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A new soft coral species from the Gulf of Mexico (Octocorallia: Scleralcyonacea: Parasphaerascleridae)

ANDREA M. QUATTRINI[1*], DECLAN MORRISSEY[1] & LUKE J. MCCARTIN[2]
[1]*Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington DC, USA.*
morrisseyd@si.edu; https://orcid.org/0000-0003-3064-3560
[2]*Department of Biological Sciences, Lehigh University, Bethlehem PA, USA.*
ljm419@lehigh.edu; https://orcid.org/0000-0001-5374-3148
**Corresponding author: quattrinia@si.edu; https://orcid.org/0000-0002-4247-3055*

Abstract

A new species of soft coral, *Parasphaerasclera mcfaddenae* (Octocorallia: Scleralcyonacea: Parasphaerascleridae), is described from mesophotic hardbottom habitats of the Gulf of Mexico, western North Atlantic Ocean. Previously, this family was only known from the tropical Indo-Pacific and South Africa; therefore, we extend the distribution of the family Parasphaerascleridae into the North Atlantic Ocean. This diminutive species differs from other parasphaerasclerids by a capitate growth form, non-retractile polyps, and presence of tuberculated spindles. Notably, this species was also detected in environmental (e)DNA samples from locations where it was not physically collected, highlighting the importance of both eDNA for biodiversity surveys as well as specimen collections for building comprehensive reference databases for eDNA analyses.

Key words: *Parasphaerasclera,* Scleralcyonacea*,* North Atlantic Ocean, eDNA, mesophotic reef

Introduction

The Gulf of Mexico (GoM) is a basin in the western North Atlantic Ocean that contains coral reefs, gardens, and other marine animal forests (see Rossi *et al.* 2017) from shallow waters to the deep sea. To date, approximately 160 corals in the Class Octocorallia (Cnidaria: Anthozoa), which include soft corals, gorgonians, sea pens and stoloniferans, have been documented at depths down to at least 2800 m (Cairns & Bayer 2009, Hourigan *et al.* 2017). Soft corals appear to be uncommon and much less diverse compared to gorgonians, at least according to current records. Eleven soft coral species from across six families and eight genera [Aquaumbridae Breedy, van Ofwegen & Vargas, 2012 (*Aquaumbra* Breedy, van Ofwegen & Vargas, 2012), Capnellidae McFadden, van Ofwegen & Quattrini, 2024 (*Pseudodrifa* Utinomi, 1961), Coralliidae Lamouroux, 1812 (*Bathyalcyon* Versluys, 1906*, Anthomastus* Verrill, 1878, *Pseudoanthomastus* Tixier-Durivault & d'Hondt, 1974), Nidaliidae Gray, 1869 (*Nidalia* Gray, 1835), Siphonogorgiidae Kölliker, 1874—cited in Kölliker, A. (1875) (*Chironephthya* Studer, 1887), Nephtheidae Gray, 1862 (*Stereonephthya* Kükenthal, 1905)] have been documented to occur in the region, although the latter record is dubious as the family is limited in distribution to the Indo-west Pacific (McFadden *et al.* 2022). In contrast, more than 125 species of gorgonians (e.g., with a proteinaceous, scleritic, or calcitic axis) are known from the GoM. Although the majority of octocoral taxa (~118 species, Cairns & Bayer 2009, Hourigan *et al.* 2017, Brooke *et al.* 2023) documented in the region are known from deep waters (>200 m), coral gardens in mesophotic depths are extensive and require further characterization and assessment. Establishing baseline biodiversity estimates of octocorals in the GoM across a wide depth range is essential to informing habitat management, protection, and restoration efforts, particularly as resource extraction and ensuing disasters (e.g., oil spills) threaten the health of vulnerable coral ecosystems throughout the region.

During a recent offshore expedition in the northern GoM, a diminutive soft coral was collected with a remotely operated vehicle (ROV) along an extensive area of mesophotic hardbottom habitats, known as the Pinnacle Trend

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(Fig. 1). Upon morphological examination and molecular characterization, this coral was determined to be a new species within the family Parasphaerascleridae, a family of soft corals unknown to the North Atlantic Ocean. Previously, this family was found only off South Africa and in the Indo-Pacific (McFadden & van Ofwegen 2012). Currently, the family contains one genus and nine species (Worms Editorial Board, 2016) with the most recent species described off western Australia by Bryce *et al.* (2015). Here, we systematically describe a new species of *Parasphaerasclera.* We also discuss this new species discovery in the context of environmental (e)DNA analyses and exploration of deepwater coral habitats.

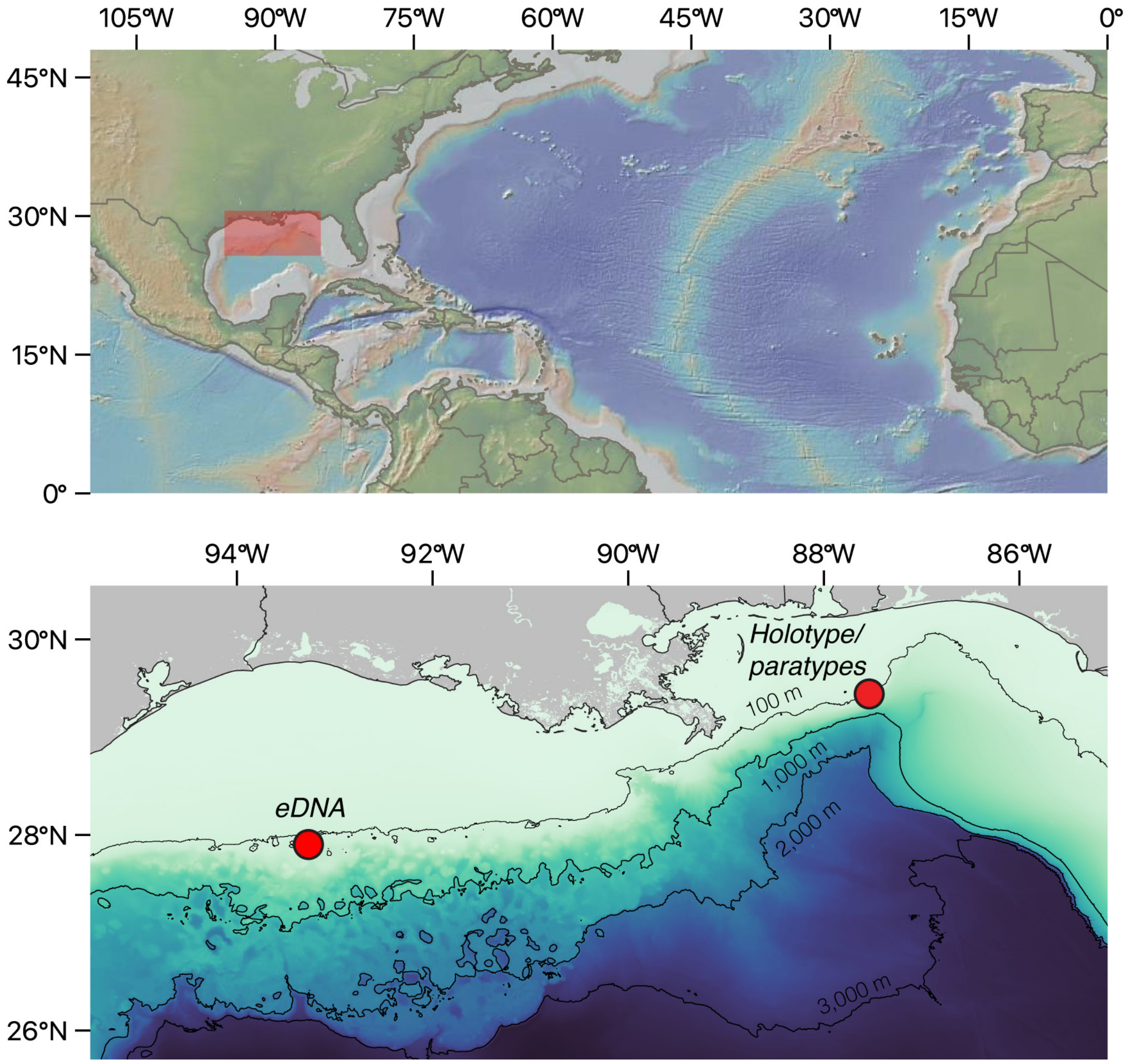

FIGURE 1. Map with the sampling locations of the *Parasphaerasclera mcfaddenae* **sp. nov.** specimens, and seawater samples where *P. mcfaddenae* was detected in eDNA sequencing data. The lower map corresponds to the area that is highlighted in red in the upper map. The upper map is from the Global Multi-Resolution Topography Data Synthesis (Ryan *et al.* 2009) (gmrt.org). Bathymetric data in the lower map is from the General Bathymetric Chart of the Oceans (GEBCO Compilation Group 2023) (www.gebco.net).

Methods

Specimen Collection

Three individuals were collected in July 2022 in the northeastern GoM during an expedition aboard the NOAA Ship *Pisces* (PC-22-02) as part of the Mesophotic and Deep Benthic Communities (MDBC) Program, under the Deepwater Horizon Oil Spill Natural Resource Damage Assessment, Open Ocean Trustee Implementation Group Final Restoration Plan 2 (OOTIG 2019). The specimens were collected from a hardbottom habitat within the Pinnacle Trend at a depth of 74–75 m with a suction sampler attached to the remotely operated vehicle (ROV)

Mohawk. Tissue samples were taken for genetic analyses and voucher specimens were preserved in 95% EtOH. Samples were deposited in the Smithsonian National Museum of Natural History (NMNH or USNM).

Morphological Analysis

A thin cross section was cut from the holotype (USNM1676189) with a razor blade and briefly immersed in 5% bleach followed by hydrogen peroxide to remove tissue while keeping the sclerites in place. Further, one polyp and a piece of the coenenchyme from the inner and outer stalk and the surface of the capitulum were dissected and dissolved in 5% bleach, followed by rinses with hydrogen peroxide, water, and 95% ethanol. Sclerites were then allowed to dry and were shaken onto a double-sided carbon adhesive fixed to a metal stub. The thin cross section was also adhered to the carbon adhesive. Stubs were gold coated for 120 s using a Quorum Q150R ESplus at a sputter current of 25 mA, resulting in a coat thickness of approximately 10 nm, and were imaged at 15 kV using a Thermofisher APEREO Field Emission Scanning Electron Microscope (SEM) at the Centre for Imaging, National Museum of Natural History. In addition, sclerites from the paratypes were examined using a light microscope but not imaged with SEM.

Molecular Analysis

DNA was extracted from single polyps of two specimens (USNM1676189, USNM16761940) on a 96-well plate with other samples using the high-throughput AutoGen (Holliston, Massachusetts, USA) extraction device, which uses a phenol-chloroform based extraction method. DNA was quantified with a QuantIT kit and 23–32 ng from each specimen was used as input into library preparation. The NEBNext Ultra II FS DNA Library Prep Kit was used with some modifications as in Quattrini *et al.* (2024). DNA libraries were quantified and assessed with a Qubit fluorometer High Sensitivity Assay and an Agilent Tapestation. Samples were sequenced on an Illumina NovaSeq X at Admera Health (South Plainfield, NJ) for a target read number of 10M paired-end (PE) reads (150 bp).

Demultiplexed reads were trimmed with fastp v 0.23.4 (Chen *et al.* 2018) to remove polyG tails and passed to Trimmomatic v 0.40 (Bolger *et al.* 2014) to remove adapters. Circularized mitochondrial genomes were assembled *de novo* for each individual using NOVOplasty v. 4.3.3 (Dierckxsens *et al.* 2017). A partial *cox1*, retrieved from the mitogenome of *Parasphaerasclera valdiviae* (Kükenthal, 1906) (Genbank Accession NC_062023.1, Muthye *et al.* 2022), was used as a seed. In addition, a k-mer size of 21 was used and the initial seed was not extended. Annotation was completed with Mitos2 (Donath *et al.* 2019) using translation table 4 (Mold, Protozoan, Coelenterate) with Refseq 89 Metazoa. Annotations were fine-tuned in Geneious Prime 2023.1.1 (https://www.geneious.com) using the ORFfinder function. *mtMutS* was then pulled from the mitogenome data, trimmed to a target length of 702 bp and aligned using LINS-I method in MAFFT v 5 (Katoh *et al.* 2005) with a reference dataset that included 446 *mtMutS s*equences (McFadden *et al.* 2022, Quattrini *et al.* 2024, see https://doi.org/10.25573/data.24319078 for alignment file) and an additional four *Parasphaerasclera* sequences from GenBank (MG583636: Etsebeth 2018, HG970082: Bryce *et al.* 2015, DQ302809: McFadden *et al.* 2006, HG970081: Bryce *et al.* 2015). The resulting alignment was input into IQTree v 2 (Minh *et al*. 2020) for maximum likelihood phylogenetic reconstruction using modelfinder (-m TESTMERGE, Kalyaanamoorthy *et al.* 2017) and 1000 ultrafast bootstrap replicates (-B 1000, Hoang e*t al.* 2018).

We also obtained the *28S* rDNA sequence from the trimmed read data of our holotype specimen USNM1676189 with BLAST. We queried a *28S* barcode sequence classified to the genus *Parasphaerasclera* from a recent eDNA survey in the GoM (McCartin *et al.* 2024) against contiguous sequences (contigs) that were assembled *de novo* using SPAdes (Bankevich *et al.* 2012). One contig was retrieved that contained *18S*, *5.8S*, and most of *28S*, as identified bbased on similarity to an rDNA repeat sequence from an NCBI *Xenia* reference genome (RefSeq assembly GCF_ 021976095.1, scaffold NW_025813507.1). A partial *28S* sequence from our *P. mcfaddenae* specimens was aligned using the LINS-I method in MAFFT v 5 (Katoh *et al.* 2005) along with 155 reference sequences from Quattrini *et al.* (2024) and from four additional species of *Parasphaerasclera* (JX203639: McFadden & van Ofwegen 2012, KF728087, KF728086, KF728082: McFadden & van Ofwegen 2013). The resulting alignment was input into IQTree v 2 (Minh *et al.* 2020) for phylogenetic analyses using modelfinder (-m TESTMERGE, Kalyaanamoorthy *et al.* 2017) and 1000 ultrafast bootstrap replicates (-B 1000, Hoang *et al.* 2018).

Results

Systematic Account

Class Octocorallia Haeckel, 1866

Order Scleralcyonacea McFadden, van Ofwegen, & Quattrini 2022

Family Parasphaerascleridae McFadden & van Ofwegen 2013

Genus *Parasphaerasclera* McFadden & van Ofwegen 2013

Diagnosis (amended)

Octocorals without a skeletal axis. Colonies digitiform, digitate lobate, or capitate, usually with a sterile stalk although this may be indistinct. Polyps monomorphic and distributed evenly over surface of lobes or restricted to top of capitulum. Polyps retractile or non-retractile. Retracted polyps may remain visible as small mounds on polyparium surface. Polyp sclerites absent. Sclerites of colony surface and interior predominantly radiates and tuberculate spheroids, tuberculated spindles, and occasionally rods and crosses. Sclerites both colorless and brightly colored. Azooxanthellate.

Distribution

Shallow to mesophotic depths. Indo-Pacific, South Africa, and Gulf of Mexico.

***Parasphaerasclera mcfaddenae* sp. nov.**
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Figures 2–3, Suppl. Figures 1– 2

Material Examined

Holotype: USNM1676189 (field numbers: PC22-0144, PC2202L1_20220704_S05_154B) 29.44128° N, 87.5347° W, 75 m, *R/V Pisces*, *ROV Mohawk* dive ROV13 (UNCW1044), collected by NOAA MDBC PC2202L1 Science Team, 04 July 2022

Paratype: USNM1716278 (field numbers: SH12611, PC2202L1_20220704_S05_154B) 29.44128 ° N, 87.5347° W, 75 m, *R/V Pisces*, *ROV Mohawk* dive ROV13 (UNCW1044), collected by NOAA MDBC PC2202L1 Science Team, 04 July 2022

Paratype: USNM1676194 (field numbers: PC22-0149, PC2202L1_20220704_S05_160B), 29.44127° N, 87.5345° W, 74 m, *R/V Pisces*, *ROV Mohawk* dive ROV13 (UNCW1044), collected by NOAA MDBC PC2202L1 Science Team, 04 July 2022

Type Locality

Pinnacle Trend, Gulf of Mexico, western North Atlantic Ocean, Alabama, USA, 75 m depth.

Description

A small, soft coral without a central axis with a capitate growth form that has a distinct short stalk and capitulum. Polyps non-retractile, possibly non-contractile, but evenly distributed over top of capitulum. Only autozooids are present. Holotype (USNM1676189) measures 6 mm wide and 6 mm tall (base to top of capitulum) with six polyps (2–4 mm tall) spaced evenly apart. Three polyps were removed for genetics and morphological analyses. One paratype (USNM1676194) measured 3 x 3 mm with three polyps (~3 mm tall) each; the capitate growth form of this specimen was not as evident as the other two specimens. The paratype (USNM1716278) measured 9 mm tall X 4 mm wide with 6 polyps ranging from 2–3 mm tall. Color of all specimens yellow-orange in alcohol and *in situ* whereas the polyps are white in alcohol, but translucent *in situ* (Fig. 2). *In situ* images of additional colonies (not collected) depict up to 12 polyps, densely but evenly distributed on surface of capitulum (Fig. 2A).

Polyps lacking sclerites and armature. Sclerites of coenenchyme colored yellow-orange; some colorless sclerites in the inner layer. Sclerites include tuberculated spindles featuring pointed tips (0.10–0.28 mm), crosses (0.05–0.18 mm in diameter), and few small radiates (mostly 7- and 8- radiates, 0.05–0.10 mm) (Fig. 3). Sclerite composition similar between stalk, top of capitulum and inner layer (Suppl. Fig. 3). All sclerites highly ornamented with complex tuberculate sculpture.

Remarks

This species is different from all other *Parasphaerasclera* due to the combination of non-retractile polyps, a capitate growth form with polyps limited to the top of the surface, and sclerites consisting of tuberculated spindles with very pointed tips (Table 1). The capitate growth form of *P. mcfaddenae* may be unique within the genus, although the description of *P. albiflora* (Utinomi, 1957) did not distinguish if the growth form was in fact capitate or cylindrical. However, the polyps are evenly spread over the capitulum in *P. mcfaddenae* while they are irregularly distributed in *P. albiflora* (Utinomi, 1957). The presence of tuberculated spindles is unique to *P. mcfaddenae*, only comparable to the tuberculated rods found in *P. grayi* (Thomson & Dean, 1931), but the former is easily distinguished by the distinctive pointed tips at both ends of each spindle.

Etymology

The species is named in honor of Catherine S. McFadden, Harvey Mudd College, CA, USA, a world expert in systematics of Octocorallia.

Distribution

Known from the type locality: Pinnacle Trend, Gulf of Mexico, western North Atlantic Ocean, Alabama USA, 74–75 m depth. eDNA analyses (Fig. 1) suggest it also occurs in the northwestern Gulf of Mexico at Bright Bank at a depth of 85 m.

Phylogenetic Results

Phylogenetic analyses based on *mtMutS* included eight species of *Parasphaerasclera.* The family was recovered as monophyletic with 100% bootstrap support. This clade was recovered sister to the family Coralliidae with full bootstrap support. The new species, *P. mcfaddenae,* was found to be most closely related to *P. kimberlyensis* Bryce, Poliseno, Alderslade & Vargas, 2015 and *P.* aff. *grayi* . The genetic distance (p-distance) between *P. mcfaddenae* and both species, which were 100% similar across this region of *mtMutS,* was 1.6%. Both *P. mcfaddenae* samples were also identical across this region of *mtMutS* as well. *P. mcfaddenae* was recovered sister to *P. aurea* (Benayahu & Schleyer, 1995) in the phylogeny with low support (72 % bs) based on nuclear *28S* rDNA (Suppl. Fig. 3). *P. kimberlyensis* was not included because the sequence available on GenBank (HG970069, Bryce *et al.* 2015) was a different sequenced portion of *28S.*

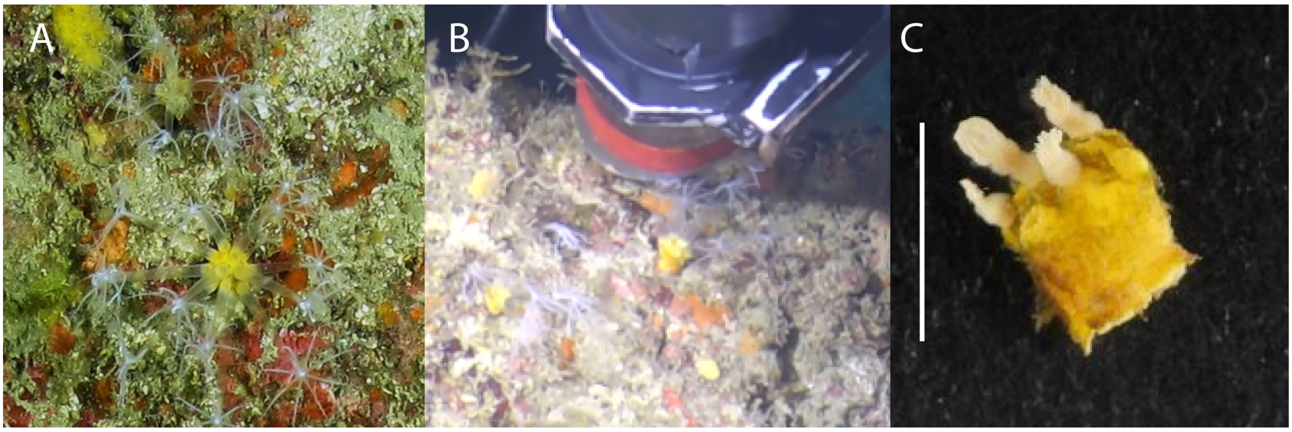

FIGURE 2. Images of *Parasphaerasclera mcfaddenae* **sp. nov.** A) *in situ* image of two colonies, B) *in situ* image of the holotype prior to ROV collection, and C) image of holotype under the microscope with a 1 cm scale bar.

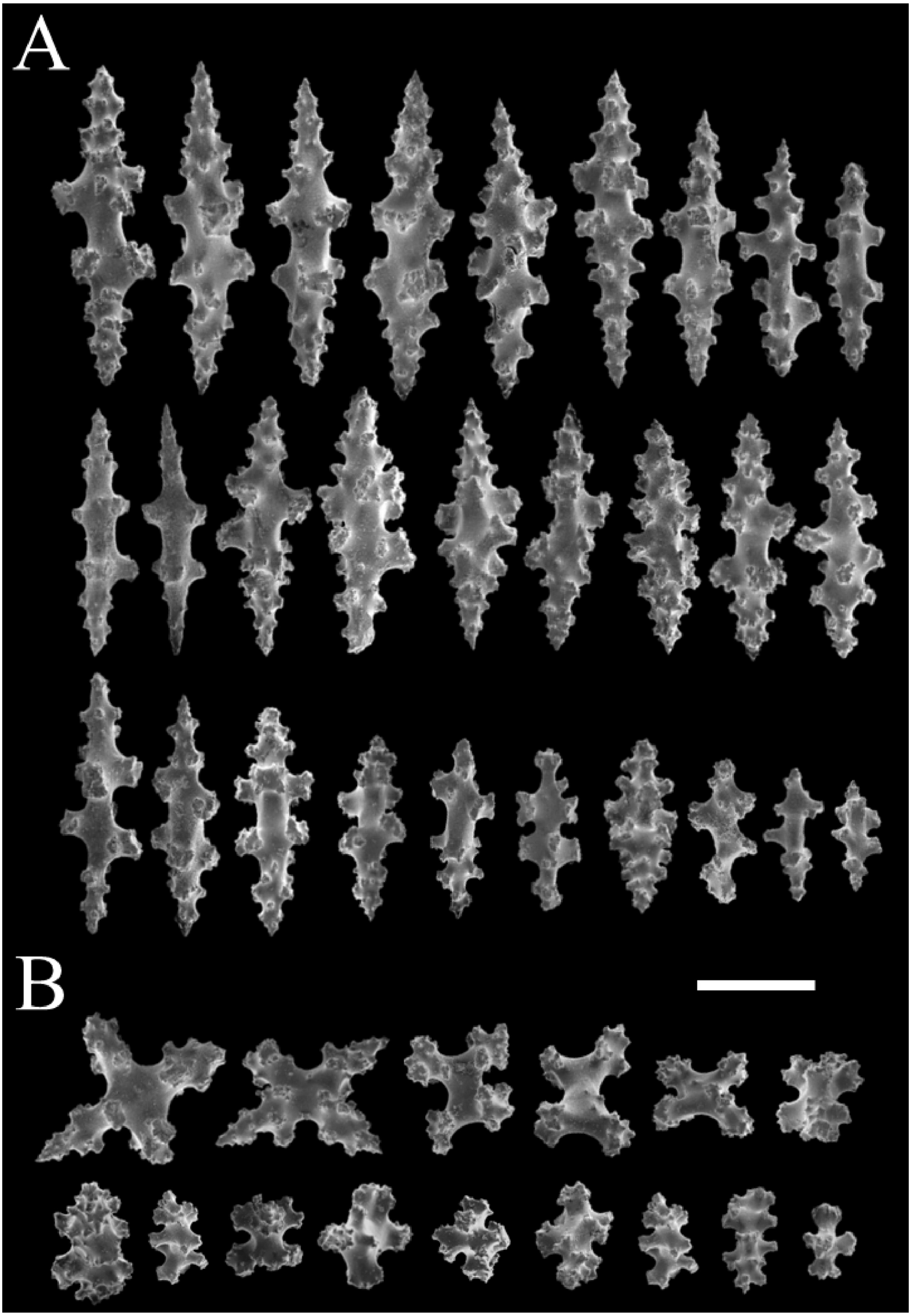

FIGURE 3. A) Spindles and B) crosses and radiates from *Parasphaerasclera mcfaddenae* **sp. nov.** USNM1676189. 0.1 mm scale bar included.

TABLE 1. Diagnostic morphological characters compared among species.

Species	Colony Shape	Polyp Retractile	Polyp Distribution	Sclerite form	Geographic Distribution
Parasphaerasclera albiflora (Utinomi, 1957)	cylindrical, but with stalk and capitulum*	Polyps fully extended[#]	irregularly distributed over capitulum	8-radiate capstans, capstans with stellate heads	Japan
Parasphaerasclera aurea (Benayahu & Schleyer, 1995)	digitiform to lobular growth form with a short, indistinct stalk	yes	dense, irregularly distributed throughout except base of stalk barren	double-deltoids, small 6-radate capstans, and tuberculate spheroids.	South Africa
Parasphaerasclera grayi (Thomson & Dean, 1931)	digitiform, wider base tapering distally	yes	dense, evenly distributed throughout	6-, 7-, and 8-radiate capstans along with tuberculate rods that lack a smooth waist, crosses at times. Much variation	Wide distribution throughout Indo-West Pacific, western Australia
Parasphaerasclera kimberylensis Bryce, Poliseno, Alderslade & Vargas, 2015	digitiform, wide base tapers distally	yes	sparse but evenly distributed throughout except base of stalk barren	tuberculate capstans, few rodlets, crosses, small radiates	Western Australia
Parasphaerasclera mcfaddenae **sp. nov.** Quattrini, Morrissey, & McCartin 2024	capitate	no	evenly distributed over surface of capitulum	tuberculated spindles, crosses, small radiates	Gulf of Mexico
Parasphaerasclera morifera (Tixier-Durivault, 1954)	digitiform to lobular growth form with a short, indistinct stalk	yes	Dense, evenly distributed throughout, except at base	compact radiates and spheroids	South Africa
Parasphaerasclera nezdoliyi (Dautova & Savinkin, 2009)	digitiform	yes	Evenly distributed throughout	6 through 8 radiate capstans, small compact capstans, flattened and granulated rods with one extended end, crosses	South China Sea
Parasphaerasclera rotifera (Thomson, 1910)	conspicuous stalk gives rise to either branched or digitate lobes	yes	evenly distributed	small capstans and tuberculate spheroids	South Africa
Parasphaerasclera valdivae (Kukenthal, 1906)	conspicuous stalk gives rise to either branched or digitate lobes	description says “many polyps extended”^	dense, absent on stalk	compact 6- and 8-radiates, spheroids	South Africa
Parasphaerasclera zanahoria (Williams, 2000)	digitiform to lobate; several finger-like lobes may be united at base, tapers distally	yes	evenly distributed throughout 95% of colony	radiates and some crosses	Tonga Islands, South Pacific

*unclear if capitate or cylindrical, [#] description states all polyps fully extended, unclear if retractile or not, ^Verseveldt & Williams 1988.

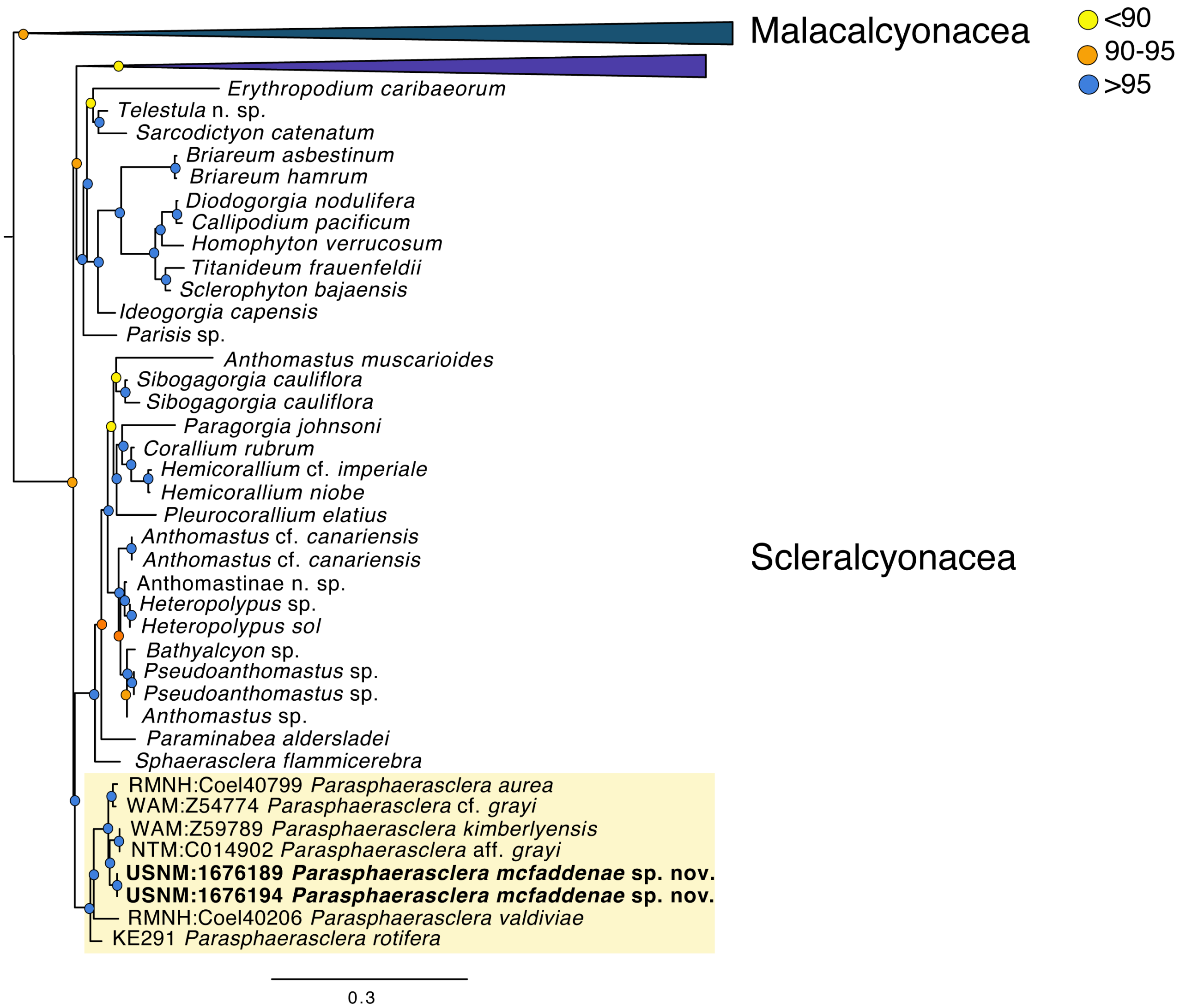

FIGURE 4. Maximum likelihood tree of Octocorallia based on a *mtMutS* alignment (1074 bp). Ultrafast bootstrap supports are included as colored circles on the nodes. The order Scleralcyonacea is rooted to the order Malacalcyonacea. Some nodes are collapsed.

Mitogenome Assembly

Mitogenomes were 18,721 bp in length and had the expected protein-coding genes, *ATP6*, *ATP8*, *cob*, *cox1-3*, *nad1-6*, *nad4l*, and *mtMutS*, two rRNAs (rns and rnl), and a single transfer RNA (tRNA—Met). Sizes of each gene are listed in Supplemental Table 2. Complete mitogenomes were uploaded to Genbank (USNM1676189 accessioned as PQ009932, USNM1676194 accessioned as PQ009933).

Discussion

In previous studies, the family Parasphaerascleridae has been recovered often with poor to moderate levels of support in numerous places within the order Scleralcyonacea (McFadden & van Ofwegen 2013, Bryce *et al.* 2015, McFadden *et al.* 2022). Even phylogenies based on 100s of nuclear loci (i.e., ultraconserved elements and exons) have shown an unstable phylogenomic placement of this family within the order (McFadden *et al.* 2022, Quattrini *et al.* 2024). This study, which included a comprehensive octocoral DNA barcode dataset, albeit just *mtMutS*, recovered Parasphaerascleridae as sister to the Coralliidae Lamouroux, 1812 with 100% bootstrap support. In contrast, the phylogeny based on nuclear *28S* rDNA recovered *Parasphaerasclera* as an early-diverging lineage and sister to the rest of Scleralcyonacea, a relationship recovered in Quattrini *et al.* (2024) based on 100s of nuclear loci. This mito-nuclear discordance is commonly observed in Octocorallia (Quattrini *et al.* 2023). Nevertheless, Parasphaerascleridae shares several morphological characters (e.g., colony growth form, absence of polyp sclerites, and brightly colored sclerites) with the coralliid genus *Paraminabea* Williams & Alderslade, 1999. Furthermore, many parasphaerasclerid species contain the radiate sclerites that are characteristic of the family Coralliidae. Notably, DeLeo *et al.* (2024) demonstrated that Coralliidae and Parasphaerascleridae both contain bioluminescent coral species.

Within the genus *Parasphaerasclera*, *P. mcfaddenae* was recovered as sister to *P. kimberlyensis* in the comprehensive *mtMutS* phylogeny. *P. kimberlyensis* was described by Bryce, Poliseno, Alderslade & Vargas 2015 from specimens collected in shallow-water depths (~10 m) off Australia. *P. kimberlyensis* has sclerites of tuberculated rods, radiates and crosses whereas *P. mcfaddenae* was collected from mesophotic depths with sclerites of tuberculated spindles, radiates, and crosses. In contrast, the early-diverging lineages, *P. rotifera* (Thomson, 1910) and *P. valdivae* (Kukenthal, 1906)*,* within the family both contain spheroid sclerites; perhaps an ancestral sclerite form for the family. Notably, *P. mcfaddenae* appears to be the smallest species of the genus, although we caution that more specimens need to be collected to gather a more thorough size range. This new species is also the only one with a capitate growth form, although it is possible that *P. albiflora* is also capitate. The original description of *P. albiflora* discusses a "very beautiful cylindrical colony" but also mentions a stalk and a capitulum in the description (Utinomi, 1957).

The genus *Parasphaerasclera* includes nine nominal species, eight reassigned from other genera and one (*P. kimberlyensis*) originally described to the genus. Many species lack molecular data, and some specimens discussed in the literature do not match any described species. For example, McFadden & van Ofwegen (2013) outline the considerable variation among specimens of *P. grayi* illustrated in the literature and suggest that these specimens may represent as-of-yet undescribed species. This extensive undescribed diversity, and absence of available molecular data for many species, has limited our ability to explore the concordance between morphological and molecular evidence for species boundaries. Finally, we note that gene order within the mitogenome of *P. mcfaddenae* follow the ancestral mitogenome order "A" (Brockman & McFadden 2012) as its congener *P. valdivae* (Muthye *et al*. 2022).

With the discovery of *P. mcfaddenae* from the Gulf of Mexico, we extend the distribution of the family Parasphaerascleridae to the western North Atlantic Ocean. All previous records of species in the family are limited to shallow waters of the tropical Indo-Pacific and South Africa (McFadden e*t al.* 2022). Although there are unconfirmed records that this family can be found at depths down to 110 m (obis.org), our records confirm that *Parasphaerasclera* can be found in mesophotic depths as well.

It is curious that *P. mcfaddenae* was never collected before in the GoM. The GoM is perhaps one of the most well-explored regions in the US Exclusive Economic Zone. Furthermore, the Pinnacle Trend has been surveyed numerous times in the region, particularly since the Deepwater Horizon Oil spill in 2010 (e.g., Etnoyer *et al.* 2016, Silva *et al.* 2016). The diminutive size and hardbottom affinity in mesophotic depths likely precluded *P. mcfaddenae* from observation and collection during past expeditions using trawls or ROVs. Recently, there have been recorded observations of introductions or invasions of soft corals into regions of the western Atlantic Ocean, generating negative impacts on local communities de Carvalho-Junior *et al.* 2023, Toledo-Rodriguez *et al.* 2024). Thus, it is essential that baseline characterization of deepwater coral communities continue, even in areas that we believe to be well explored. Further exploration and detailed characterization can improve our understanding of healthy ecosystems and monitor any community responses to anthropogenic change.

We first suspected the presence of a coral in the genus *Parasphaerasclera* in the GoM from eDNA in water samples collected in August 2021 at ~85 meters depth at Bright Bank, a mesophotic bank in the northwestern GoM (Fig. 1) (McCartin *et al.* 2024). Three *28S* amplicon sequence variants (ASVs) detected in these samples were classified to the genus using a reference database that included a barcode sequence of *P. valdivae* collected from South Africa. The most similar ASV had 99.8% pairwise identity with the aligned region of the *28S* sequence retrieved from *P. mcfaddenae*. Based on this high sequence similarity and the similar collection depths of the eDNA sample and holotype/paratypes, we infer that these detections in eDNA at Bright Bank plausibly represent the presence of *P. mcfaddenae*. Thus, the range of *P. mcfaddenae* likely extends across the northern GoM at least from the Pinnacle Trend in the east to the Flower Garden Banks National Marine Sanctuary in the west. These eDNA results underscore the exploratory potential of eDNA sequencing and the importance of building complete, regional reference databases from vouchered collections for accurate biodiversity detection in eDNA samples.

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Data availability

Mitogenomes (PQ009932, PQ009933) and 28S (PQ201879) are available on NCBI's Genbank. Raw read data were uploaded to the Sequence Read Archive under PRJNA1149763 and under the umbrella Mesophotic and Deep Benthic Community restoration project PRJNA1135238. Specimens are housed at the Smithsonian National Museum of Natural History.

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Supplementary Materials. The following supporting information can be downloaded at the DOI landing page of this paper:

Supplemental File 1. Mitochondrial *MutS* alignment for the *Parasphaerasclera* included in the study.

Supplemental File 2. *28S* rDNA alignment for the *Parasphaerasclera* included in the study.

Supplemental Figure 1. Images of *Parasphaerasclera mcfaddenae* **sp. nov.** paratypes

Supplemental Figure 2. Image of *Parasphaerascerla mcfaddenae* **sp. nov.** cross section of holotype

Supplemental Figure 3. Maximum likelihood tree of Octocorallia based on an alignment of *28S* rDNA (551 bp). Ultrafast bootstrap supports are included. The order Scleralcyonacea is rooted to the order Malacalcyonacea. Some nodes are collapsed.

Supplemental Table 1. Properties of the mitogenome of *Parasphaerasclera mcfaddenae* **sp. nov.** Negative numbers represent overlaps between genes.