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# Taxonomic Notes on Discoaters and Catinasters from Tomboy Field, Offshore Western Niger Delta, Nigeria

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## ABSTRACT

The aim of this paper is to present the taxonomic notes on Discoasters and Catinasters found in five wells in the Tomboy Field, offshore western Niger Delta area of Nigeria. Niger Delta lies between latitudes 4° and 6° N and longitudes 3° and 9° E in the south-south geo-political region of Nigeria. Ditch cutting samples collected from five wells at the industry standard of 9.14 m depth intervals were subjected to the pipette and smear laboratory technique to prepare them for microscopic assessment of nannoliths. Discoasters and Catinasters (nannoliths) were identified and their taxonomic notes were written in line with the International Code for Botanical Nomenclature.

**Keywords**: *Calcareous nannofossils, Discoasters, Catinasters, Tomboy Field, offshore western Niger Delta, Nigeria*

## 1. INTRODUCTION

The study area is the Tomboy Field and it is located in the offshore western Niger Delta area of Nigeria (Figure 1). The Niger Delta is situated in the Gulf of Guinea on the west coast of Central Africa. It lies between latitudes 4° and 6° N and longitudes 3° and 9° E in southern Nigeria [16]. The Delta is situated at the intersection of the Benue Trough and the South Atlantic Ocean where a triple junction developed during the separation of South America and Africa in the Late Jurassic [25]. The aim of this paper is to present the taxonomic notes on identified Discoasters and Catinasters from the Tomboy Field.

## 2. GEOLOGICAL SETTING

Three formations have been recognised in the subsurface of the onshore and offshore Niger Delta [10], [20], [24], [1], [13], [23]. These are the Akata, Agbada and Benin Formations. These formations were deposited in marine, transitional and continental environments, respectively; together they form a thick, overall progradational passive-margin wedge [9]. The Akata Formation, the basal unit, is composed mainly of marine shales believed to be the main source rock within the basin. The Agbada Formation is made up of alternating sandstone, siltstone and shale sequences that constitute the petroleum reservoirs of the basin and it is Eocene to Pliocene in age. The topmost unit which is Upper Oligocene to Recent is called the Benin Formation and it consists mostly of non-marine sands with shaly intercalations [9].

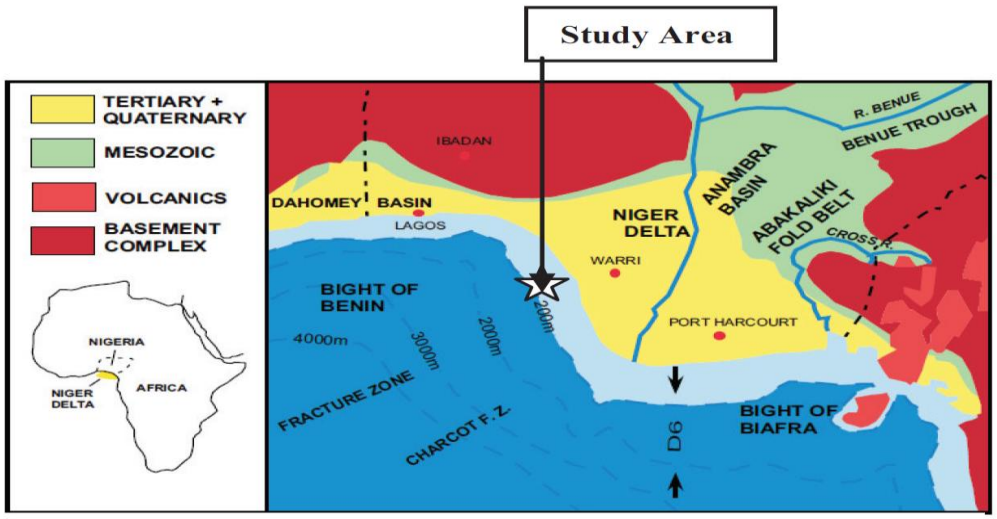


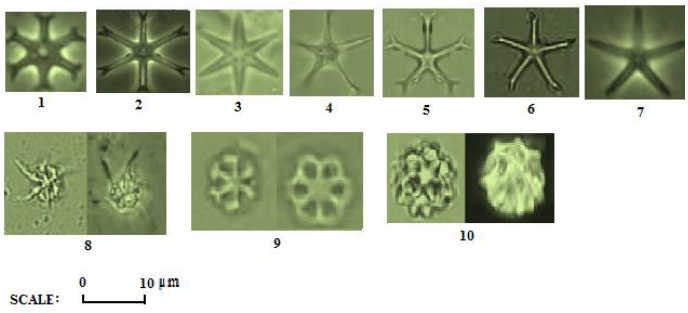

**Figure 1: Index map of Niger Delta and Location of Study Area (Source: Doust and Omatsola [8])**

## 3. METHODS OF STUDY

The five wells are denoted by TMB-1, TMB-2, TMB-4, TMB-5 & TMB-6 and they have 226, 212, 222, 216 and 224 ditch cutting samples, respectively, totalling 1,100 samples that were collected at the industry standard of 9.14 m sampling intervals for analysis for calcareous nannofossils. The pipette and smear technique was used for calcareous nannofossils preparation. The unwashed ditch cuttings were slightly rinsed to remove drilling mud. Absolute care was taken at all stages of the sample preparation to avoid contamination. About 25 grams of each sample were required but 10 grams were utilised. They were broken down by soaking and swirling in distilled water. Addition of a small quantity of sodium hexametaphoshate (calgon) helped in the dispersion of the clays and ensured even distribution of the particles in the final mount. Drops of the suspensions taken from the beakers using pipette were carefully placed on glass cover slips (22 mm x 22 mm). Few drops of distilled water were added to dilute the suspensions, which were then dried on a hot plate. Two blobs of Norland optical adhesive (Refractive Index = 1.56) were placed on glass slips with the samples inverted over the glass slides until the adhesive was completely spread evenly, resulting in clean mounts. The mounts were cured over ultraviolet light for 30-45 minutes. The glass slides were then made ready for inspection under the microscope.

## 4. RESULTS AND DISCUSSION

Seven Discoasters and three Catinasters species, respectively, were identified and taxonomic notes based entirely on phenetic data, structure and shape was recorded for them in accordance with the International Code of Botanical Nomenclature (ICBN). The small size (less than 30 microns) of these species made them very useful because they remain preserved in small samples such as ditch cuttings, sidewall cores, etc. and they are extremely useful for Cenozoic biostratigraphy because of their short life span and fast extinction [19], [3]. Thus their taxonomic study is very imperative both for academic researchers and industry practitioners. The Discoasters and Catinasters belong to the same family called Discoasteraceae and one of their peculiar taxonomic features is that they are rayed nannoliths. They are made up of four groups, namely: *Discoaster variabilis* (6-rayed discoasters with bifurcations), *Discoaster brouweri* (6-rayed discoasters without bifurcations), taxonomic notes have been structured to discuss the family and then the species, their description, remarks and age range for biostratigraphic significance. Plate 1 shows photomicrographs of identified taxa in the study area.




### 4.1 Taxonomic Notes on Discoasters and Catinasters

**Family Discoasteraceae** TAN [21]

Taxa include: ***Discoaster and Catinaster*** (Plate 1).

*Discoaster bollii* MARTINI & BRAMLETTE [14] (Plate 1.1)

Description: Similar to *D. exilis* except for its smaller size (<10µm) and the presence of large distal boss, small proximal boss and wide central-area [3]. (Bown, 1999).
Range: NN8 to NN9 [19], [3].

*Discoaster exilis* MARTINI AND BRAMLETTE [14] (Plate 1.2)

Variants:

*Eu-discoaster protoexilis* THEODORIDIS [22] intermediate to *D. deflandrei*, large bifurcations, medium central-area. N.B.: If this morphotype was distinguished then other names (e.g. *D. aulakos* GARTNER [11]) would have priority;
*Discoaster signus* BUKRY [4] - form with well developed bifurcated tips.

*Discoaster subsurculus* GARTNER [11] - with weakly trifurcate tip, due to bifid proximal extensions in centre of bifurcations. This morphotype can be quite distinctive, however, it is not consistently developed.

Description: *D. exilis* is a 6-rayed discoaster with small central-area; usually with weak distal and proximal bosses. The bifurcated tips are acutely angled in plan-view and wedge-shaped in cross-section. The rays from the proximal and distal sides are flat and virtually identical [3].
Range: NN4 to NN 9 [3].

*D. braarudii* BUKRY [4] (Plate 1.3)
Description: Similar to *D. brouweri* but with simple ray tips, without proximal extensions. N.B. Dissolved or poor developed species, e.g. *D. exilis, D. brouweri,* may be classed into this morphotype [3].
Range: NN7 to NN11 [3].

1. *Discoaster bollii* MARTINI & BRAMLETTE [14]
2. *Discoaster exilis* MARTINI AND BRAMLETTE [14]
3. *Discoaster braarudii* BUKRY [4]
4. *Discoaster quinqueramus* GARTNER [11]
5. *Discoaster pentaradiatus* TAN [21]
6. *Discoaster hamatus* MARTINI & BRAMLETTE [14]
7. *Discoaster bellus* BUKRY AND PERCIVAL [6]
8. *Catinaster calyculus* MARTINI & BRAMLETTE [14]
9. *Catinaster coalitus* MARTINI & BRAMLETTE [14]
10. *Catinaster mexicanus* BUKRY [4]

**Plate 1. Photomicrographs of Discoaters and Catinasters of Tomboy Field**

*Discoaster quinqueramus* GARTNER [11] (Plate 1.4)
Synonym: *D. quintatus* BUKRY & BRAMLETTE [5]

Description: Symmetrical 5-rayed discoaster; central-area, with prominent distal sutural ridges and large proximal boss; rays concavo-convex, with rounded tips. The width of the central area is less than the free ray length. The size is highly variable, ca. 5-15 microns [3].

Remarks: *D. bergenii*, *D. berggrenii* and *D. quinqueramus* form an anagenetic lineage, with central area size decreasing and free ray length increasing. Distinguishing them is useful for determining position within the early part of zone NN11 [3], [19].

Range: Confined to NN11A – NN11B (zone defining species).

*Discoaster pentaradiatus* TAN [21] (Plate 1.5)
Synonyms:
*Discoaster anconitanus* BORSETTI & CATI [2] - an etched form without bifurcated tips.

*Discoaster misconceptus* (THEODORIDIS [22], [15] [Eudiscoaster] - alternative name proposed for nomenclatural reasons.

*Discoaster stradneri* CATI & BORSETTI [7] - an etched form without bifurcated tips.
*Discoaster tridenus* KAMPTNER [12] - an etched form without bifurcated tips.

Description: Symmetric 5-rayed discoaster (with rare 3 and 4 rayed variants); ray tips with acute bifurcations. It is sturdily concavo-convex and birefringent. The central area is small, but distinct. It often has scalloped depressions and/or sutural ridges on the distal side and stellate proximal knob [19], [3].

Range: NN10B to NN17 (Tortonian, Late Miocene to Piacenzian, Late Pliocene) [19], [3].

*Discoaster hamatus* MARTINI & BRAMLETTE [14] (Plate 1.6)

Description: Symmetric 5-rayed discoaster with clockwise deflected rays (in distal view) as proximal extensions. The central area is small with a dull distal surface and minute proximal knob [19], [3].

Range: NN9 (LO and FO of Discoaster *hamatus* MARTINI & BRAMLETTE [14] define the base and top of NN9 Zone in the Tortonian, Late Miocene age [19], [3].

*Discoaster bellus* BUKRY AND PERCIVAL [6] (Plate 1.7)

Description: Symmetric 5-rayed species with simple ray tips. It intergrades with *D. hamatus* [19], [3].

Remarks: *D. bellus* is a name available for non-birefringent symmetrical pentaradial discoasters with simple ray ends, and small central areas. *D. bellus* occurs commonly in association with *D. hamatus* (q.v.), and it arguably intergrades with it, but in order to preserve the biostratigraphic value of *D. hamatus*, it is important to separate unambiguous *D. hamatus* specimens from these more non-descript forms. Also *D. bellus* persisted at low abundances after the LO of *D. hamatus*, and probably gave rise to *D. quinqueramus* [19], [3].

Range: NN8 to NN11 [19], [3].

Genus *Catinaster* MARTINI AND BRAMLETTE [14]

*C. calyculus* MARTINI & BRAMLETTE [14] (Plate 1.8)

Description: Curved rays extend beyond basket. *N.B.:* Peleo-Alampay & Wei [17] and Peleo-Alampay et al. [18] used the basket shape as the alternative criterion for naming *C. calyculus* [19], [3].

Range: NN9 to NN10 [19], [3].

*C. coalitus* MARTINI & BRAMLETTE [14] (Plate 1.9)

Description: *Catinaster* with rays which bifurcate to form a distal rim, but which do not extend significantly beyond this rim. The rim continues to the proximal pole producing a basket-like body. *N.B.* short pseudo-rays are often formed where the tips of bifurcations meet [19], [3].

Range: NN8-NN10, this is the first *Catinaster* species to appear and it is the most common [3].

*Catinaster mexicanus* BUKRY [4] (Plate 1.10)

Description: Compact nannolith formed of six stubby rays with similar shape to *C. coalitus* but lacking the basket-like structure [3].

Remarks: Probably isolated central-areas of discoasters rather than a discrete species [3]. *N.B.* Occasional citations in NN14 - NN15 are probably records of *D. altus* [3].

Range: Scattered records only, NN9 - NN11 [3].

## 5. CONCLUSION

Seven discoasters and three catinasters species, respectively, were identified and taxonomic notes based entirely on phenetic data, structure and shape was recorded for them in accordance with the International Code of Botanical Nomenclature (ICBN). Discoasters and Catinasters belong to the same family called Discoasteraceae and they are rayed nannoliths. The family has four group members called *Discoaster variabilis*, *Discoaster brouweri*, *Discoaster pentaradiatus* and *Catinaster* group, respectively. The taxonomic notes on Discoasters and Catinasters have been discussed accordingly. The taxonomic study of these nannoliths is very important because they are very useful index and biozone fossils and paleogeographic indicators besides their far-reaching economic industrial uses.

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