Chapter 7

# Fossil Ophiuroids of Mexico

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1. Abstract ..... 115
2. Introduction ..... 115
3. The Fossil Record of Mexican Ophiuroids ..... 119
   3.1. Ixtaltepec Fm., Oaxaca ..... 120
   3.2. Tlayúa Fm., Puebla ..... 120
   3.3 Aguja Fm., Chihuahua ..... 121
   3.4 Cerro del Pueblo Fm., Coahuila ..... 122
   3.5 San Juan Fm., Chiapas ..... 122
   3.6 El Cien and Almejas Fms., Baja California Sur ..... 123
4. Present Studies ..... 125
5. Other Fossil Echinoderms of Mexico ..... 126
6. Conclusions ..... 129
   References ..... 129

## 1. Abstract

Here we present an up to date study on fossil ophiuroids from Mexico. The specimens come from the following States within the Mexican Republic: Baja California Sur, Chiapas, Chihuahua, Coahuila, Oaxaca and Puebla. The total number of specimens is 20 and one ophiuroid bed that bears many specimens. The ophiuroids have been collected in rocks from upper Paleozoic age (Pennsylvanian) to Pliocene. Almost all specimens are well preserved and with the aid of several techniques such as X rays and detailed images taken from SEM, they are being described. We have recognized two families and four genera all belonging to the order Ophiurida. A new species will soon be published in a research paper.

## 2. Introduction

Ophiuroids are one of six living classes that form the phylum Echinodermata (Hendler *et al.,* 1995), they comprise more than 250 genera and 2000 species making them the most abundant and diverse class of Echinodermata (Smith *et al.* 1995).

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Ophiuroids have a cosmopolitan distribution almost exclusively restricted today to marine environments. However a few species can survive in brackish water, for example *Ophiophragmus filograneus,* which occurs in estuaries with reduced salinities and not in the open sea (Talbot and Lawrence, 2002). Ophiuroids are found buried in sediment, inhabiting cracks or natural hollows. These echinoderms also can form symbiotic associations with corals and sponges. The lifespans of ophiuroids vary between 10 and 20 years; deep-water species may generally live longer than shallow-water ones (Donovan, 1991).

The body of ophiuroids is composed of a central disk, which can reach a diameter from 2 to 65 mm. Ophiuroids also have five mobile arms, simple or branched, which allow them to keep their normal corporal position, with the oral surface directed towards the substrate.

The success of this group is partly due to their internal skeleton (the most specialized among echinoderms), which is responsible for their versatile movements. The skeleton is composed of many calcareous ossicles connected by mesodermic tissue. In the center of the oral surface and surrounding the mouth there is a complex chewing system made up of a series of ossicles: the oral plate, oral and adoral shields, teeth and oral papilla (Figure 1). Every arm joint is composed of articulated segments including two kinds of skeletons, internal and superficial. Internal ossicles are called vertebrae, which are paired and may also be fused; and the external or superficial, composed of four plates which are named according to their position, as dorsal, ventral or lateral (Figure 1). Each lateral plate has spines with variable sizes, forms and numbers. Arms posses apical development, such that the form of plates in each arm segment is not the same. A common mistake is to give the name of vertebrae to the internal and superficial plates that form every arm joint, but according to Rasmussen (1950) the term vertebrae refers only to the internal plates in each segment of the arm. The arms used by ophiuroids to move, feed and protect themselves from predators, are very variable in their shape, in their ability to flex, in the character of their integuments and in the degree to which they are armed. It is possible to get some information about the habits of a species by analyzing its arm mobility (Litvinova, 1994).

Ophiuroids are carnivorous, suspension, filtration or detritus feeders (Barnes and Ruppert, 1996). This group of echinoderms do not have an anus nor intestine, instead they get rid of their waste materials by means of the bursal slit (Figure 1). The bursal slit is a specialized pouchlike structure located at the base of the arms and is also involved in reproduction and respiration. The nervous system of ophiuroids is not centralized, however their whole body has epithelial cells sensitive to touch (Barnes and Ruppert, 1996). In some species there is a photosensitive system at the tip of the arms made of calcite crystals soaked in soft tissue, which can detect the direction and intensity of light (Aizenberg *et al.*, 2001).

Ophiuroids are food for fishes, crustaceans, polichaetes, asteroids and other ophiuroids. Predators have intensified their activities since Jurassic times, when they diversified (Aronson, 1987). These echinoderms are capable of losing one of their

arms or part of it if they feel threatened from predator or environmental stress; the lost portion of the body grows again through the development of new plates.

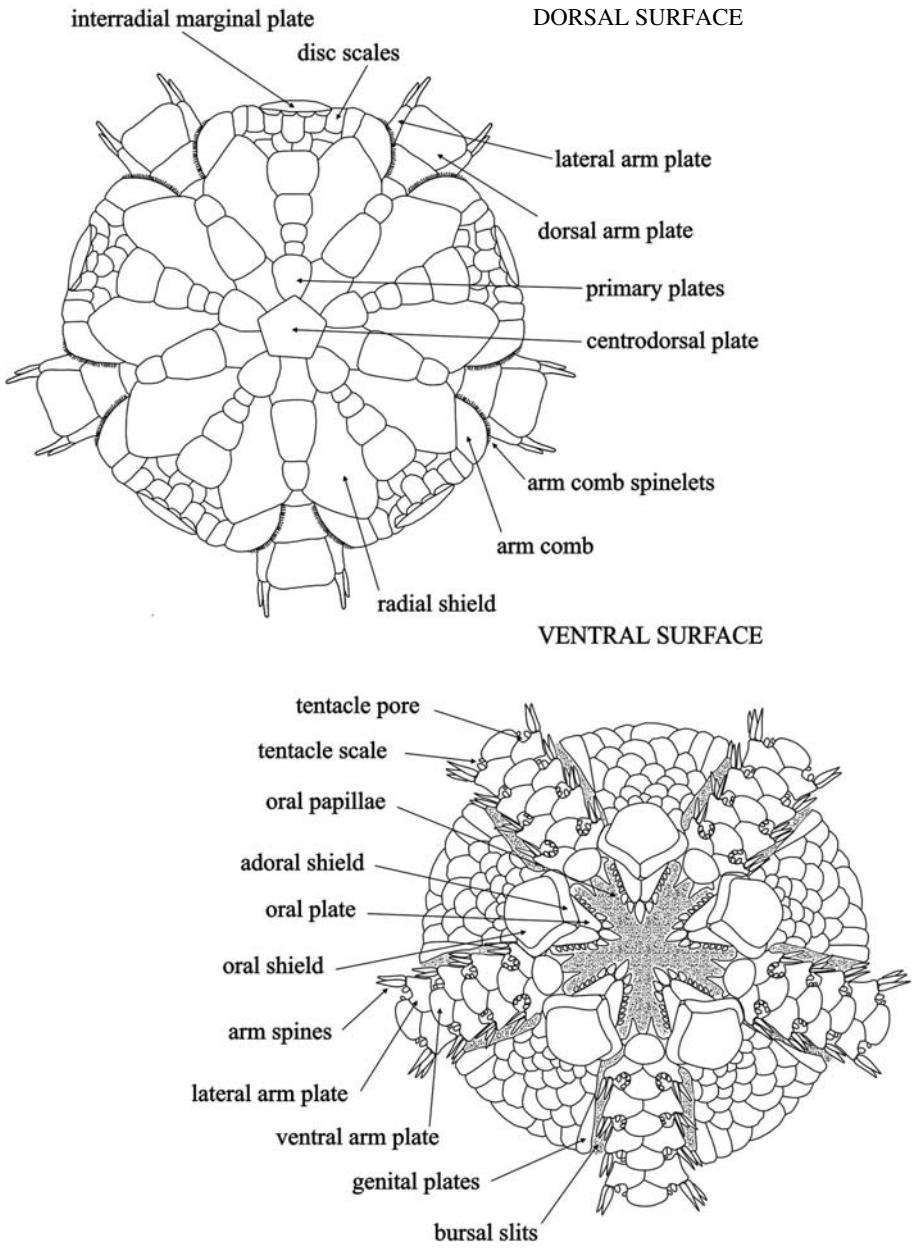


**FIGURE 1.** Illustrated glossary of morphological terms used in this study.

Although there is a lot of research concerning the higher taxonomy of ophiuroids (Matsumoto, 1917; Murakami, 1963; Fell, 1960; Spencer and Wright, 1966; Smith *et al.* 1995), there is still a need for a complete revision.

Spencer and Wright´s classification (1966) recognized four orders of fossil and recent ophiuroids: Stenurida, Oegophiurida, Phrynophiurida and Ophiurida. The first two orders appeared during early Paleozoic times (Spencer and Wright, 1966), and are the most primitive forms believed to have lived in shallow water, feeding on small organic suspended particles. With the exception of the family Ophiocanopidae, which belongs to order Oegophiurida, Stenurida and Oegophiurida became extinct in the Paleozoic (Bambach, 1985). Phrynophiurida and Ophiurida adopted different feeding habits. The members of the order Phrynophiurida developed branched arms, increasing the surface for food trapping. The members of the order Ophiurida had a greater mobility to their arms, which enabled them to become predators of many species, leading them to be the most abundant and diverse group of ophiuroids from the Mesozoic to present (Figure 2).

The first record of fossil ophiuroids dates back to the Ordovician, nearly 470 million years ago, with the genus *Stenaster*, which has been identified from isolated ossicles, arms, disc parts, and complete specimens collected from the United States, Canada, Ireland, Kasajstan and Scotland (Dean, 1999). Although ophiuroids are considered to be one of the most succesful groups among extant echinoderms, they

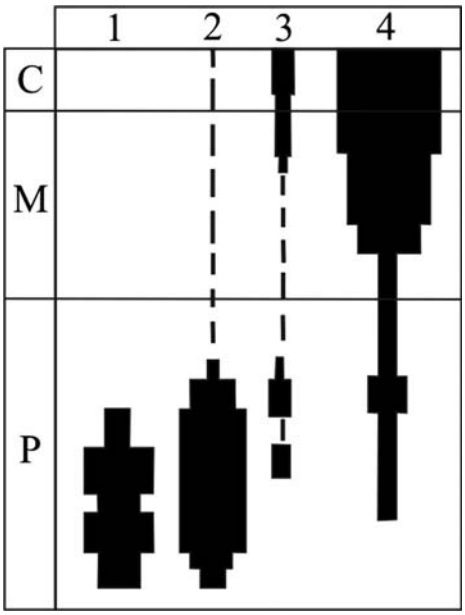


**FIGURE 2.** Geological ranges and diversity of the Orders within the Class Ophiuroidea. P, Paleozoic; M, Mesozoic; C, Cenozoic; 1, Order Stenurida; 2, Order Oegophiurida; 3, Order Phrynophiurida; 4, Order Ophiurida (Modified from Bambach, 1985).

almost went extinct at end of Permian. Only a small group of ophiuroids survived the Permian extinction event radiating to the numerous forms of ophiuroids found today.

Despite the fact that ophiuroid remains are quite common in Mesozoic and Cenozoic rocks, the fossil record of the ophiuroids is very scarce, when compared to Paleozoic deposits (Jagt, 1998). Ophiuroids are commonly preserved as disarticulated ossicles or fragments of discs and arms. Localities which yield more or less complete specimens are very few. However there are some extraordinary deposits around the world, called "brittlestars beds," from many geologic ages where ophiuroid specimen density is very high (Aronson and Sues, 1988). The specific identification of dissociated ossicles is often difficult, but not impossible. Ophiuroids seem to be evolutionary conservative, and it is common to recognize Mesozoic or Cenozoic taxa as representative of extant genera (Kutscher and Villier, 2003).

## 3. The Fossil Record of Mexican Ophiuroids

The fossil record of Mexican ophiuroids is relatively scarce when compared to other groups of echinoderms. The analysis of ophiuroids diversity and geologic distribution (Table 1, Figure 3) was recently published by Martín-Medrano (2003).

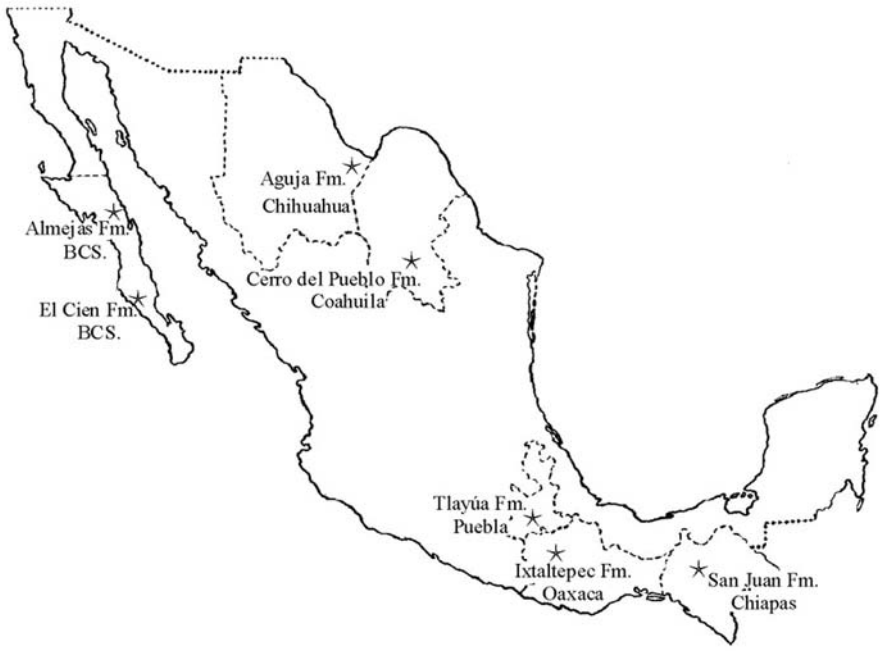


**FIGURE 3**. Geographical distribution of outcrops containing fossil ophiuroids in Mexico.

### 3.1. Ixtaltepec Fm., Oaxaca

Quiroz-Barroso and Sour-Tovar (1995) briefly described a Paleozoic ophiurinid from Ixtaltepec Formation (Pennsylvanian), Oaxaca. This is the oldest ophiuroid found in Mexico. The specimen is deposited at the Paleontology Museum, Facultad de Ciencias, U.N.A.M., and is represented by negative impressions of the dorsal and ventral surfaces.

The disc is pentagonal. Oral plates and adoral shields are very large and thin. The arms are large and thin without dorsal plates; the ventral arm plates are inconspicuous, while the tentacle pores are very wide (Quiroz-Barroso and Sour-Tovar, 1995).

This specimen represents the most austral finding in Mexico.

### 3.2. Tlayúa Fm., Puebla

The occurrence of Cretaceous ophiuroids at Tlayúa Quarry, Puebla was the first report of ophiuroids from Mexico (Applegate, 1987; Buitrón-Sánchez and Malpica-Cruz, 1987). The occurrences were also later confirmed by several additional workers (Applegate, 1996; Feldmann *et al.* 1998; Espinosa-Arrubarrena *et al.* 2000). However, no detailed descriptive work has been done with these specimens. In addition, Buitrón and Solís-Marín (1993) indicate the existence of a Cretaceous ophiuroid specimen, genus *Ophiura* collected in Puebla, but they do not give enough information to clarify the exact taxonomic and geographical placement of this specimen.

To date, thirteen different fossil ophiuroids from Tlayúa Quarry (Lower Cretaceous, Albian) have been collected and are under study by the first author of this work. Twelve of them are part of the Colección Nacional de Paleontología, Instituto de Geología, U.N.A.M. and the remaining specimen is deposited at the Paleontology Museum, Facultad de Ciencias, U.N.A.M. These are complete specimens, five of them with the dorsal surface exposed and eight with the ventral surface exposed.

The Tlayúa Quarry´s specimens show affinities with representatives of the *Ophiura* genus. The dorsal and ventral surfaces of the ophiuroid disc is covered by overlapping small scales of very different size and shape. The spinelets of the arm comb are very few and small. There are enlarged mouth slits with some small and thin teeth. The shape of the proximal dorsal arm plates is rhomboidal, while the distals are triangular. Ventral arm plates are pentagonal with 1 to 4 tentacle scales. The lateral arm plates are long with 3 to 5 spines (Figure 4).

In some specimens the arms are extended and oriented in different ways, in several others they are contracted under the central disk; these postures can help to infer the behavior of the animal before death. The excellent preservation of these specimens enables fine details of their anatomy to be easily seen (Figure 4). Environmental conditions that account for sediment deposition at Tlayúa Quarry have been interpreted in several different ways: Malpica-Cruz *et al*. (1989) and Pantoja-Alor (1992) suggest that the deposit was formed at a post-reef lagoon connected with the open sea;

**FIGURE 4.** Oral surface of ophiuroid specimen from Tlayúa Quarry in Puebla deposited at the Paleontology Museum, Facultad de Ciencias, U.N.A.M.

whereas, Applegate (1987) and Espinosa-Arrubarrena and Applegate (1996) present an up to date model, where they suggest an extremely shallow post-reef, stagnant, anaerobic and hypersaline lagoon, surrounded on one side by semi-arid land and on the other side by a deeper, well oxygenated lagoon with a high biodiversity; finally, Kashiyama *et al*. (2004) suggest a deposit formed within deep sea conditions (see Applegate *et al.* in this book).

## 3.3. Aguja Fm., Chihuahua

Martin-Medrano in 2003 reported the first record of an ophiuroid belonging to the family Amphiuridae from the Cretaceous of Chihuahua. In that work, she only briefly described it, however the complete description of that fossil is one of the subjects in her Masters Degree Thesis.

The complete specimen is represented by the ventral surface with two extended arms exposed and the distal parts of the other three arms folded near the central disk. The arms are thin and flexible. The ventral arm plates are pentagonal; the lateral arm plates are wider at the base with 2 to 3 large and thin spines. The mouth slits are very wide with small oral papilla. The oral shields are triangular; the bursal slits are large

and convex (Figure 5). This specimen shows affinities with representatives of the genus *Amphiura*.

This specimen was collected at Aguja Formation, Chihuahua, in sediments considered to be transitional brackish, marine and fluvial environments (Lehman, 1997). However considering the marine nature of the ophiuroids, probably the deposit resembles a marine entrance in a coastal flood plain. The specimen is deposited at the Paleontology Museum, Facultad de Ciencias, U.N.A.M.

### 3.4. Cerro del Pueblo Fm., Coahuila

Only one specimen of ophiuroid has been reported from Cerro del Pueblo Formation, Coahuila (Martin-Medrano, 2003) (Figure 6). It is currently being studied by the same author. Due to permineralization the dorsal surface of this specimen is very well preserved. Unfortunately this specimen is incomplete, lacking one arm and the distal portions of the others. It shows affinities with representatives of the *Ophiomusium* genus. The dorsal surface of the disc is almost completely covered by the radial shields, primary and interradial marginal plates. Middle and distal dorsal arms plates are absent. Lateral arm plates are wing-shaped and cover almost completely the surface of the arm (Figure 6). The specimen is deposited at the Paleontology Museum, Facultad de Ciencias, U.N.A.M.

The Cerro del Pueblo Formation has been interpreted as a deltaic environment in a coastal flood plain, the deposit resembles a mixture of fresh, brackish and marine waters without any barriers to block the terrestrial vertebrate migrations (Kirkland *et al.* 2000).

### 3.5. San Juan Fm., Chiapas

A complete specimen of ophiuroid assigned to the family Ophioleucidae was briefly described by Martín-Medrano (2003), it belongs to the San Juan Formation, Chiapas, and has remarkably preserved extended arms and ventral surface (Figure

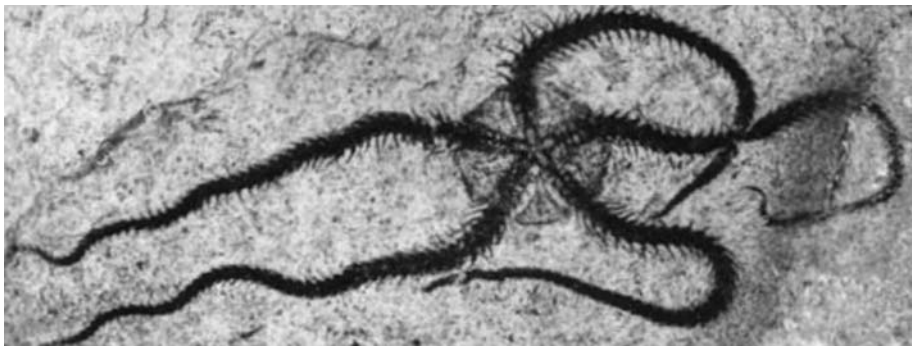

**FIGURE 5.** Oral surface of the amphiuroid found in Chihuahua (Martín-Medrano, 2003).

**FIGURE 6**. Dorsal surface of the ophiuroid specimen from Coahuila reported by Martin-Medrano, 2003.

7). Calcium carbonate preservation enables observation of tridimensional features of this specimen.

The shape of disc is pentagonal; bursal slits large. The mouth slit is very wide. The distal parts of oral plates are in contact. Ventral arm plates are rhomboidal. The lateral arm plates are very wide and cover almost completely the arm surface; two spines are present (Figure 7).

The San Juan Formation is believed to represent an open platform, shallow marine environment (Aguilar-Piña, 1993) with terrestrial influx. The specimen is deposited at the Paleontology Museum, Instituto de Historia Natural del Estado de Chiapas.

## 3.6. El Cien and Almejas Formations, Baja California Sur

The ophiuroids reported from El Cien Formation, in Baja California Sur by Martin-Medrano (2003) are represented by impressions of three specimens with exposed ventral surfaces and complete body disks; however the distal portions of the arms are absent (Figure 8). The specimens are deposited at the Paleontology Museum, Facultad de Ciencias, U.N.A.M. The detailed description of these specimens is being completed by the same author.

The interradial margins of the disc are convex. The oral shields cover almost all the interradial area of the disc; they are large and pyrifoms. Bursal slits large and convex. The arms are short with the widest part at the base and extremely acute at the tips. Ventral arm plates small and quadrangular; lateral arm plates curved with short

**FIGURE 7.** Ventral surface of the ophiuroid specimen assigned to the family Ophioleucidae found in Chiapas by Martin-Medrano (2003).

spines compressed to the body arm (Figure 8). These fossil ophiuroids show affinity with the representatives of the *Stegophiura* genus.

The Late Oligocene-Middle Miocene El Cien Formation has been interpreted as a transitional environment from terrestrial to deep sea facies (Applegate, 1986), but the deposit where the fossil ophiuroids have been found is characterized by a stable shallow platform.

Buitrón *et al.* (1994) reported the presence of Pliocene brittlestar beds within

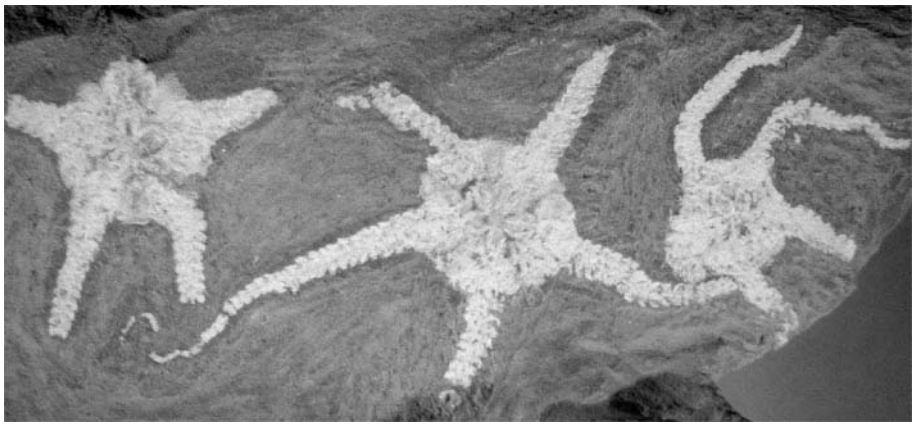

**FIGURE 8.** Ventral surface of three ophiuroid specimens from El Cien Formation, Baja California Sur.

the Almejas Formation, Baja California Sur. The brittlestar layer is composed of sediments interpreted as a shallow marine environment deposited under normal salinity conditions (Buitrón *et al.* 1994). More than one hundred specimens were collected and assigned to the genus *Ophiura*. However there is no detailed description of these fossils in the literature, and the final taxonomic placement of these specimens remains uncertain.

The fossil record of Mexican ophiuroids is represented by four genera and two families all belonging to the order Ophiurida. These fossils cover a wide stratigraphic range from the Pennsylvanian to the Pliocene (Table 1, Figure 3). It is important to note that fossil ophiuroids of Mexico have been, up to now, reported by Mexican investigators who work and study at the Universidad Nacional Autónoma de México, where the majority of specimens are deposited.

## 4. Present Studies

Taxonomic determination of fossil ophiuroids is difficult because the dorsal and ventral complete surfaces are rarely preserved in the fossil record; even if fossil ophiuroids are well preserved it is still difficult to make an accurate taxonomic placement (Cornell *et al.* 1991). Accurate taxonomic assignment of Mexican fossil ophiuroids is especially difficult due to the small number of known specimens from Mexico. This is exemplified when there is only one specimen, of a given new taxonomic position, that has only the one surface, ventral or dorsal, exposed when both surfaces are needed for taxonomic assignment. This is true with specimens from: Cerro del Pueblo Formation, Coahuila; Aguja Formation, Chihuahua; San Juan Formation, Chiapas, and El Cien Formation, Baja California Sur. However good preservation of these fossils does allow the observation of some diagnostic structures of the disk and arms.

The fragility of fossil ophiuroids, caused by the degradation of organic matter, provokes a rapid disarticulation of the skeleton. Isolated ossicles should be represented more often in the fossil record than the relatively rare whole body (Hotchkiss *et al.* 1999a and b). There are no studies on mexican ophiuroids that report the finding of skeletal ossicles. In addition, there is no report in the literature that refers to the finding of marks or tracks in sediments that would indicate activity by ophiuroid echinoderms in Mexico (Bell, 2004).

At present the study of Mexican fossil ophiuroids is part of a Masters Degree project by Martín-Medrano at the Facultad de Ciencias, U.N.A.M. This project includes all known specimens of ophiuroids (Table 1), with the exception of those reported by Quiroz-Barroso and Sour-Tovar (1995) and Buitrón *et al.* (1994). With this Masters research it is hoped that more elements to refine the taxonomic determination of Mexican fossil ophiuroids can be accomplished. In addition this study will include isolated skeletal ossicles and in the future, when the number of specimens and the preservation of material permit it, some aspects of evolution, ethology, functional

**TABLE 1.** Fossil record of ophiuroids collected in Mexico. Abbreviations: FCMP, Museo de Paleontología, Facultad de Ciencias, UNAM; IGM, Colección Nacional de Paleontología, Instituto de Geología, UNAM; MPCH, Museo de Paleontología, Chiapas.

| TAXA | FORMATION, STATE and AGE | COLLECTION | REFERENCE |
|---|---|---|---|
| *Ophiura* | Almejas Fm, BCS, Pliocene | ? | Buitrón et al. 1994. |
| aff. *Stegophiura* | El Cien Fm, BCS, Late Oligocene | MPFC | Martin-Medrano (pers. obs.) |
| Fam. *Ophioleucidae* | San Juan Fm, Chiapas, Middle Eocene | MPCH | Martin-Medrano, 2003 |
| aff. *Ophiomusium* | Cerro del Pueblo Fm, Coahuila, Late Cretaceous | MPFC | Martín-Medrano (pers. obs.) |
| aff. *Amphiura* | Aguja Fm, Chihuahua, Late Cretaceous | MPFC | Martin-Medrano (pers. Obs.) |
| aff. *Ophiura* | Tlayúa Fm, Puebla, Early Cretaceous (Albian) | IGM, MPFC | Martín-Medrano (pers. obs.) |
| Fam. Ophiurinidae | Ixtaltepec Fm, Oaxaca, Pennsylvanian | MPFC | Quiróz-Barroso and Sour-Tovar, 1995 |

anatomy, taphonomy, paleoecology and paleobiogeography.

Complete and well preserved fossil ophiuroid specimens can be related to extant families and genera. Therefore the Masters research will include a detailed comparative analysis of fossil and extant ophiuroids, including some families among the 10,000 specimens deposited at the Colección Nacional de Equinodermos de México of the Instituto de Ciencias del Mar y Limnología, U.N.A.M., and the recent ophiuroids Collection at the Natural History Museum of Los Angeles County.

Preperation of ophiuroid specimens is done by chemical and mechanical treatment, which enables the fine anatomy of the fossil ophiuroid to be viewed under the stereoscopic microscope, scanning electron microscope (Figure 9) and X-rays (Figure 10).

## 5. Other Fossil Echinoderms of Mexico

The degree and quality of preservation among the classes of echinoderms is based upon, in part, to the proportion of organic and inorganic matter that composes them. These differences cause a bias in the fossil record, favoring those forms with greater quantities of calcareous skeletal material and narrower sutures among plates.

This is reflected in the fossil record of echinoderms all over the world (Boardman *et al.*, 1987) including Mexican fossil echinoderms.

Echinoids are the group of echinoderms best represented in Mexico. In 1989

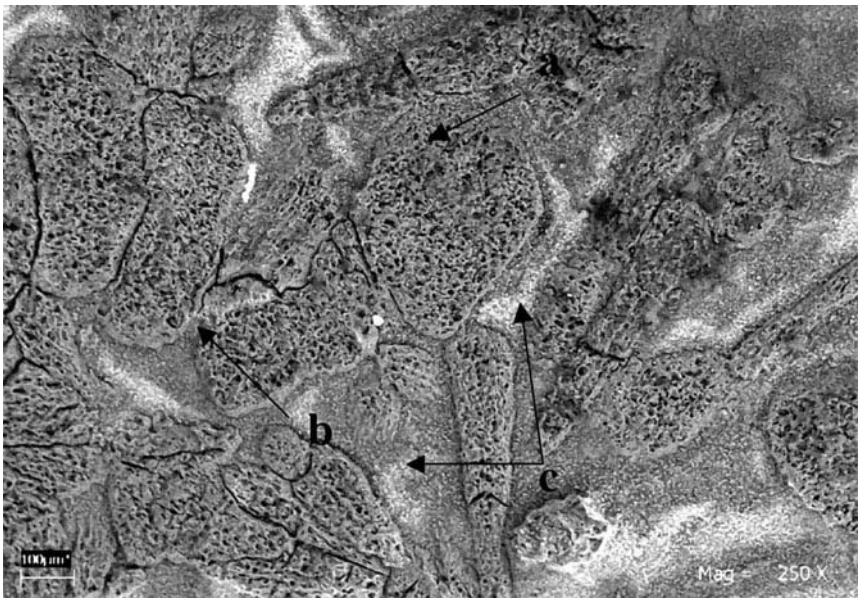


**FIGURE 9.** Image obtained with scanning electron microscope (250x). Detail of dorsal plates (a), lateral plates (b) and spines (c) of the arms of an ophiuroid fossil from Puebla.

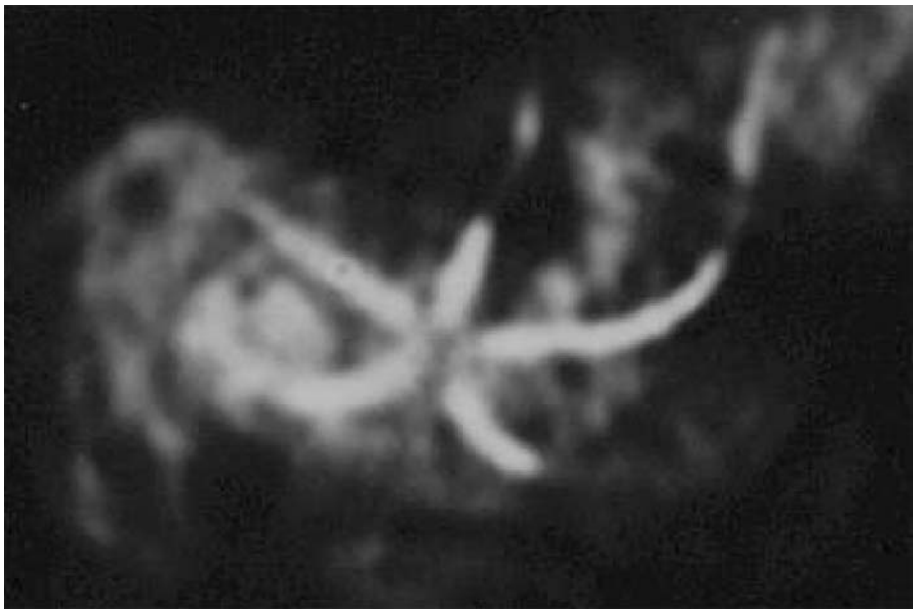

**FIGURE 10**. Image obtained with X-ray technique of the fossil ophiuroid from the San Juan Formation, Chiapas.

there were 33 Mesozoic and 34 Cenozoic type species described from Mexico (Perrilliat, 1989). In 1993 the numbers reached 186 Mesozoic and 117 Cenozoic species described from the states of Baja California, Sonora, Chihuahua, Coahuila and Nuevo León (Buitrón and Solís-Marín, 1993). Nieto-López and García-Barrera (in this volume) report 150 species of cretaceous echinoids from México. This diversity is closely related to the ossified calcareous material that composes the echinoids body morphology, which allows for the preservation of complete organisms in the fossil record.

The fossil record of Mexican crinoids is represented by only a few species. Up until 1989 there were only 1 Paleozoic and 3 Mesozoic type species described (Perrilliat, 1989). Four years later the number had grown to 11 Paleozoic and 4 Mesozoic species collected from the states of Puebla, Guerrero, Oaxaca, Tamaulipas, Hidalgo, Chiapas and Coahuila (Buitrón and Solís-Marín, 1993). The crinoid body consists of tightly sutured calcareous plates making them good candidates for fossil preservation.

In the class Holothuroidea there are seven complete Cretaceous species collected from Tlayúa Quarry, Puebla, Mexico (Applegate *et al.* 1996). Five of these species are closely related to the Family Psolidae, one of them belongs to the Family Phyllophoridae and the last species belongs to a new family (Buitrón *et al.,* 1995a). A new genus and species, *Ocuilinpilli faustinoi*, was also described in 1995, representing the second fossil record in the world for the Family Caudinidae (Buitrón *et al.*, 1995b). One year later, Applegate *et al*. (1996) reassigned the holothuroids from Tlayúa Quarry, indicating that four of the seven specimens belong, or are closely related, to the Family Psolidae; one specimen is part of the Family Sclerodactylidae; one specimen represents a new Family; and the last specimen was placed in an *incertae sedis* Family. Further research is needed to correctly place these seven species into exact taxonomic assignment. These findings constitute the first record of complete fossil holothuroids in the American continent, the first record of complete skeletal holothuroids of Cretaceous age and the first record of this class of echinoderms in Mexico. The seven specimens are deposited in the Colección Nacional de Paleontología, Instituto de Geología, U.N.A.M.

Although holothuroids are well represented in the fossil record of Mexico the preservation of these specimens was favored by the exceptional conditions of the sedimentary environment in which they were deposited (see Applegate *et al.* in this book). There are only six localities worldwide where complete holothuroids have been previously reported (Buitrón *et al*. 1995a). Holothuroids are usually only represented by isolated ossicles because most of the body is composed of organic material, which is rapidly degraded.

The fossil record of Mexican asteroids is limited to one Cretaceous species from Puebla, Mexico (Buitrón and Solís-Marín, 1993); however, there is no information concerning the location of where it was found or where it was accessioned. Cretaceous asteroids have been mentioned by several workers from Tlayúa Quarry,

Puebla, however none of them are formal descriptive publications (Applegate, 1987; Applegate, 1996; Feldmann *et al.* 1998; Espinosa *et al.* 2000; and Kashiyama *et al.* 2004); Applegate *et al*. (in this volume) mention the presence of at least two or three forms of asteroids in the Tlayúa Quarry, that have not been classified. The asteroids body is formed by numerous calcareous ossicles sutured by organic matter that breaks down after burial, which facilitates the disgregation of the ossicles. Therefore preservation of complete fossil asteroids is rare.

## 6. Conclusions

Within extant forms of ophiuroids, the number of fossil specimens is relatively scarce (only 25% of all known genera have been found as fossils, Boardman *et al.*, 1987). The rarity of fossil ophiuroids is due to the fragility and composition of the skeleton. Also, it must be noted, that the scarcity of reports of fossil echinoderms in Mexico is probably due to the lack of specialists in this group. However, fossil ophiuroids have a wide stratigraphic range in Mexico. The first author of this chapter catalogued six forms of fossil ophiuroids, from seven different formations in Chihuahua, Coahuila, Puebla, Oaxaca, Chiapas and Baja California Sur, with ages ranging from Pennsylvanian to Pliocene. At present, the same author is preparing some of those fossils to refine their taxonomic identity by using comparative analysis with recent organisms, and innovative techniques like scanning electron microscopy and x-rays; v. gr. the ones collected from Tlayúa, Aguja, Cerro del Pueblo, San Juan and El Cien Formations.

These fossil echinoderms contribute important information about sedimentary environments, behavior and community ecology. Due to the preservation bias in the fossil record, ophiuroids may have always been as abundant and diverse in the fossil record as they are today. However, for now, ophiuroids are considered a low diversity fossil group in Mexican paleontological records.

Systematic work in Mexico concerning this group is reaching maturity, and it is expected, with ongoing research, that the fossil record of Mexican ophiuroids will continue growing, taxonomically, and in other important aspects such as behavior, evolution, taphonomy, paleoecology and paleobiogeography, and from those studies, finally, this important group of echinoderms could be better understood in Mexico.

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