stringocephalus* Beds at Siewierz, and the biohermal Kadzielnia-type limestones.

The second association includes solely monaxone-bearing siliceous demosponges (and/or ?lyssakid hyalosponges). There are sites where calcitized demosponge monaxones are associated with rare octactinellid spicules (Posłowice, Jaźwica). In some cases monaxons associated with the octactinellids (e.g. Sowie Górkki, set C; Laskowa Góra; Góra Zamkowa, set I; Kowala hill) may appear (cf. Langer 1991) originally calcareous.

The demosponges were important elements of varied benthic biotas dominated by shelly and echinoderm faunas, which thrived during the late

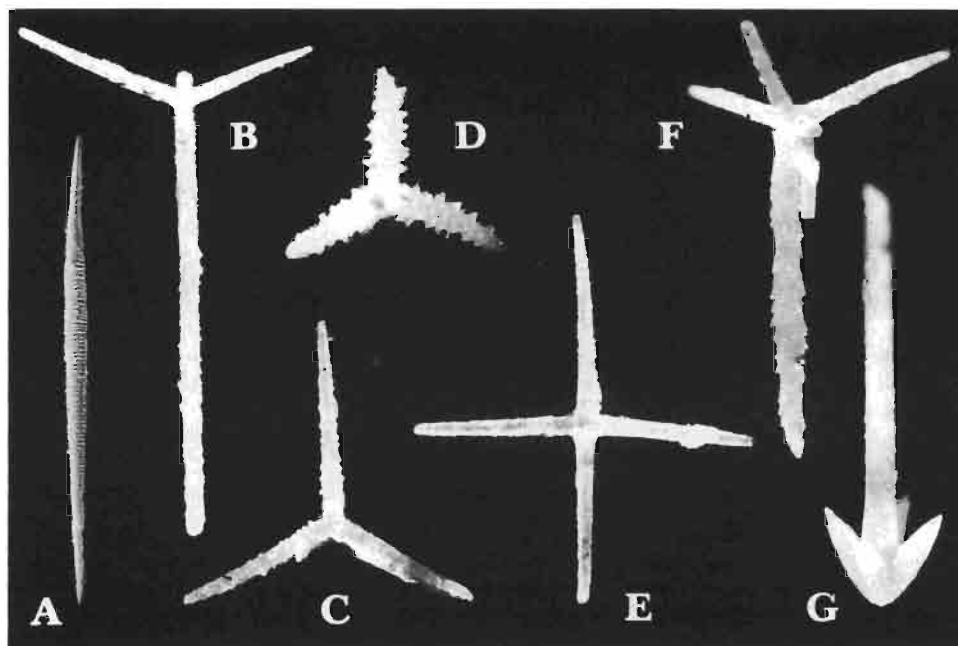


Fig 4. Calcitized, originally siliceous sponge spicules from the Late Givetian (A-B) and Early Famennian (C-G). □A. *Oxea* from Laskowa Góra; $\times 15$. □B-D. Tetraaxones: protriaenes (B, D), and acanthotriactine (C) from Jaźwica (set B; B) and Kowala Quarry (C-E). All $\times 30$ except for C that is $\times 20$. □E-G. Triaxones: stauractine (E), acanthopentactine (F) and anapentactine (G) from Kowala Quarry. All $\times 30$ except for F that is $\times 90$.

Givetian transgressive episode in the southwest part of the Kielce carbonate platform (see data on the Jaźwica Member in Racki 1993). The sponges prevailed in some slightly younger assemblages (sites Sitkówka and Góra Zamkowa, set H) inhabiting quiet, deeper-water environments, similar to modern *Poecilosclerida* and *Lyssakida* (Finks 1960; Reid 1968).

Sponges with rigid siliceous skeletons, (i.e.) lithistids, and rarer dictyids, accompanied by lyssakids, flourished locally in some Frasnian deeper subtidal habitats of the southern Kielce region (Hurcewicz 1985; see also Rigby 1979; Rigby *et al.* 1981). Furthermore, early Famennian spicule assemblages of the Gałęzice Syncline indicate an abundance of the *Hyalospongea*, probably due to further deepening of the shelf basin; this association may be analogous to that described from the Early Carboniferous of the Silesia-Cracow Region by Alexandrowicz (1978).

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Streszczenie

Bogaty zespół spikul świadczy o znacznym zróżnicowaniu gąbek w żywocie i późnym dewonie Gór Świętokrzyskich i regionu śląsko-krakowskiego. Spikule wielopromienne gąbek wapiennych z rodziny *Astraeospongiidae* należą do najbardziej szeroko rozpowszechnionych i zróżnicowanych, szczególnie w żyweckich i wczesnofrańskich budowlach organicznych (np. biohermach typu kadzielniańskiego).

Gąbki krzemionkowe z gromady *Demospongea* (lub ?lyssakidy z *Hyalospongea*) zazwyczaj zasiedlały wówczas biotopy basenowe, o niskiej energii wód. Znaczne zmiany w obrębie tego typu asocjacji gąbkowych nastąpiły w późnym franie (lokalny rozkwit litistidów oraz Dictyida i Lyssakida) i wczesnym famenie (rozwój głębokowodnych zespołów z przewagą gąbek szklistoszkieletowych).