

A new genus of coral (*Rugosa*) from the Adarouch area (Brigantian, NE Central Morocco)

Un género nuevo de coral (Rugosa) del área de Adarouch (Brigantiense, NE Marruecos Central)

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Abstract: A new genus of rugose coral, *Tizraia*, has been recorded in the Tizra and Akerchi formations of the Adarouch area (Brigantian, Central Meseta, Morocco). The new genus is characterised by incomplete, mesa-shaped tabulae, absence of axial structure and presence of well developed lonsdaleoid dissepiments, as well as parricidal increase. It evolved from *Diphyphyllum* by the development of lonsdaleoid dissepiments. Only the type species, *Tizraia berkhlii* gen. nov. sp. nov. is included with certainty in the new genus, but an additional species represented by one single specimen is tentatively described under this generic name. *Tizraia* has also been recorded in the Djerada Basin (Eastern Morocco) and may be present in Ireland. It has high biostratigraphic value as an Upper Brigantian (Upper Viséan) index taxon.

Key words: Systematics, Biogeography, Rugose corals, Tizra, Akerchi, Mississippian.

Resumen: El nuevo género de coral rugoso *Tizraia* ha sido encontrado en las formaciones Tizra y Akerchi, en la región de Adarouch (Marruecos central, Brigantiense). El nuevo género está caracterizado por tábulas incompletas en forma de mesa, ausencia de estructura axial, disepimentos lonsdaleoides bien desarrollados y gemación parricida. Evolucionó de *Diphyphyllum* mediante el desarrollo de disepimentos lonsdaleoides. Solo se asigna a este género con seguridad la especie tipo, *Tizraia berkhlii* gen. nov. sp. nov., aunque otra especie representada por un solo ejemplar se describe tentativamente bajo la misma denominación genérica. *Tizraia* ha sido identificada también en la cuenca de Djerada (Marruecos oriental) y puede estar presente también en Irlanda. Puede tener un alto valor bioestratigráfico como marcador de Brigantiense superior.

Palabras clave: Sistemática, Biogeografía, Rugosa, Tizra, Akerchi, Mississipiense.

INTRODUCTION

Mississippian outcrops in the Adarouch area (NE Central Morocco) have provided a diverse coral assemblage (SAID *et al.*, 2003, 2007). Most taxa are already well known and comparable with the assemblages from Western Europe and the Sahara (SEMENOFF-TIAN-CHANSKY, 1974; POTY, 1981; RODRÍGUEZ & FALCES, 1992; SOMERVILLE, 1997; RODRÍGUEZ *et al.*, 2007). Some corals, however, show special features that have not been described previously and are described here as a new genus.

The Early Carboniferous sequences of the Adarouch area crop out in a broad area south of

the city of El-Hajeb (Fig. 1). The Palaeozoic rocks in that area have a NE-SW orientation and are bounded by Mesozoic rocks. The Mississippian succession is subdivided into five lithostratigraphic units: the Oued Amhars formation (oldest), the Tizra Formation, the Mouarhaz Formation, the Akerchi Formation and the geographically isolated Idmarrach Formation. They comprise Upper Viséan to Serpukhovian sedimentary rocks (BERKHLI, 1999; BERKHLI & VACHARD, 2001). Micropalaeontological data suggest that Serpukhovian strata are present only in the upper part of the Akerchi Formation and probably at the top of the coeval Idmarrach Formation.

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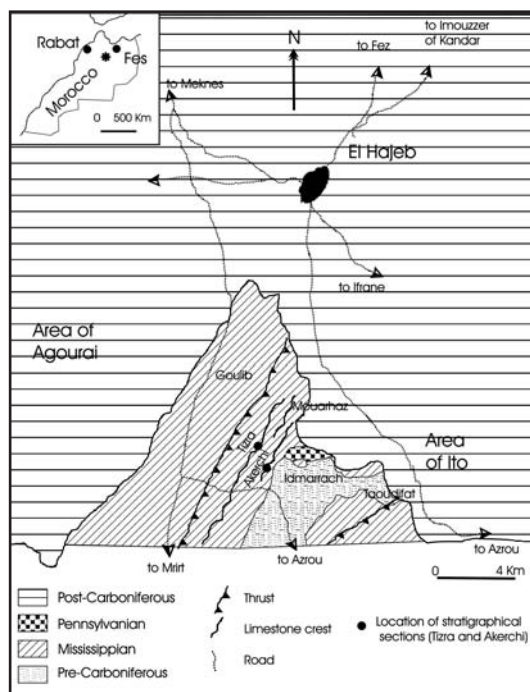


Figure 1.– Location map of the studied outcrops containing *Tizraia berkhlia* gen. nov. sp. nov.

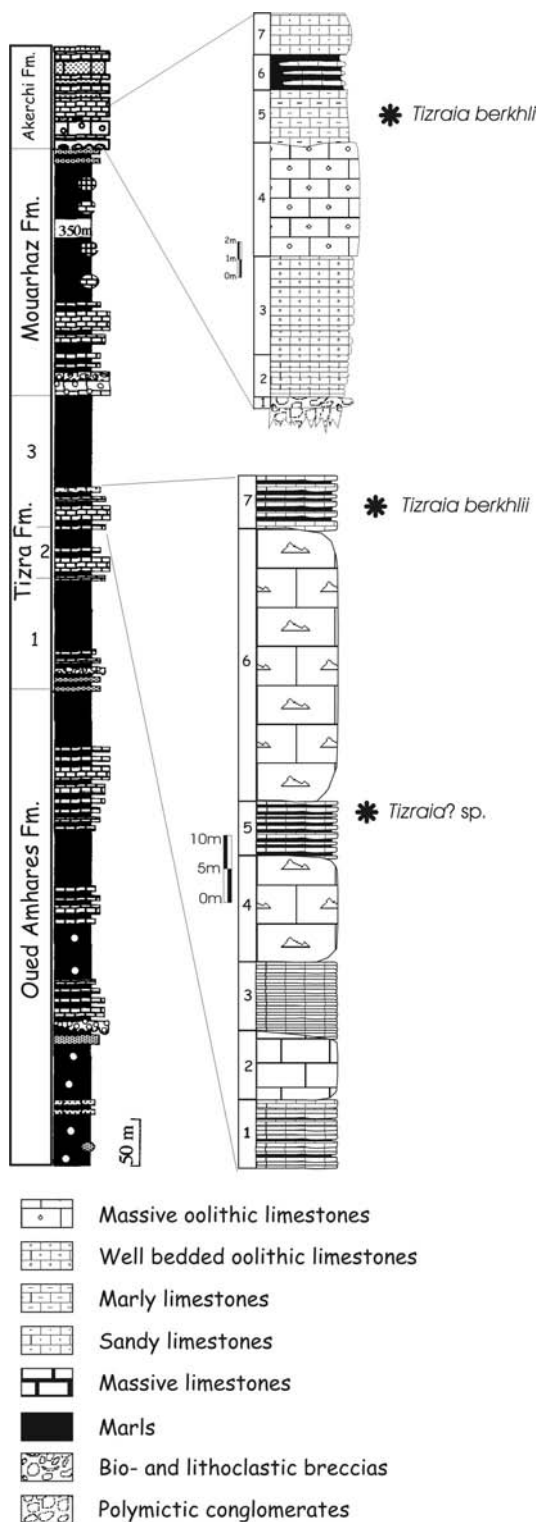
Figura 1.– Mapa de situación de los afloramientos estudiados con *Tizraia berkhlia* gen. nov. sp. nov.

Coral assemblages have been recorded from the Tizra, Akerchi and Idmarrach formations. However, despite the fact that the most diverse coral assemblages were recorded in the Idmarrach Formation, the new genus has been recorded only in the Tizra and Akerchi formations.

The Tizra Formation is subdivided into three members (TZ1-3). Each member is composed of a succession of limestones in its lower part and shales in its upper part. Only the second and third members (TZ2 and TZ3) yielded abundant corals. Two sections were measured in the Tizra Formation and several horizons from both sections yielded abundant corals. Specimens attributed to the new genus were collected from near the top of the second section (Fig. 2). There, a biostrome

Figure 2.– Stratigraphical logged sections of Tizra and Akerchi formations with location of the occurrence of *Tizraia berkhlia* and *Tizraia?* sp.

Figura 2.– Secciones estratigráficas de las formaciones Akerchi y Tizra con la posición de *Tizraia berkhlia* y *Tizraia?* sp.



located at the top of a large microbial mound contains abundant and diverse fasciculate corals, including the new taxon (unit 7 of Tizra Formation). It is designated as the type locality for the new genus. The rugose assemblage found in the biostrome includes: *Haplolasma densum* (SALÉE), *Siphonophyllia samsonensis* (SALÉE), *Clisiophyllum* sp. 1, *Clisiophyllum* sp. 2, *Axoclisia* sp., *Corwenia* sp. 1, *Corwenia* sp. 2, *Aulokoninckophyllum carinatum* (CARRUTHERS), *Aulokoninckophyllum* sp. nov., *Siphonodendron irregulare* (PHILLIPS), *Siphonodendron intermedium* POTY, *Diphyphyllum lateseptatum* MCCOY, *Diphyphyllum fasciculatum* (FLEMING), *Tizraia berkhlii* gen. nov. sp. nov., *Axophyllum densum* (RYDER) and *Axophyllum* aff. *pseudokirsopianum*.

The Akerchi Formation is 100 m thick and it is divided into two members. The lower member is composed of bioclastic and oolitic limestone (Fig. 2). They are overlain by marly limestone containing gigantoproductids and corals that pass upward progressively into shale and sandstone with calcareous cement (sandy limestone). Some specimens of the new taxon have been recorded in the marly limestone. The rugose assemblage of the Akerchi Formation includes: *Clisiophyllum garwoodi* (SALÉE), *Clisiophyllum* sp. nov. A, *Clisiophyllum keyserlingi crassiseptatum* SEMENOFF-TIAN-CHANSKY, *Clisiophyllum* sp. 1, *Clisiophyllum* sp. 2, *Dibunophyllum bipartitum* THOMSON & NICHOLSON, *Arachnolasma sinense* (YABE & HAYASAKA), *Arachnolasma cylindricum* YÜ, *Palaeosmia murchisoni* MILNE-EDWARDS & HAIME, *Palastraea regia* (PHILLIPS), *Koninckophyllum interruptum* THOMSON & NICHOLSON, *Aulokoninckophyllum carinatum*, *Siphonodendron junceum* (FLEMING), *Siphonodendron pauciradiale* (MCCOY), *Lithostrotion decipiens* (MCCOY), *Lithostrotion vorticale* (PARKINSON), *Diphyphyllum furcatum* (SMITH), *Diphyphyllum lateseptatum*, *Tizraia berkhlii*, and *Axophyllum* aff. *dibunophylloides*.

SYSTEMATIC DESCRIPTIONS

We follow basically the classification and macrostructural terminology proposed by HILL

(1981). The microstructural terminology is that proposed by SEMENOFF-TIAN-CHANSKY (1974). All specimens are housed in the Department of Paleontology, Universidad Complutense de Madrid and have register numbers of this department. Each specimen number includes indications of locality and stratigraphic level.

Subclass Rugosa MILNE-EDWARDS & HAIME, 1850

Order Stauriida VERRILL, 1865

Family Lithostrotionidae D'ORBIGNY, 1852

Subfamily Diphyphyllinae DYBOWSKI, 1873

Genus *Tizraia* gen. nov.

Type species: *Tizraia berkhlii* sp. nov.

Derivatio nominis: The genus name is derived from Tizra, the formation from which the type specimens were collected.

Occurrence: Brigantian (Upper Viséan) from Adarouch Area (Tizra and Akerchi formations; Figs. 1, 2) and Djerada Basin in Morocco. The genus possibly also occurs in Ireland.

Diagnosis: Fasciculate lithostrotionid corals lacking axial structure and having transeptal (lonsdaleoid) dissepiments of first and second order. Dissepithea usually well developed and tabulae mesa-shaped, tabellae commonly form axial and peripheral series. Budding parvicidal.

Remarks: In transverse section, *Tizraia* shows similar features to those in *Lublinophyllum* KHOA, 1977 in transverse section. However, detailed study shows many differences between these two genera (Fig. 3); first, the dividing in *Tizraia* is parvicidal, whereas *Lublinophyllum* has lateral budding. Septa are thickened and short in the tabularium of the latter, but the thickening is usually limited to the dissepithea in the former and the septa are longer, leaving a smaller open area in the axial zone. The cardinal septum is typically shortened in *Lublinophyllum*, but only very rarely in *Tizraia*. The counter septum is longer than the adjacent septa in *Lublinophyllum* but it is not

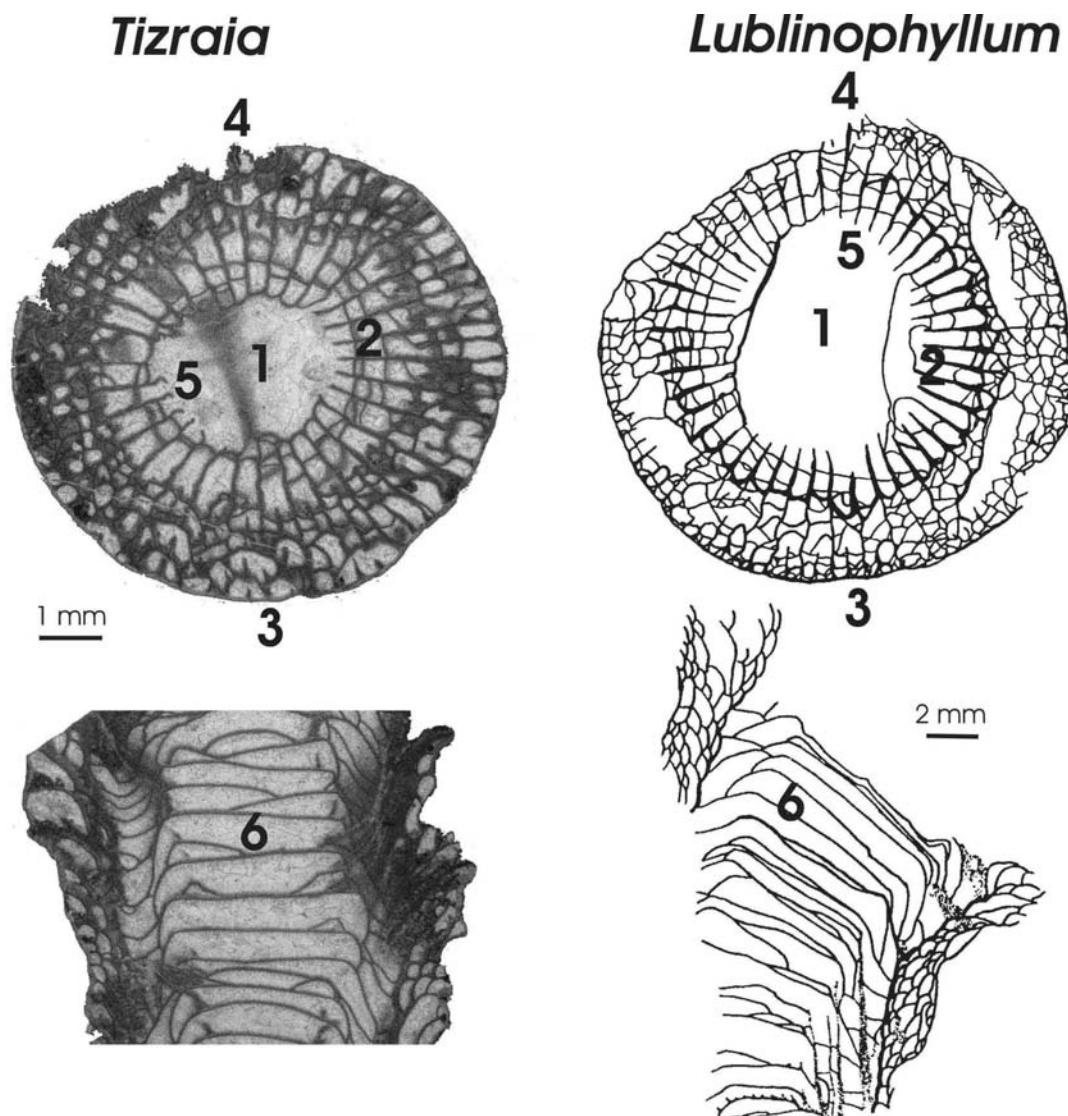


Figure 3.— Comparison between *Tizraia* and *Lublinophyllum*. 1. The septa are shorter in *Lublinophyllum* producing a larger open axial area. 2. Septal thickening in the tabularium is conspicuous in *Lublinophyllum*, but thickenings in *Tizraia* are homogeneous or located exclusively in the boundary between tabularium and dissepimentarium. 3. Cardinal septum is shortened in *Lublinophyllum*, but inconspicuous in *Tizraia*. 4. Counter septum may be longer in *Lublinophyllum* (not seen in the picture) but also inconspicuous in *Tizraia*. 5. Tabulae form quite regular rings in *Tizraia*, but they are more irregular in *Lublinophyllum*. 6. Axial tabellae are more regular and mesa-shaped in *Tizraia*. In addition, there is a prominent through between the inclined dissepiments and mesa-shaped tabulae in *Tizraia*. (Illustrations of *Lublinophyllum* from KHOA, 1977).

Figura 3.— Comparación de Tizraia con Lublinophyllum. 1. Los septos son más cortos en Lublinophyllum dejando un área central hueca mayor. 2. El engrosamiento septal en el tabulario es muy marcado en Lublinophyllum, pero los engrosamientos en Tizraia son homogéneos o localizados exclusivamente en el límite entre el tabulario y el disepimentario. 3. El septo cardinal está acortado en Lublinophyllum, pero no se diferencia en Tizraia. 4. El septo antípoda puede ser más largo en Lublinophyllum (no observable en la figura) pero tampoco se diferencia en Tizraia. 5. Las tábulas forman anillos bastante regulares en Tizraia, pero son irregulares en Lublinophyllum. 6. Las tabelas axiales son más regulares y con forma de mesa en Tizraia. Además hay una fuerte ruptura entre los disepimentos y las tábulas en Tizraia. (Ilustraciones de Lublinophyllum según KHOA, 1977).

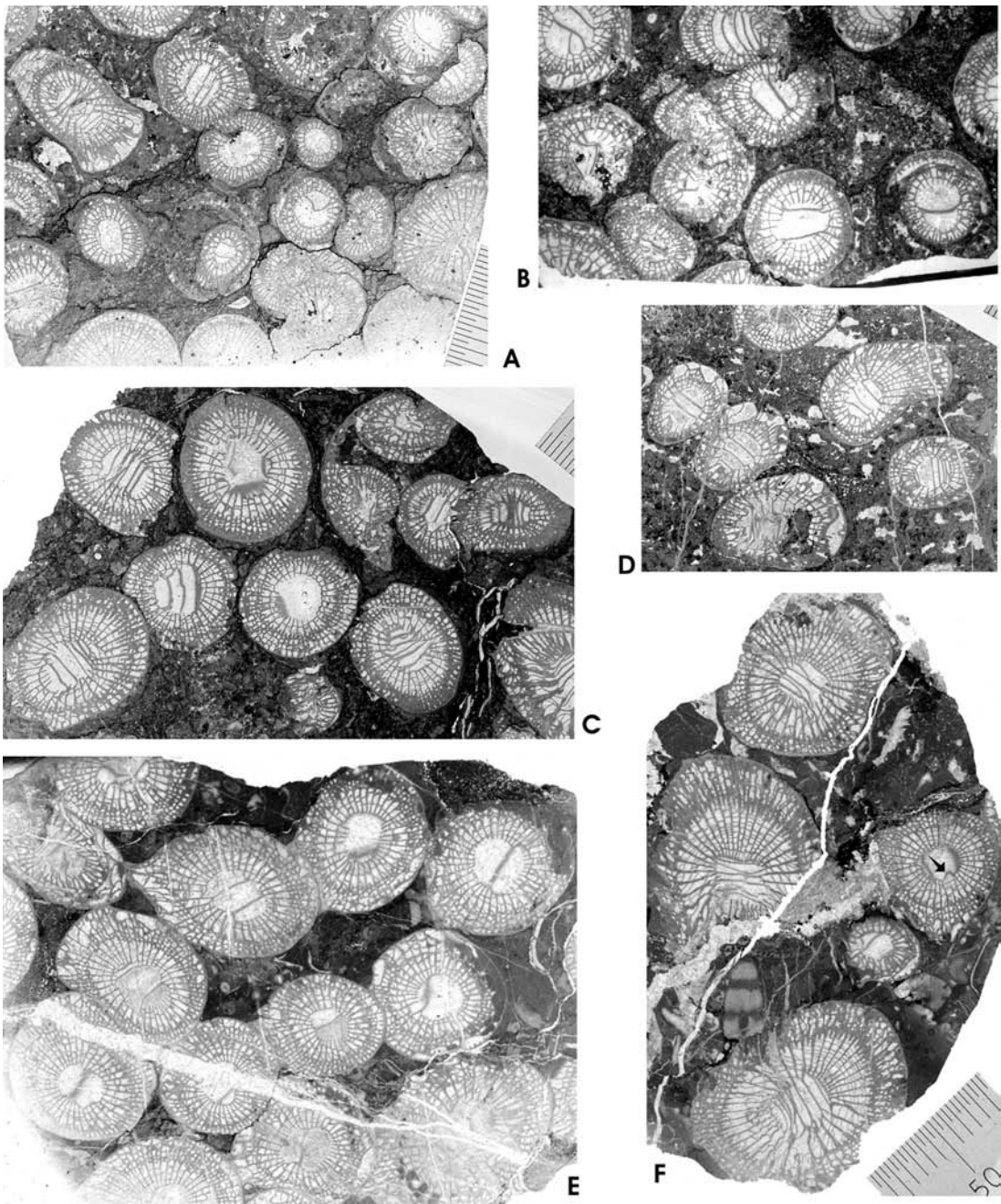


Figure 4.— *Tizraia berkhlii* gen. nov. sp. nov. A. DPM-TIZ0/5-2 (holotype), transverse section. B. DPM-TIZ0/5-2 (holotype), transverse section, showing a parricidal budding. C. DPM-TIZ0/5-32 (paratype). D. DPM-TIZ2/5-6 (paratype). E. DPM-AKE1/1-46, specimen with dense packing. F. DPM-AKE1/1-43, specimen with large corallites. Slightly shortened cardinal septum in a small fossula indicated by the arrow. All figures $\times 1.75$.

Figure 4.— *Tizraia berkhlii* gen. nov. sp. nov. A. DPM-TIZ0/5-2 (holotipo), sección transversal. B. DPM-TIZ0/5-2 (holotipo), sección transversal que muestra gemación parricida. C. DPM-TIZ0/5-32 (paratipo). D. DPM-TIZ2/5-6 (paratipo). E. DPM-AKE1/1-46, ejemplar con denso empaquetamiento. F. DPM-AKE1/1-43, ejemplar con poliperitos muy grandes. La flecha señala un septo cardinal ligeramente acortado en una pequeña fósula. Todas las figuras $\times 1,75$.

conspicuous in *Tizraia*. The tabulae form complete or almost complete rings in *Tizraia*, but this feature is not conspicuous in *Lublinophyllum*. Differences in morphology and type of budding between these two genera indicate that they belong to different families.

Specimens from Ireland of the same age as the Moroccan (and Polish) corals have been identified by I.D. SOMERVILLE (in CÓZAR & SOMERVILLE, 2005, fig. 12; RODRÍGUEZ & SOMERVILLE, 2007) as *Lublinophyllum*, but further detailed study is necessary to establish their relationship to *Tizraia*.

On the other hand, the described features relate *Tizraia* to the subfamily Diphyphyllinae. All characteristics of the new genus are identical to those of the genus *Diphyphyllum* LONSDALE, 1845, except for the presence of transeptal (lonsdaleoid) dissepiments, which have not been described in the latter genus. This feature is very persistent in all specimens of *Tizraia*. Some specimens from the Tizra Formation show common transeptal dissepiments of the second order, but only rare transeptal dissepiments of the first order. Sections through young stages of all specimens show a weak development of transeptal dissepiments; this indicates that the new genus probably was derived directly from *Diphyphyllum* by development of this type of dissepiments.

Tizraia gen. nov. may have important biostratigraphic and biogeographic value. Additional specimens belonging to this genus have been recorded, but not yet described in the Djerada Basin (Western Morocco) at the same stratigraphic level (Upper Brigantian) as the type material. If new detailed studies on the specimens from Ireland show that they belong to *Tizraia*, the geographic distribution of this genus would be enlarged considerably. Moreover, the stratigraphic level (Upper Brigantian) would be identical in the two areas. This genus has not been recorded in intermediate areas such as SW Spain, probably because marine Upper Brigantian rocks are very rare in that region. No similar corals have been described from the Eastern Europe. Consequently, *Tizraia* gen. nov. seems to be restricted to the Western Paleotethys.

Tizraia berkhlii sp. nov.
(Figs. 4-8)

Holotype: Specimen DPM-TIZ2/5-6, upper beds of the Tizra Formation in the Adarouch area, northeastern part of the Central Moroccan Meseta, Brigantian (upper Viséan). The collected sample is approximately 10 cm in diameter and 15 cm in high, but the colony is about 60 cm in diameter and 40 cm in high. It is stored in the Departamento de Paleontología, Universidad Complutense de Madrid.

Derivatio nominis: The species name is dedicated to Mostafa Berkhli, the geologist who introduced the authors to the study of the Adarouch area and was a co-director of the Ph. D. program of the first author.

Diagnosis: Fasciculate corals showing parricidal budding. Septa short, leaving an axial space without axial structure. Dissepimentarium composed of interseptal and transeptal dissepiments in different degrees of development. Tabulae incomplete, axial tabellae mesa-shaped. Mean septal number 25-40 and mean alar diameter 6-12 mm.

Material: 10 specimens from Tizra and Akerchi formations: DPM-AKE/1-2; AKE/1-43; AKE/1-46; TIZ0/5-2; TIZ0/5-18; TIZ0/5-32; TIZ0/5-40; TIZ2/5-6; TIZ2/5-7; TIZ2/5-8. All specimens from the Tizra Formation, except the holotype are designed as paratypes. 21 transverse sections, 18 longitudinal sections and 3 ultrathin sections. All specimens stored in the Departamento de Paleontología, Universidad Complutense de Madrid.

Description:

External features: Phaceloid fasciculate corals with some individuals showing irregular growth trajectories and adult corallites with broad range of diameters (Fig. 4A-F). Corallites commonly densely packed, but this feature varies in different parts of a single colony and it is overprinted by the high degree of stylolitization in some instances (Fig. 4A, C, F).

Internal features: Transverse section: The mean septal number in each colony varies from 25 to 36.19; the mean alar diameter varies from 6.89 to 11.56 mm and the mean tabularium diameter varies from 4.47 to 7.62 mm.

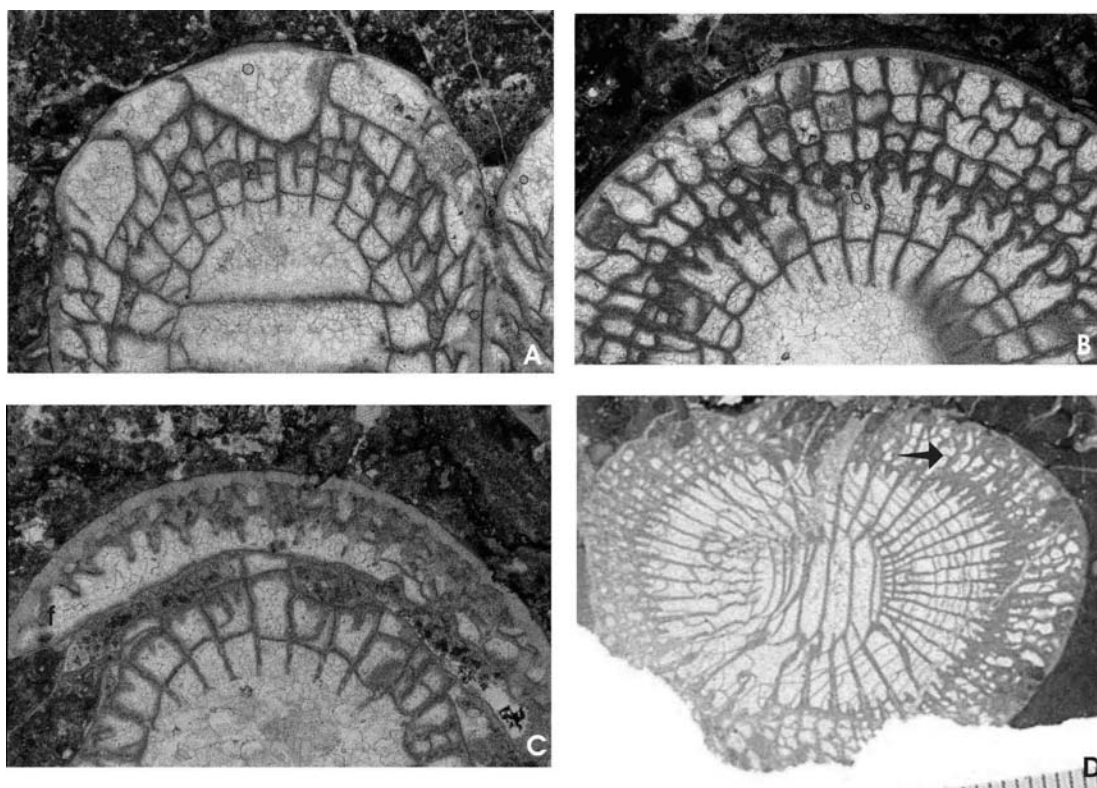


Figure 5.— *Tizraia berkhlii* gen. nov. sp. nov. Details of corallites in transverse section. A. DPM-TIZ2/5-6. (paratype), note the globose transeptal dissepiments and irregular wall. $\times 10.5$. B. DPM-TIZ0/5-32 (paratype), note thickened inner row of dissepiments, more regular wall, undulating septa and the scarce transeptal dissepiments. $\times 10.5$. C. DPM-TIZ0/5-2 (holotype), note thickened wall and elongated transeptal dissepiments. $\times 10.5$. D. DPM-AKE1/1-43, specimen showing irregular thickenings of septa in dissepimentarium indicated by the arrow. $\times 3.5$.

Figura 5.— *Tizraia berkhlii* gen. nov. sp. nov. Detalles de poliperitos en sección transversal. A. DPM-TIZ2/5-6. (paratipo), note-se los disepimientos transeptales globosos y la muralla irregular. $\times 10.5$. B. DPM-TIZ0/5-32 (paratipo), note-se la fila más interna de disepimientos engrosados, la muralla regular, los septos ondulados y la escasez de disepimientos transeptales. $\times 10.5$. C. DPM-TIZ0/5-2 (holotipo), note-se la muralla engrosada y los disepimientos transeptales alargados. $\times 10.5$. D. DPM-AKE1/1-43, ejemplar que muestra engrosamientos irregulares de los septos en el disepimentario (flecha). $\times 3.5$.

Outer walls are irregular in thickness and in type within the same colony and along individual corallites. They may be thin to slightly thickened and are smooth to undulose to a variable degree (Fig. 5A-C).

The major septa show a radial pattern; their length reaches $2/3$ to $3/4$ of the corallite radius. They are typically thin, but locally show thickening that may occur along the entire length of the septum and is more common along the boundary between the tabularium and dissepimentarium (Fig. 5 B, D). The major septa are straight to sinuous. Sinuosity is mainly developed in the dissepimentarium and is more con-

spicuous in thin septa (Fig. 5B). Some corallites show septa with small lateral granulae (Fig. 5D). The sinuosity together with the granulae produces a false appearance of carinae. The inner margins of the septa are always thin.

Protosepta are inconspicuous, except for the cardinal septum, which may be somewhat shortened in the largest corallites and is located in a small fossula (Fig. 4F). Minor septa are usually thin and slightly penetrate the tabularium. Like the major septa, they locally show carinae-like structures. Where lonsdaleoid dissepiments are broadly developed, the minor septa occur as sep-

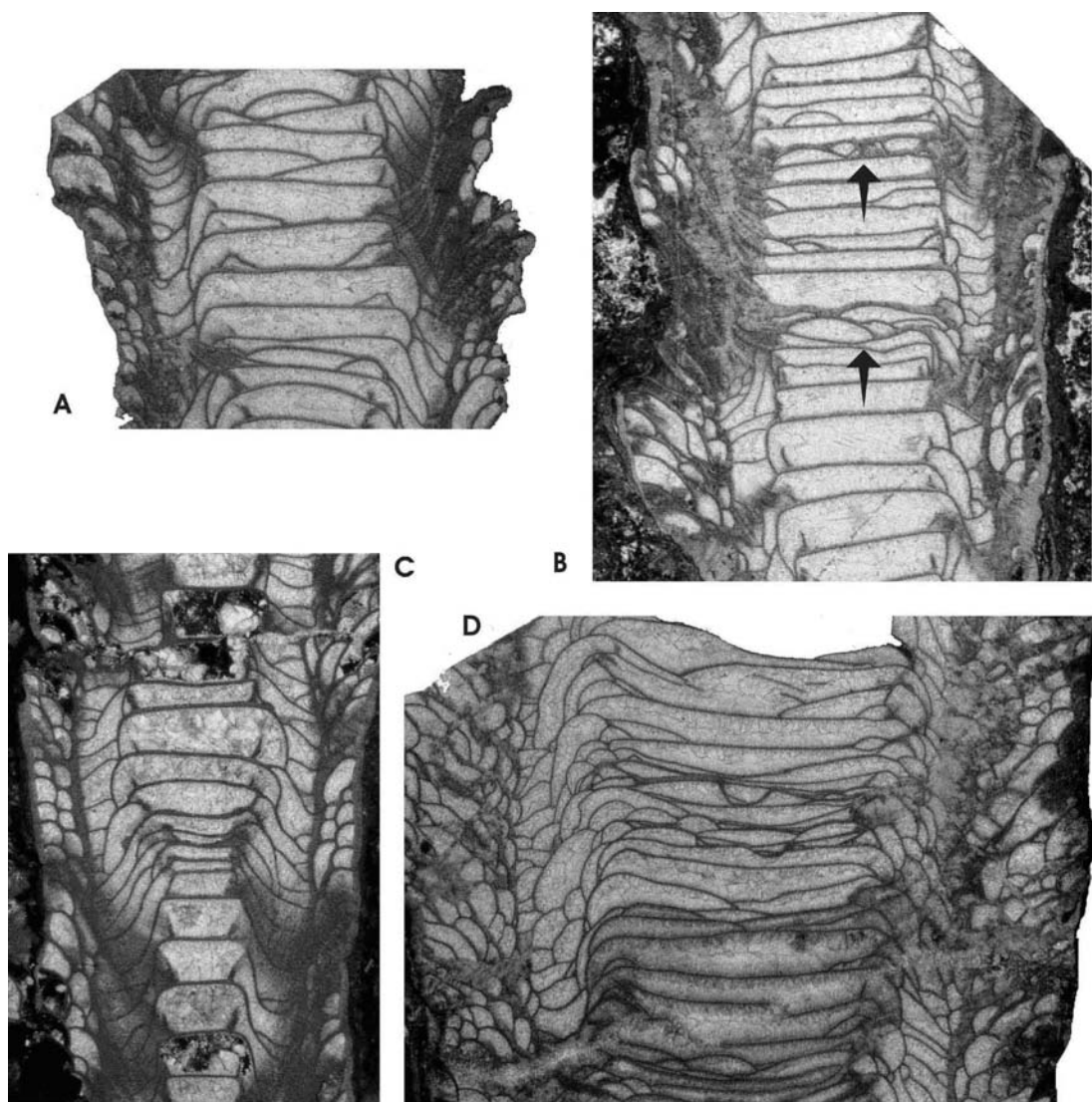


Figure 6.— *Tizraia berkhlii* gen. nov. sp. nov. Details of corallites in longitudinal section. A. DPM-TIZ0/5-2 (holotype), note variation in size of dissepiments and supplementary irregular tabellae. B. DPM-TIZ0/5-2 (holotype), note supplementary axial tabellae indicated by arrows. C. DPM-TIZ0/5-18 (paratype), small corallite showing typical diphyphylloid tabellae. D. DPM-AKE1/1-2, large corallite showing wider dissepimentarium and incomplete axial and periaxial tabellae. All figures x7.

Figura 6.— *Tizraia berkhlii* gen. nov. sp. nov. Detalles de los poliperitos en sección longitudinal. A. DPM-TIZ0/5-2 (holotipo), note-se la variation en tamaño de los disepimentos y de las tabelas suplementarias irregulares. B. DPM-TIZ0/5-2 (holotipo), note-se las tabelas suplementarias indicadas por flechas. C. DPM-TIZ0/5-18 (paratipo), poliperito pequeño que muestra tábulas diphyphylloides típicas. D. DPM-AKE1/1-2, poliperito grande que muestra un disepimentario ancho y tabelas axiales y periaxiales incompletas. Todas las figuras x7.

tal crests on the surface of the wall and dissepiments (Fig. 5A, C).

The dissepimentarium is composed of 2-6 (rarely 8) rows of dissepiments, which are mainly interseptal in the inner part of the dissepimen-

tarium, but commonly transeptal in the outer zone (Figs. 4, 5). Interseptal dissepiments occur in 1-5 rows and are mainly regular, but some angular dissepiments may occur. Transeptal dissepiments of the first and second orders may be

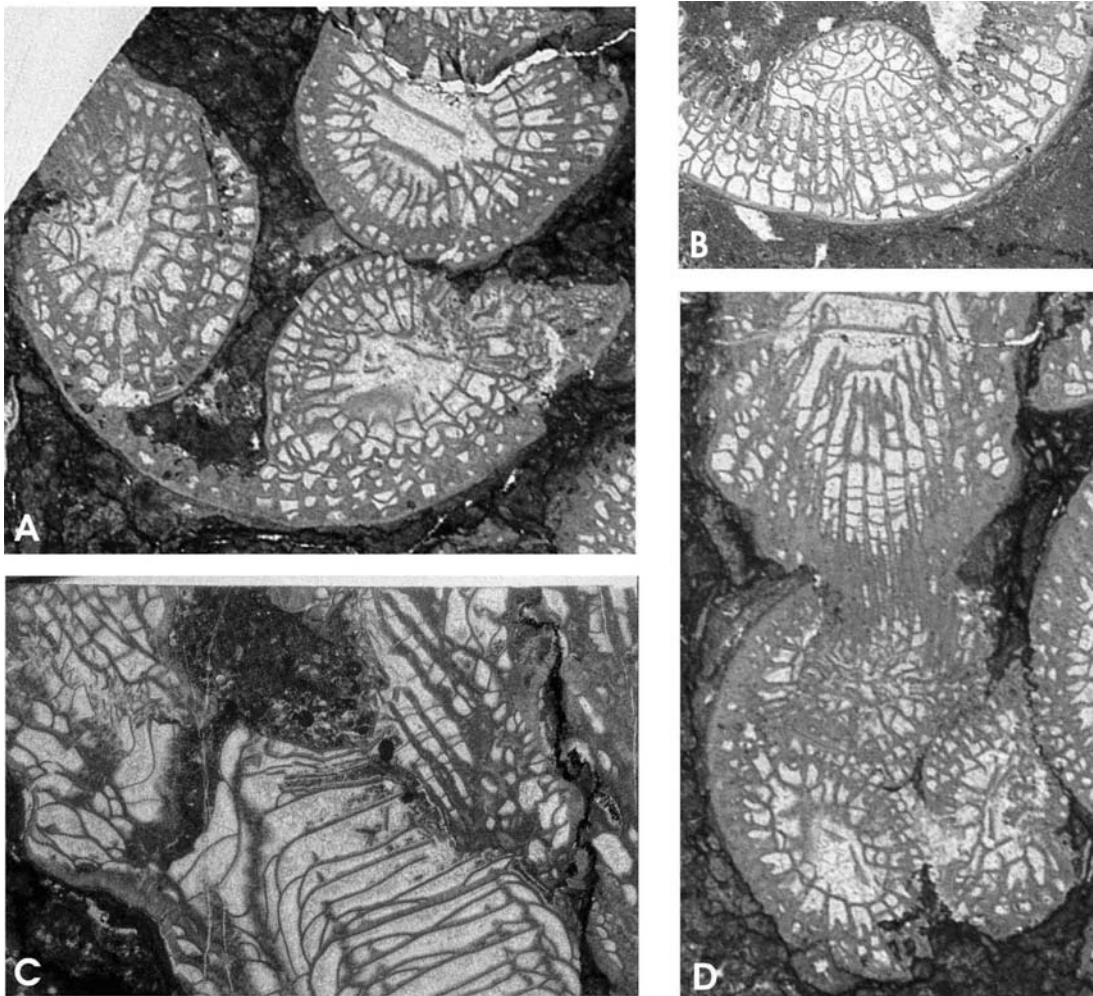


Figure 7.— *Tizraia berkhlia* gen. nov. sp. nov. Increase. A. DPM-TIZ0/5-32 (paratype), budding of three daughter corallites in the calice of a large corallite, produced by axial parricidal increase. $\times 5.25$. B. DPM-AKE1/1-2, beginning of development of a new corallite produced by peripheral increase. $\times 5.25$. C. DPM-TIZ0/5-32 (paratype), partition of a parent corallite into at least two daughter corallites (longitudinal section). $\times 7$. D. DPM-TIZ0/5-32 (paratype), budding of three daughter corallites. $\times 4.4$.

Figura 7.— *Tizraia berkhlia* gen. nov. sp. nov. Gemación. A. DPM-TIZ0/5-32 (paratipo), aparición de tres poliperitos en el cáliz de un gran poliperito, producida por gemación axial parricida. $\times 5.25$. B. DPM-AKE1/1-2, comienzo del desarrollo de un nuevo individuo producido por gemación periférica. $\times 5.25$. C. DPM-TIZ0/5-32 (paratipo), partición de un poliperito padre en al menos dos poliperitos hijos (sección longitudinal). $\times 7$. D. DPM-TIZ0/5-32 (paratipo), gemación simultánea de tres poliperitos. $\times 4.4$.

present only sporadically (Fig. 5B), occasionally as a complete ring (Fig. 5C). The transeptal dissepiments may be long and flat (Fig. 5C) or globose and strongly curved (Fig. 5A). The inner row of dissepiments is typically thickened to form a discontinuous inner wall (Fig. 5B, D).

Longitudinal section: The dissepimentarium typically consists of 1 to 6 rows of small, globose

to elongate dissepiments, which are moderately steeply inclined (declined 40° - 60° towards the axis). The boundary with the tabularium is usually sharp and in some instances shows discontinuous thickenings.

The tabularium is composed of 16 to 33 tabulae per cm, with a mean of 22.17. They are usually incomplete, mesa-shaped; consist of an inner

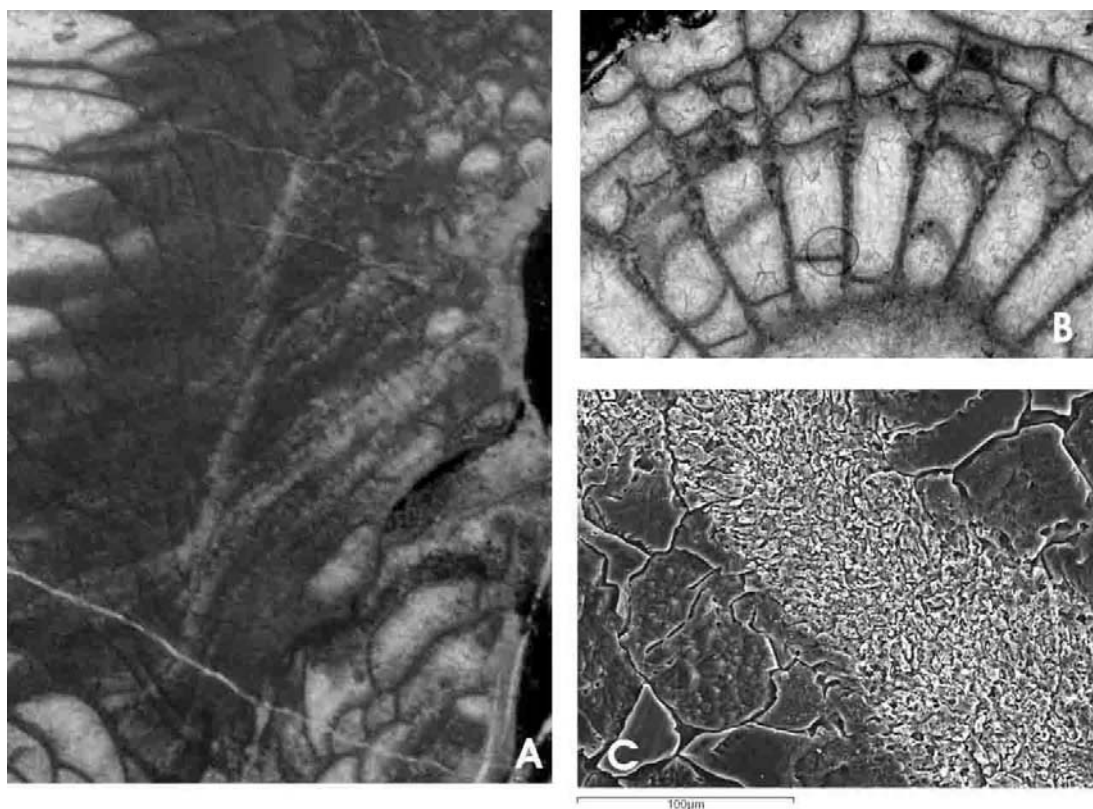


Figure 8.— *Tizraia berkhlii* gen. nov. sp. nov. Microstructure. A. DPM-AKE1/1-46, longitudinal section showing trabecular septa and fibrous wall. x10.5 B. DPM-AKE1/1-43, transverse section showing multiple trabeculae in the middle part of the septa. x22. C. DPM-TIZ0/5-2 (holotype). Detail of a septum with SEM showing euhedralization of the original fibres. x308.

Figure 8.— *Tizraia berkhlii* gen. nov. sp. nov. Microestructura. A. DPM-AKE1/1-46, sección longitudinal que muestra septos trabeculares y muralla fibrosa. x10,5 B. DPM-AKE1/1-43, sección transversal que muestra trabéculas múltiples en la parte central del septo. x22. C. DPM-TIZ0/5-2 (holotipo). Detalle de un septo con microscopio electrónico de barrido que muestra euhedralización de las fibras originales. x308.

and an outer series of tabellae in both immature and mature corallites and show small convex tabellae reinforcing the peripheral zone (Fig. 6A-D). Some convex tabellae occur rarely in the axial part of the tabularium (Fig. 6A, B). The periaxial part of the tabulae is reinforced with numerous small globose tabellae in the large corallites of colonies from the Akerchi Formation, in which the axial part of the tabulae may be slightly depressed (Fig. 6D). Some periodical irregular tabulae with additional thickenings occur in some specimens (Fig. 6B).

Increase: Increase is parvicidal, peripheral and axial. New individuals develop in the calyx of the parent corallite; offsets generally do not meet at the axis (Fig. 7A-C), but in some ins-

tances they may do so (Fig. 7D). Usually three new corallites occur, but rarely there may be one, two or four. Division occurs by prolongation of several septa of the parent corallite which converge near the axis of the parent corallite; later they are thickened to form walls of the daughter corallites (Figs. 7A, B). Outer part of the walls and some septa are inherited from the parent corallite. Simultaneously, new septa develop on those new walls. The daughter corallites increase in diameter and acquire parallel (Fig. 7C) or divergent growth trajectories (Fig. 7D). Transeptal dissepiments are rare or absent in this first stage of development and begin to develop when the corallites reach larger diameters.

Microstructure: The microstructure is recryst-

tallised in most specimens, but when preserved it seems to be completely fibrous. The wall shows fascicles of fibres that are arranged perpendicularly to the external surface (Fig. 8A). The septa are fibroradial in the outer zone of the dissepimentarium, but the middle and the inner parts of the septa are trabecular. The inner parts of the septa in the tabularium show simple trabeculae, but multiple trabeculae occur near the inner wall, where the septa are thicker (Fig. 8B). Euhedralization of the original fibres can be seen in most specimens (Fig. 8C).

Remarks: The different specimens of *Tizraia berkhlili* show various aspects of intracolony variability. Specimens from the Tizra Formation show homogeneous features, with minor variations in the thickening of structures, development of transeptal dissepiments, diameter of the axial zone and alar diameter. Specimens from the Akerchi Formation show higher intracolony variability in size, in septal number and in aspect of the dissepimentarium. In some colonies part of adult corallites show an almost total absence of transeptal dissepiments whereas others show a complete ring of them. The diameter of corallites showing adult features varies from 6 to 15 mm. The difference in septal number in neighbouring corallites may reach 10. As a result, the specimens from the Akerchi Formation show very unusual features in colonial corals with a very heterogeneous aspect of the corallites in one single colony. The largest corallites of those colonies reach dimensions very different from the type specimens from the Tizra Formation and could be interpreted as a different species, but smaller corallites in the same colonies have dimensions identical with the types. We regard these differences as ecologically controlled factors; we consider the specimens from the Tizra and Akerchi formations as two populations of the same species somewhat separated in space and time and consequently having small differences between them.

Tizraia? sp. nov.
(Fig. 9)

Material: A single fragment of a colony 6 cm long, 4 cm wide and 4 cm high, DPM TIZ1/5-9.

Three transverse sections and 2 longitudinal sections.

Occurrence: Tizra Formation, Adarouch Area, Brigantian.

Description:

External features: Phaceloid colonial corals showing large variation in corallite diameter.

Inner features: Transverse section: The corallites have a mean septal number of 33, varying from 28 to 38. The mean of the alar diameter is 10.63 mm, varying from 7.3 to 13.5 mm; the mean of the tabularium diameter is 8.12 mm.

The wall is thick to very thick; it is composed of the thickened external borders of the septa. The major septa are thick in the dissepimentarium, but they become thin in the tabularium. They are short, reaching 1/2 of the corallite radius in length. They are slightly undulose in the dissepimentarium but straight in the tabularium. Their inner margins may curve to join other major septa. The protosepta are not well differentiated, but the cardinal septum is shortened locally. The minor septa are short, reaching only 1/3 to 1/2 of the major septa in length.

Where the peripheral thickening of the septa is reduced, 1 to 3 rows of dissepiments are visible. They are mainly regular dissepiments, but some transeptal dissepiments of the 1st and 2nd order are present in all corallites. Most dissepiments show thickening, but a true, complete dissepitheca is not developed.

Longitudinal section: The dissepimentarium is composed of two or three rows of small, subglobose, very steeply inclined dissepiments. They are substituted locally by a mass of stero-plasmic calcite. The tabularium is wide; it is composed of incomplete mesa-shaped tabulae. They are joined to the inner margins of the septa which show amplexoid structure. The axial parts of the tabulae are flat to slightly concave and wide (about fi of the corallite diameter). The peripheral borders are curved downwards to an almost vertical position. They may curve upward again to join the dissepiments with a gentle inclination or they may join the underlying tabula. Some small, flat or concave tabellae may reinforce the peripheral part of the tabularium.

Increase: The budding is parricidal. The

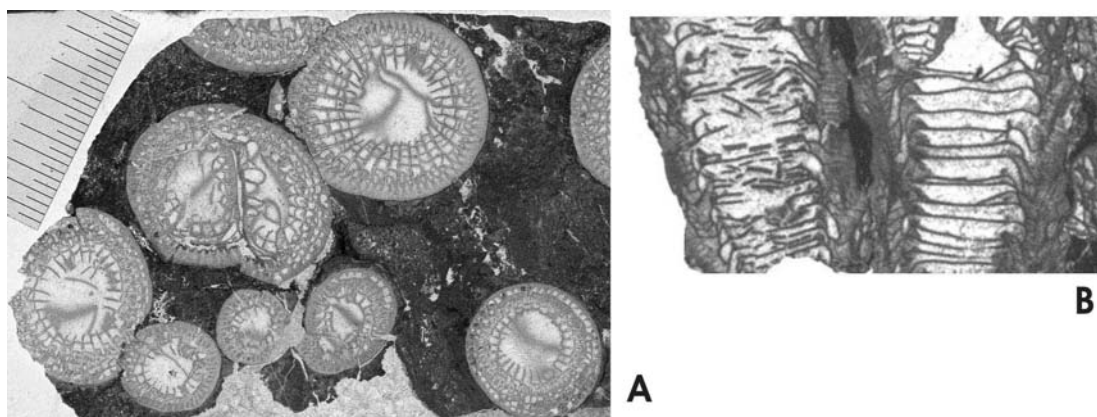


Figure 9.— *Tizraia?* sp.. A-B, DPM-TIZ1/5-9. A. Transverse section showing axial parricidal increase. B. Longitudinal section. Both figures $\times 2.65$.

Figure 9.— *Tizraia?* sp.. A-B, DPM-TIZ1/5-9. A. Sección transversal que muestra gemación axial parricida. B. Sección longitudinal. Ambas figuras $\times 2.65$.

corallites split into one to three, most commonly two, new individuals.

Remarks: The described specimen shows many common features with the type species of *Tizraia* (phaceloid habit, mesa-shaped, incomplete tabulae, transeptal dissepiments). Nevertheless, it shows a peculiar marginarium, in which the dissepiments are commonly enclosed in stereoplasm and wall is composed of thickening of septa. In addition, the septa (major and minor) are shorter and the tabularium is much wider than in the type species. Unfortunately, we collected only a fragment of a colony, thus restricting further comparisons. *Tizraia* sp. nov. definitively appears to be a different species, but the weak development of the transeptal dissepiments also indicates a close relationship with *Diphyphyllum*. It is necessary to collect more specimens to check the intracolony and inter-colony variability. For the time being, we maintain this species in open nomenclature and include it provisionally in *Tizraia*.

CONCLUSION

A new genus, *Tizraia*, is described from the Tizra and Akerchi formations of the Adarouch Area in Central Morocco. The type species, *Tizraia berkhlilii* sp. nov., is the only one assigned

definitively to this genus. The inclusion of a second species in the genus is doubtful because of the scarcity of material (a single fragmentary specimen). New specimens from the Djerada Formation (Eastern Morocco) have been recorded in similar aged beds and similar corals have been cited under the name *Lublinophyllum* in beds of the same age in Ireland. The stratigraphic range of *Tizraia* is restricted to the Upper Brigantian and its geographic distribution to the Western Paleotethys region.

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