CAMPANIAN TO MAASTRICHTIAN FOSSILS IN THE NORTHEASTERN WESTERN CORDILLERA COLOMBIA

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ABSTRACT

Restricted outcrops of: 1) Turbidite quartz-poor graywacke sandstones near Peque (7°N, 76°W, Department of Antioquia), have yielded numerous fossils, mainly as crushed moulds of ammonites and bivalves, which range in age from Campanian to Maastrichtian. *Nostoceras* **cf.** *hyatti*, *Nostoceras* **cf.** *pauper*, **and** *Inoceramus (Trochoceramus)* **sp. ind., are the most common fossils;** *Acila (Truncacila)* **cf.** *bivirgata* **is also recorded; if this last identification proves true, it would suggest the probability of reworking of older paleontological elements. 2) Thinly bedded siltstones and siliceous limestones appear heavily bioturbated by cosmopolitan trace-fossil forms such as** *Zoophycos* **and** *Chondrites.* **As the accretionary complex pile of the Western Cordillera consists of poorly dated fault -bounded packets, a revised summary of the macropaleontological evidence is reported.**

RESUMEN

Afloramientos pequeños de: 1) Arenitas turbidíticas -grauvacas pobres en cuarzo- en las cercanías de Peque (Departamento de Antioquia), han suministrado bivalvos y amonitas cuya dispersión bioestratigráfica abarca el lapso Campaniano - Maastrichtiano. *Nostoceras* **cf.** *hyatti*, *Nostoceras* **cf.** *pauper*, **e** *Inoceramus (Trochoceramus)* **sp. ind., son los fósiles más comunes;** *Acila (Truncacila)* **cf.** *bivirgata* **también está presente: si esta última identificación resulta ser válida, sugeriría la posibilidad de resedimentación de materiales más antiguos que las amonitas antes citadas. 2) Limolitas y calizas delgadamente estratificadas aparecen intensamente bioperturbadas por** *Zoophycos* **y** *Chondrites.* **Puesto que el complejo acrecionario de la Cordillera Occidental consiste de paquetes limitados por fallas los cuales están pobremente datados, se presenta la revisión de la información macropaleontológica para las mencionadas dataciones.**

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INTRODUCTION

Knowledge of the Western Cordillera Mesozoic paleontology has been hindered by the scarcity of well investigated exposures which at first sight appear to be almost non-fossiliferous, plus the lack of accurate lateral and vertical spatial control of lithofacies. Recently, during field work in the area of Peque (NW Antioquia), H. González and M. Mejía (INGEOMINAS, Medellín) and later H. González and F. Etayo Serna found many body fossils as trace fossils in outcrops of turbidite graywackic sandstones, thinly bedded siltstones and siliceous limestones. These findings provide valuable information on the age of the beds and an insight into the facial relationships within the stratigraphy of the northeastern part of the Western Cordillera.

GEOLOGICAL SETTINGS AND AGE

Rocks in the known outcrops can be grouped into two informal members: **1)** quartz-poor graywakes with detrital serpentinite, which show normal grading upward from coarse or medium grained sandstone to intensively burrowed mudstone, and which may represent turbidity-current deposits; **2)** thinly bedded, siliceous to calcareous siltstones which show intercalations -a few millimeters thick- of bands of meniscate burrows *(Zoophycos)* and bands with almost no visible bioturbation. The stratigraphic ties between graywackes and siliceous siltstones have not been clearly established, due to dense vegetation and noticeable folding and faulting. On the other hand, the mudstone division of the turbidites contains the only datable fossils which may be coeval with the time of deposition *(Nostoceras* sp., *Trochoceramus* sp.), or even older *(Truncacila* cf. *bivirgata).* Although previously, the author (ETAYO SERNA *et al,* 1983) had chosen the middle Albian as the age for the graywackes, additional material now described demonstrates the reworked nature of the older fossils, thus assigning these beds to the Campanian - Maastrichtian. The general geology of the Peque area has been described by M. Mejía (in preparation).

SEDIMENTARY FRAMEWORK

There is evidence that most of the studied gray*wacke beds* represent an accumulation of the deposits of subsea sediment-gravity flows: **1)** graded bedding that fines upward to mudstone and contains part of the Bouma sequence of internal sedimentary structures can be seen in these beds (e.g., fig. 2); **2)** concentrations of fossils lie either on top or inmediately below sharp discontinuity surfaces recognized by a lithological change or a physical parting in the rock (e.g., figs. 4a, 4b); **3)** in a single layer bioclastic allochthonous components include paleofauna indigenous only to shallow-water habitats whereas the assemblage of authochthonous burrows indicates a deeper-water bottom environment. In regard to the siliceous or calcareous siltstones, although both the composition and horizontally oriented biogenic structures suggest this type of material to have been partly derived from hemipelagic mud (e.g., Plate II, fig. 4), they may represent clayey silt turbidites (cf. KELING & STANLEY, 1976).

STRATIGRAPHIC CONCLUSIONS

The lithostratigraphy of the Western Cordillera of Colombia has been summarized in the Terrane Map of Colombia (ETAYO SERNA *et al,* 1986), but the structural relationships among units of this probably accretionary complex pile are much more complex than depicted. Detailed field, paleontological and facial studied of well preserved and well exposed sections in the Western Cordillera are necessary for the understanding of the true stratigraphic (or tectonostratigraphic !) succession in the region. Although there is not enough macropaleontological information to evaluate thoroughly the ages of the Mesozoic lithostratigraphy units of the Western Cordillera, the following points are worth making: **1)** Late Campanian-early Maastrichtian *Nostoceras* and *Trochoceramus* are described from turbidite graywackes in this report (see fig. 1, locality 1); **2)** Mid-Albian ammonites were recovered from fine grained graywacke turbidites (: not cherts as previously reported in ETAYO SERNA *et al,* 1980; fig. 1, locality 2). **3)** Campanian-Maastrichtian bivalves and the Rhodophyta *Archaeolitho thamnium* have been reported by ETAYO SERNA *et al.* (1982; fig. 1, locality 3). **4)** Turonian ammonites were found in volcaniclastic rocks; ETAYO SERNA in ORDOÑEZ (1978; fig. 1, locality 4). **5)** A late Campanian-early Maastrichtian *Trochoceramus* was found in a laminated mudstone at the type locality of the Espinal Formation; ETAYO-SERNA, 1985. **6)** Ammonites and bivalves were first reported from the Western Cordillera formations by HUBACH and ALVARADO (1934), from the neighborhood of Jamundí and Golondrinas -near Cali-: the fossils were poorly preserved, but they were originally interpreted by HUBACH (op. cit.) as being late Cretaceous in age. The

author has examined Hubach's material deposited in INGEOMINAS, Bogotá, and they are identified as follows: *Inoceramus* sp. (sample 555 V.0920), and *Watinoceras* (?) sp. ind. (sample 575 V-0923), of probable Turonian age. **7)** A *Zoophycos-Chondrites* ichnofacies is a characteristic peculiar only to rocks of the Western Cordillera in Colombia; ETAYO SERNA, 1986. Because of published misinformation, it is necessary to emphasize from available evidence that the ages of the Western Cordillera "formations" and the age of deposition is still a controversial topic.

LOCATION OF SPECIMENS

The following abbreviations are used to indicate the repository of the material studied: IGM, INGEOMINAS, Bogotá. OUM, University Museum Oxford; USNM, U. S. National Museum.

SYSTEMATIC DESCRIPTIONS

Phylum MOLLUSCA - Class CEPHALOPODA
Family NOSTOCERATIDAE Hyatt, 1894
Genus *Nostoceras* Hyatt, 1894

Type species: *Nostoceras stantoni* Hyatt, 1894.

Nostoceras cf. *hyatti* Stephenson
Plate 1; figs. 1, 2.

1941 *Nostoceras hyatti* Stephenson, p. 410, pl. 81, figs. 9-12.
1974 *Nostoceras hyatti* Stephenson, Cobban, pl. 5, figs. 1-21, pl. 6, figs. 1-12, pl. 7, figs. 1-10, pl. 8, figs. 1-30, text. fig. 8 (with synonymy).
1986 *Nostoceras (Nostoceras) hyatti* Stephenson, Kennedy, p. 90, pl. 20, figs. 7-9.

MATERIAL.- Hypotypes: IGM 171210/2; IGM 171223; IGM 171209/2; IGM 171213; IGM 171214; IGM 171222; IGM 171250.

DESCRIPTION.- Somewhat loosely coiled helical shell. The whorl section is rounded between the ribs. Ornament consist of ribs and tubercles: ribs oblique, each primary bearing two rows of conspicuous tubercles, one at point of greatest convexity of whorl, other near to the deep whorl junction abapically (e.g.: IGM 171223, pl. 1, fig, 2). There are two-rarely three- **secondary ribs** to each subcentral tubercle and there is a **prominent non-tuberculate** intermediate rib separating **every other primary**. On several fragments of the looped body chambers (or hooks), it is clear that the ribs are stronger and more widely spaced than on the spiral whorls (e.g.: IGM 171210/2, pl. 1, fig. 1) (IGM 171209/2; Not figured).

COMMENTS.- My material was compared with plaster casts of Cobban's (1974) material OUM: USNM 182475; Cobban, 1974, pl. 5, figs. 19-21; USNM 182491: Cobban, pl. 8, figs. 17-19; USNM 182470, ib. pl. 9, figs. 17-18).

At first sight the helical part of the specimens referred to *N. hyatti* seems to resemble the Albian heteromoph *Pseudhelicoceras subcatenatum* Spath (1937, p.537, pl. 58, figs. 22: holotype); in the last species however, the ribs are "strongly flexuous" and the shell lacks a book.

TAPHONOMY.- In most of the specimens with a body chamber, the hook seems to have ben deposited parallel or slightly inclined in relation to a plane that cuts through its venter. Some specimens show moulds of juvenile epizoic oysters.

OCCURRENCE.- Nacatoch sand (Navarro Group), Texas. Basal parte of the Navesik Formation (Late Campanian - Early Maastrichtian), New Jersey, United States; Barra do Dande, Angola (Upper Campanian - Lower Maastrichtian; Cobban, 1974, p. 11). Northern Aquitaine, France (Maastrichtian), Kennedy, 1986. Possible Israel and Madagascar .

Nostoceras cf. *pauper* (Whitfield)
Pl. 2, fig. 4.

1974 *Nostoceras pauper* (Whitfield), Cobban. p. 12, pl. 9, figs. 1-22; text fig. 10 (with synonymy).

COMMENTS.- A rubber cast of the colombian specimen was compared to a plaster cast of Cobban's figured hypotipe USNM 182501 (Cobban pl. 9, fig. 17-18); they share in common "A deeply impressed area on the upper surfaces of the whorls ..." and "Two rows of small pointed bullate tubercles . . ., one near middle of the side and other lower".

OCCURRENCE.- The geographic range extends from New Jersey (Basal part of the Navesik Formation, late Campanian-early Maastrichtian), to Colombia.

Class BIVALVIA
Family INOCERAMIDAE Giebel, 1852
Genus *Inoceramus* J. Sowerby, 1814
Subgenus *Trochoceramus* Heinz, 1932

Type species. *I. helveticus* Heinz, 1932.

Inoceramus (Trochoceramus) sp. ind.
Pl. 2, figs. 1, 2.

MATERIAL.- Several specimens IGM 171250.

DESCRIPTION.- Several partly well-preserved specimens of a large, flat to slightly convex *Inoceramus*. Ornamentation consisting of strong, widely separated concentric fold-like ribs, with the adventral slope steeper than the abventral ((Pl. 2, fig. 1). Concentric folds are crossed by narrow radial ribs. The forms included in this species show a great amount of variations: both, the radial ribbing or the concentric ribs may be absent, indistinct or weakly developed. Some individuals show an internal (endocostal) furrow.

OCCURRENCE.- Althoug the subgenus has a wide geographic range its biochron is rather narrow (late Campanian - early Maastrichtian) (cf. ETAYO-SERNA, 1985, fig. 3).

Family NUCULIDAE, Gray, 1824
Genus Arcila H. & A. Adams, 1858
Subgenus *Truncacila* Grant and Gale, 1931

Type species. *Nucula castrensis* Hinds, by original designation.

Arcila (Truncacila) cf. *bivirgata* (J. de C. Sowerby)
Pl. 1, fig. 3.

1899 *Nucula (Acila) bivirgata* Sowerby, 1836. Woods p. 19, pl. 3, figs. 1, 2a-c, 3, non 4, 5a-c, 6-12.
1936 *Acila (Truncacila) bivirgata* (J. de C. Sowerby), 1836. Schenck, p. 47, pl. 2, figs. 1, 2, 11, 12, 14, 15 (with synonymy).

MATERIAL.- Hypotipes. IGM 171233 (internal mould); IGM 171250 (external mould).

DESCRIPTION.- A slightly crushed right valve 14 mm long, trigonal; ventral margin evenly curved. Surface of shell sculptured with numerous (+ 50) fines radiating ribs, separated by subequal interspaces. The ribs diverge at an acute angle (: divarication) from a line extending from the umbo to a point near that middle of ventral margin.

COMMENTS.- This specimen seems to be closer to the Mediterranean - Alpine species rather than to the Pacific *Acila (Truncacila) demessa* Finlay (cf. SCHENCK, 1936, p. 48, pl. 2, figs. 5, 7, 8, 9).

OCCURRENCE.- Although this would be the westernmost finding of the specie *A. (T.) bivirgata* in the Tethyan Realm, specimens referred to the species have been figured by SCHENCK (1936; p. 48, p. 2, fig. 15) from Venezuela. The species is known from occurrences in Albian beds of western Europe (Aube) and from the Aptian of northern Africa (Morocco and Tunisia), according to MONGIN (1979, p. 118).

TRACE FOSSILS

Ichnogenus *Sabellarifex* Richter, 1921
Sabellarifex
Pl. 2, fig. 3.

MATERIAL.- IGM 171227.

DESCRIPTION.- Several fragments up to 5 cm long of tubular sheaths, about 1,5 mm in diameter, consisting of a mosaic of closely packed silt size grains; they occur in very fine tubidite sandstone.

TAPHONOMY.- *Sabellarifex* represent tubes of *Sabellaria*-like polychaetes; recent sabellariids thrive in pure sandy bottoms of the intertidal environment (RICHTER, 1921), and their occurrence in the turbidite sandstone would mean they were transported into deeper water.

Ichnogenus *Zoophycos* Masalongo, 1855
Zoophycos
Pl. 1, fig. 4.

MATERIAL.- Sample P-34.

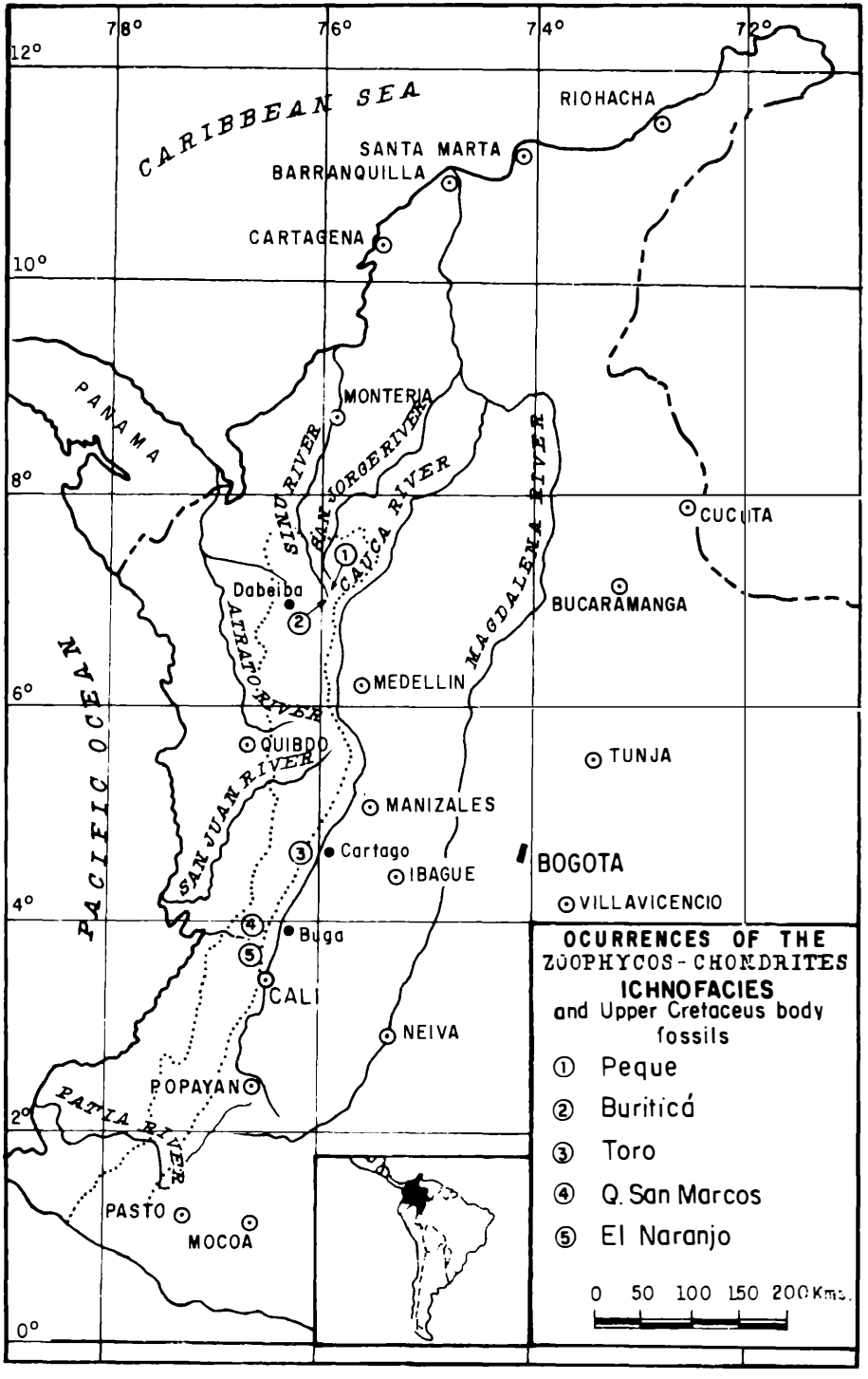

FIG. 1: Occurrence of the *Zoophycos-Chondrites* ichnofacies and late Cretaceous body fossils in Western Cordillera Formations.

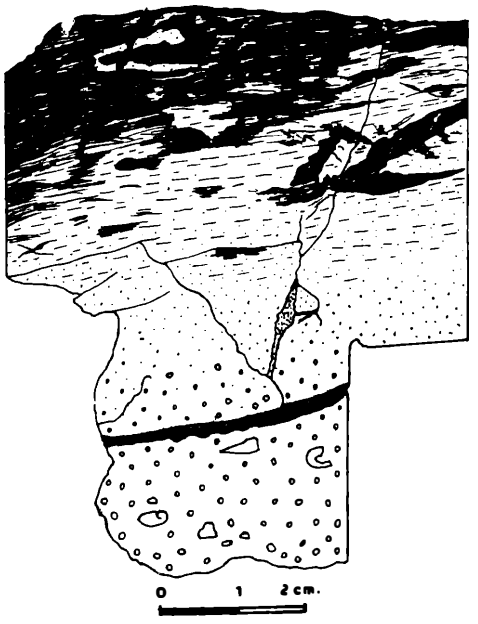

FIG. 2: Vertical section through turbidite sandstone bed, graded from medium sand to fine -bioturbated- silt and mudstone Schematic. Diverse types of basalt or andesite and basic plagioclase grains are mixed with detrital serpentinite clasts. IGM 183218/2. The poorly sorted lower portion of this sample contains angular clasts up to 5 mm diameter of andesite basalt (from photograph).

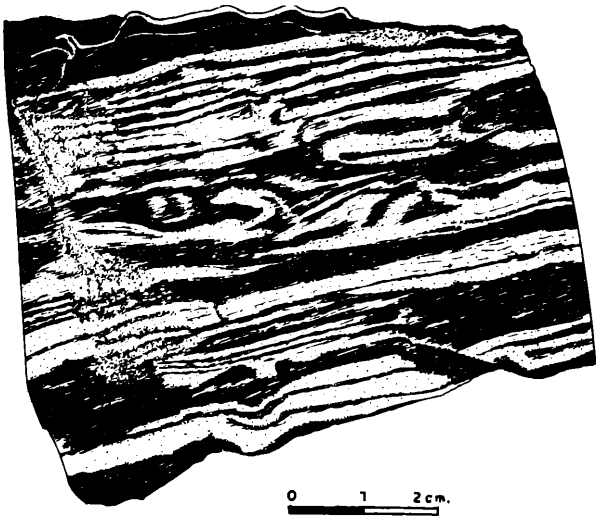

FIG. 3: Vertical section through post-depositional convolute lamination in fine grained turbidite. Notice a shell of *Inoceramus*-arrow- on base of mudstone (from photograph).

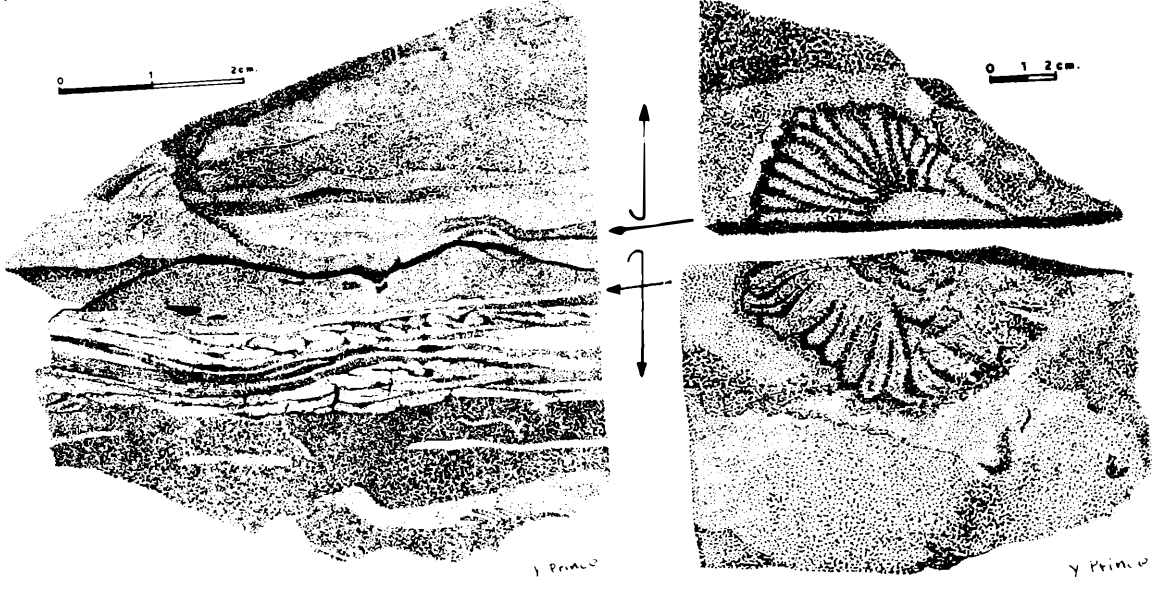

FIG. 4: Vertical section through loadcasts at the base of very fine sandstone beds interposed with fine laminae of mudstone -dark color- (fig. 4a): Notice fossil ammonite on top of mudstone -dark color- when the bedding plane shown by arrow is split open (fig. 4b): Schematic (from photograph).

COMMENTS.- According to ETAYO SERNA (1986), *Zoophycos* is a common and widely distributed ichnofossil in sedimentary rocks of the Western Cordillera, Colombia, especially in the biosileceous and argillaceous facies and in the fine grained divisions of turbidites. In sections perpendicular to bedding, the trace fossil *Zoophycos* appears as subparallel millimetre-scale belts of closely juxtaposed meniscate markings (Pl. 1, fig. 4: arrow!).

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PLATE I

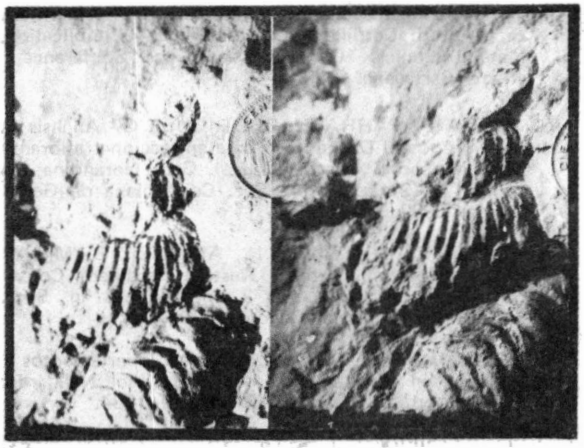


FIG. 1

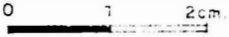


FIG. 2

FIG. 3

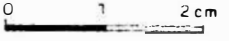
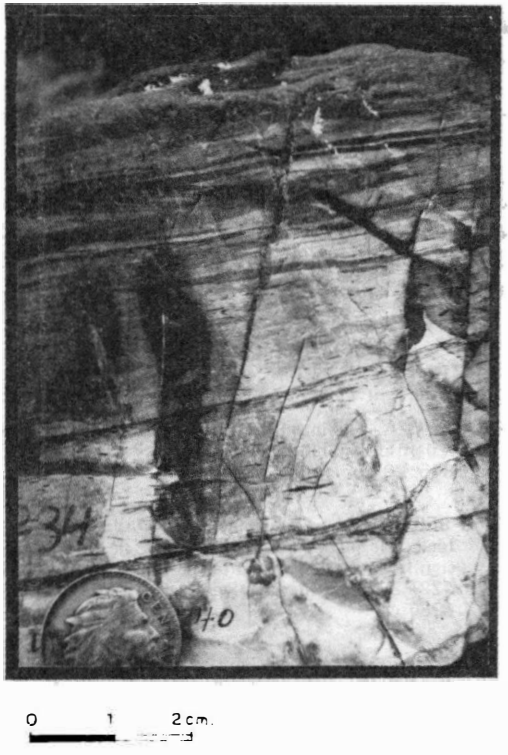


FIG. 4



Figure

1. *Nostoceras* cf. *hyatti* Stephenson. Stereopair photographs showing the morphology of the spire and a fragment of the hook (arrow). IGM 171210/2.

2. *Nostoceras* cf. *hyatti* Stephenson. Stereopair photographs of the spire of specimen IGM 131223.

Figure

3. Sterephotograph of the bivalve *Acila (Truncacila)* cf. *bivirgata* (J. de C. Sowerby). IGM 171233.

4. Bioturbated horizons *(Zoophycos*-arrow-) interbedded with horizons containing *Chondrites* in hemipelagic mud, seen in a plane, cut perpendicular to the bedding.

PLATE II

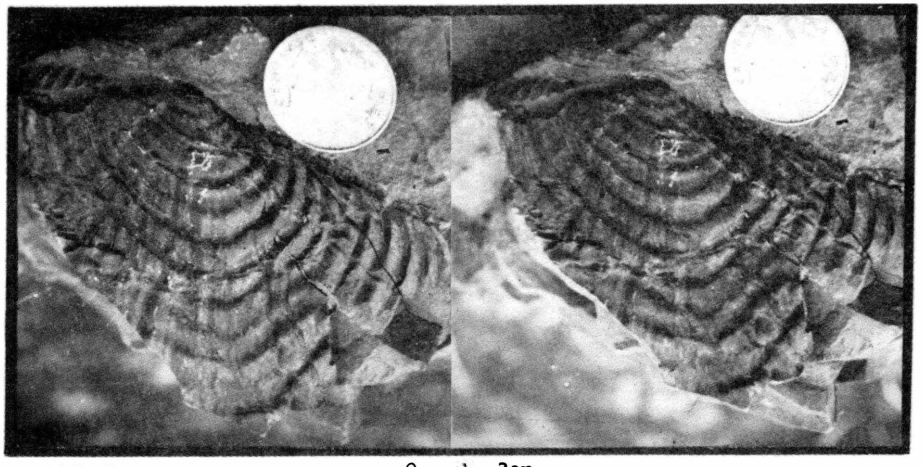


FIG.1

0 1 2cm.

FIG.2

0 1 2cm

FIG.3

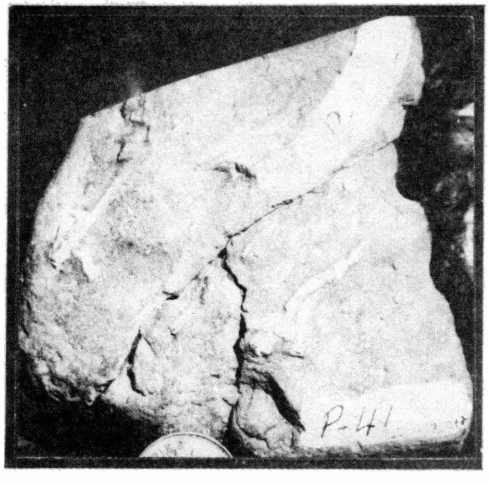


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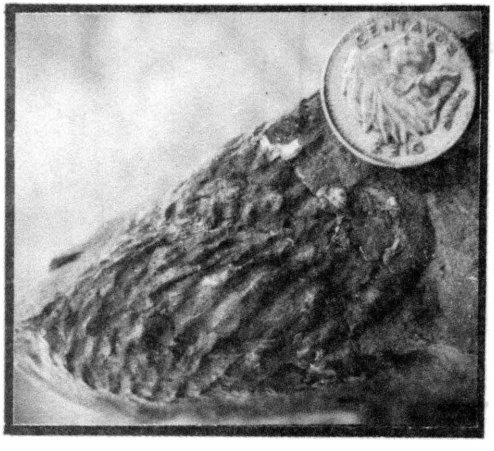
FIG.4



0 1 2cm.

Figure

1 y 2. Stereophotograph of the bivalve *Inoceramus (Trochoceramus)* sp.

3. Elongated tubes of *Sabellarifex*. Note the tube in cross section (arrow).

4. *Nostoceras* cf. *pauper* (Whitfield); adoral portion of spire, slightly deformed.