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PROGRESS REPORT ON FIELD ACTIVITIES IN THE NORTHERN TERRITORY DURING THE 1960 FIELD SEASON.

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SUMMARY

In the report observations made during a preliminary survey of the Mesozoic strata of the Northern Territory are recorded. Areas concerned are those around Darwin, between Maranboy and Mainoru, and between Mallapunyah and Borroloola stations.

Thicknesses of Mesozoic rocks nowwhere exceed 60 feet. Two lithologies are recognised, the lower sandstone and the upper claystone, the proportions of one to the other varying from one area to the next. In some outcrops the sandstone may be missing, whereas in others erosion may have removed the claystone layer. The underlying strata are of Proterozoic age, and the contacts between the Proterozoic and Mesozoic strata are unconformable. To the south-east of Darwin cross-bedding and ripple-marks, as well as the molluscan faunas, indicate shallow water conditions. Conglomerates made up of rounded boulders mark sites of Mesozoic rivers which carried plant remains out to the open sea, but the remains of marine life point to prevalent salt-water conditions. Severe lateritization around Darwin gives place to more moderate ferruginization inland. Considerable thickness of Mesozoic beds have been removed in the Bauhinia Downs - Mt. Young area, but there is no evidence for similar removal of strata elsewhere.

Most of the Mesozoic strata examined are thought to have been deposited on a slowly sinking marginal shelf. The slow rate of downwarping did not favour accumulation of large thicknesses of sediment.

INTRODUCTION

The investigation of Mesozoic stratigraphy and palæontology in the northern part of Northern Territory during the 1960 field season was confined to four areas:

1. The immediate vicinity of Darwin.
2. Areas near Darwin, i.e. Point Charles and Gunn Point-two classical collecting sites for faunas of Upper Albian (Lower Cretaceous) age.
3. North and South of the Maranboy - Mainoru Road. This area is covered by the Katherine and Urapunga four-mile Sheets.
4. Bauhinia Downs four-mile Sheet.

In addition to the above, the edge of the Mullaman Tableland which overlooks the Alice Springs - Darwin highway on the west was sampled at two spots, and two rich collections of Mesozoic fossils were obtained from outcrops on the Mount Young four-mile Sheet.

The first three areas listed above were visited from Darwin, which provided a starting point for numerous traverses during the period between 9th August and 13th September, 1960. Later in the season the writer joined the Bauhinia Downs Field party where he spent thirteen days (14th September to 27th September) investigating Mesozoic sequences in that area.

Altogether, the Mesozoic strata have been sampled for fossils at thirty-six sites, and faunas of variable nature, richness and preservation were collected. These localities were given Northern Territory fossil collection numbers ranging from T.T.I to T.T.38. Many other outcrops of Mesozoic strata were visited and observations on stratigraphy made.

Fossil collections will be investigated for the purpose of describing individual species as well as for determining the environmental characters, accurately dating the beds wherever possible and for correlation.

THE DARWIN AREA

In Darwin, the steeply dipping Proterozoic rocks are overlain by flat-lying or very gently dipping Mesozoic beds. The unconformity can be readily observed and inspected in a number of coastal sections around Darwin.

Proterozoic rocks consist of deeply weathered rich brown soft micaceous siltstone, and are rich in quartz which occurs as lens-like bodies and veins ranging in thickness from a fraction of an inch to several feet across. Quartz detritus, being more resistant to weathering during the pre-Mesozoic cycle of erosion, accumulated in the lows of the low-level Proterozoic topography as a mantle of rock debris, where it is to be found today, separating the strata of the two ages.

In the Darwin area Mesozoic sections on the whole are similar and of limited thickness, nowhere exceeding 35 feet. The sediments are uniformly fine-grained and are characterised by the predominance of white kaolinitic claystone which comprises the upper and thicker part of the section. The basal beds, which are a little coarser in texture and bright brown in colour, seem to have been derived from erosion of Proterozoic strata similar to those directly underlying the Mesozoic beds.

On the mainland there is no evidence for continuation of the Mesozoic cycle of sedimentation into the Upper Cretaceous, but the general uplift which exposed large areas of Lower Cretaceous strata to weathering action must have been accompanied by removal of some strata. Weathering has caused lateritization in the extreme northern parts of the Territory, possibly at some later date, while farther to the south and south-east ferruginization, though noticeably less severe, has nevertheless been ubiquitous.

Although no one section in Darwin shows a complete lateritized profile, individual outcrops show different laterite horizons. Thus, at the Packard Street Quarry the pallid zone is exposed, whereas the boulders at Myilly Point amplify local development of the mottled zone.

Both micro- and macrofaunas have been collected from the Darwin strata in the past. As early as 1893 Hinde* described sixteen genera and species of Radiolaria from the Fanny Bay section. Although at the time this fauna could not be precisely dated, it is now assumed on the basis of long distance correlation, as well as on the evidence provided by the macrofossils, that these beds are of Lower Cretaceous, probably Albian, age. The macrofauna consists almost exclusively of belemnites which occur in the upper part of the sequence either scattered throughout or in bands of leached out casts. Only on rare occasions has the original shell material escaped the dissolving action of percolating solutions. The belemnite fauna has been recollected (see Appendix, T.T.I, T.T.2) and it is hoped that it will provide a more exact age of the beds at Darwin.

POINT CHARLES AND GUNN POINT

It was regarded of primary importance that the fossils obtained by H.Y.L. Brown towards the close of last century from these two classical collecting sites of Upper Albian (Lower Cretaceous) age should be recollected, and more important still, that the position of the fossiliferous parent bed should be definitely determined within the sequence. This is essential before inland correlation of Mesozoic sequences as well as those in the Melville and Bathurst Islands is attempted.

The writer has been only partly successful in accomplishing these aims in spite of determined attempts on the part of C.E. Prichard, senior Geologist, Darwin, as well as his own. It is suspected that Brown's fossiliferous bed at Point Charles, which was reputedly exposed at the low tide, is now covered with drifting sand and well out of reach. Occasionally individual fossils are being carried onto the beach by the waves presumably from a reworked bed further out to sea.

Gunn Point, on the other hand, cannot be at present approached by land.

* Hinde, G.T., 1893 - "Note on a radiolarian rock from Fanny Bay, Port Darwin, Australia". Quart J. Geol. Soc. v. 49:221

KATHERINE - URAPUNGA AREA

The area examined to the north and south of the Maranboy-Mainoru Road falls within the boundaries of the Katherine and the Urapunga four-mile Sheets, but unfortunately occupies only small parts of each, as lack of time did not permit a complete coverage of these two sheets.

Of a considerable number of sections inspected 14 have been examined in detail and their faunas collected with a view to further research. These collections were given Northern Territory fossil locality numbers ranging from T.T.5 to T.T.14 and from T.T.16 to T.T.19 inclusive. Some of the collecting sites were visited by members of P. Dunn's B.M.R. Field Party of 1959, when small collections of fossils were gathered.

The Proterozoic beds underlying the Mesozoic strata in the Katherine-Urapunga area are flat-lying or gently dipping, giving rise to disconformable rather than unconformable contacts. Yet, because of the differences in lithology, little difficulty is experienced in separating strata of the two ages. Sedimentation during the Mesozoic commenced here with the deposition of coarse-grained quartz sandstone directly onto a "clean" surface of Proterozoic strata. There is no basal conglomerate as such, although fresh and unweathered slabs of Proterozoic argillites, etc. are often found embedded in the basal layers of the Mesozoic sequence. It seems that, at least in this area, Mesozoic transgression was accompanied by erosion of the Proterozoic surface by wave action and/or erosive power of bottom currents, which removed whatever loose material may have been present on that surface. At this stage of investigation it is difficult to say to what extent marine planation took place; some relief has been observed in the old surface.

Mesozoic strata in the area under discussion are mesa-forming, as their silicified topmost layers make ideal erosion-protecting cappings. Laterally directed erosion has been active for considerable time cutting deep into the once extensive and continuous Mesozoic surface. The thickness of beds varies little and no sections exceeding 50 feet have been measured. The strata fall readily into two main lithologies, consisting of a basal medium to coarse-grained quartz sandstone, and the overlying finer-grained kaolinitic claystone. This order of deposition is characteristic of the area and has been observed in other parts of the Territory as well (see below).

The lower sandstone is made up predominatly of loosely packed sand grains which are usually composed of quartz and are usually well sorted and rounded. In places the sandstone shows gradual gradation in size towards the top, and is invariably iron-stained to yellow, or more commonly red.

Towards the top of the sandstone sequence, which is from 5 to 25 feet thick, there is a marked increase of fine kaolinitic clay, which eventually becomes the predominant rock type, forming a definite layer overlying the basal sandstone. The passage from coarse to fine-grained sediments may be quite abrupt and in such cases quartz grains usually do not persist above the sandstone bed, and are completely absent from the claystone layer.

Irrespective of the thickness of the basal sandstone the claystone layer is everywhere thinner, not exceeding 8 feet. The grain size of claystone is uniformly fine, apart from the above-mentioned admixture of the coarse quartz grains which, however, do not compose more than a small percentage of the rocks.

Although the top layers of the Mesozoic sequence have undergone prolonged erosion since Cretaceous times there is no evidence to suggest removal of any considerable thickness of strata. This is probably due to silicification which seems to have been common in the Katherine-Urapunga area - and in places very severe - producing a silica rich top layer a few inches thick which is very hard and resistant to erosion. What little soil is to be found overlying Mesozoic strata appears to be of aeolian origin and only in a few cases is it produced by the disintegration of the underlying rock.

The only other type of sediment encountered in the Mesozoic strata of the Katherine-Urapunga area consists of river derived gravels and badly sorted conglomerates which are invariably associated with plant fossils.

BAUHINIA DOWNS FOUR-MILE SHEET

The period between 14th-26th Sept.inclusive was spent with the Bureau of Mineral Resources Bauhinia Downs Field Party, under the leadership of J. Smith, camped about half-way between Borroloola and Mallapunyah Stations. The writer's work was directed towards analysing Mesozoic stratigraphy and palaeontology of the Bauhinia Downs four-mile Sheet.

The terrain of this area is hilly, with rugged outcrops of Upper Proterozoic strata and dry watercourses, which together with a general lack of good roads and a moderately thick bush cover makes travel slow and laborious. The Mesozoic strata form mesas or flat-lying to gently dipping plateaux capping Upper Proterozoic rocks. As in other areas investigated no appreciable folding has occurred in the Mesozoic beds.

Altogether fourteen fossiliferous collecting sites have been established. These were allotted numbers T.T.20 - T.T.29 and T.T.31 - T.T.34. Their palaeontological and lithological content was sampled and stratigraphic sections drawn. Of the fourteen representative fossil assemblages at least eight reflected marine environment of sedimentation, and while three were definitely plant bearing, two indicated mixed "fresh" and "salt water" conditions. So far no work has been done on the fossil material and consequently no datings are available. It is thought, however, that the marine faunas are of Lower Cretaceous - possibly - Aptian age, but this dating is tentative and will have to be confirmed by a detailed research. Although no evidence has been observed in the field which would suggest a difference in age between individual outcrops such possibility exists and should be borne in mind. The difference in age, if any, between a lower sandstone layer and an upper claystone layer is also as yet not known.

One important problem in working out the stratigraphy of the Mesozoic strata in the Bauhinia Downs area is determining the base of the Mesozoic strata, and this in a number of places has proved difficult, especially where definite fossiliferous Mesozoic beds overlie poorly fossiliferous or unfossiliferous sandstone. In some cases such sandstones, crossbedded and in places ripplemarked, were at first thought to be of Proterozoic age on lithology, while in others, what appeared to be identical sandstone was considered as Mesozoic on fossil evidence. Presence or absence of fossils is the only reliable criteria in the field for the dating of this sandstone.

The basal Mesozoic sandstone has been found to be missing in some sections - particularly in those which mark positions of the former highs. When present, it was found to be very similar to Mesozoic sandstone in the Katherine-Urapunga area, except perhaps in the development of crossbedding which has been observed only rarely in the latter area. The scarcity of fossil material in the sandstone of the Bauhinia Downs area is also conspicuous. It was found that the proportion of sandstone to claystone is different from that in the Katherine-Urapunga area. The greatest thickness of sandstone measured by the writer in the Bauhinia Downs area was 26 feet, whereas the greatest thickness of claystone was 30 feet, and this also contained the richest assemblages of marine fossils.

In the Bauhinia Downs area considerable thicknesses of the claystone have probably been removed by erosion, because shells which were collected at the very top of the claystone layer have been obviously crushed by an overburden of strata, since removed. For some unknown reason the silicification has not been as severe here as in the Katherine-Urapunga area, with the result that the top layers of claystone disintegrated slowly (e.g. T.T.21). In extreme cases this may have resulted in complete removal of the claystone layer and exposure of the underlying sandstone (e.g. T.T.31, 32), but the evidence is not sufficiently good to discount the possibility that at those localities the claystone was never deposited.

As in the Katherine-Urapunga area the only other type of sediment of Mesozoic age encountered consists of river derived gravels.

SUMMARY OF CONDITIONS OF SEDIMENTATION

The following is the summary of the sedimentary characteristics of the Mesozoic strata of the part of the Northern Territory investigated during the 1960 Field Season:

1. Conditions of deposition were marine with local intermingling of salt and fresh river water. In some areas the salt-water environment was invaded by fresh water only to revert back to salt at a later stage. This process may have been repeated several times.

2. The water was shallow over large areas which allowed rich fauna of bottom-dwelling molluscs to grow.

3. The sediments were thin; little more than 50 feet is known in the Katherine-Urapunga area, but probably several times that in the Bauhinia Downs - Mt. Young area.

4. The rate of sedimentation was rapid. Sediments are poorly sorted and commonly cross-bedded, reflecting locally irregular nature of the depositional agent.

5. The thickness of accumulated sediment was limited probably because of slow sinking of the shelf.

APPENDIX I

ON THE AGE OF SAMPLE T.T.15 FROM 6 MILES SOUTH OF GUNN POINT, NORTH-EAST OF DARWIN, N.T.

A large sample of soft, plastic, grey claystone, collected from a coastal outcrop six miles south of Gunn Point was regarded in the field to be of Cretaceous age. It gave rise to problems in its dating when it was more carefully examined in the paleontological laboratory.

Belford states that examination of the foraminifera revealed the presence of some planktonic species which are not older than Miocene. However, the possibility of contamination from present day beach deposits does exist, and Belford suggests obtaining additional samples.

Evans separated some 17 genera and species of microspores, pollens and microplankton of which one, Hystrichokolpoma rigandae is known from the Eocence and possibly Miocene of Victoria, whereas the other 16 do not restrict the age of the sample within finer limits than Cretaceous or Lower Tertiary. Evans suggests that it is probable that the sample is of Lower Tertiary age.

Skwarko examined the macrofossils which are limited in number and are confined to several species of Pelecypoda, Gastropoda, Crustacea and possibly Ammonoidea. Unfortunately most of the fossil material is either very fragmentary of hitherto undescribed in paleontological literature, or both. It seems, however, that most of the forms have a Tertiary aspect, while evidence for the Cretaceous age is limited to a single specimen of a ribbed coiled shell very reminiscent of an ammonite. Absence of preserved suture lines does not allow, however, definite conclusions on its class.

The fossils so far separated from the deposit are hardly satisfactory for even a broad age determination, and what evidence is present seems to point to a Tertiary rather than Cretaceous age of the sediment.

APPENDIX II

LIST OF FOSSILIFEROUS LOCALITIES ESTABLISHED IN THE MESOZOIC STRATA OF THE NORTHERN TERRITORY DURING THE 1960 FIELD SEASON

DARWIN 4-MILE SHEET:

(a) Darwin 1-mile Sheet.

T.T.1 : Quarry between the end of Packard St., Darwin and the coast.

Fossils: Belemnites

Age: Lower Cretaceous

T.T.2 : Myilly Point, Darwin.

Fossils: Belemnites

Age: Lower Cretaceous

(b) Cape Hotham 1-mile Sheet

T.T.15: Base of a wave-cut cliff on the west coast of Cape, about 6 miles south of Gunn Point.

Fossils: Pelecypoda, Gastropoda, Cephalopoda (Ammonites).

Age: ? Tertiary

PINE CREEK 4-MILE SHEET:

(a) Tabletop 1-mile Sheet.

T.T.3 : About 30' below mesa top on hill on the west side of Pine Creek-Darwin Road; 4.8 miles north of Pine Creek.

Fossils: Plant remains

Age: Upper Jurassic or Lower Cretaceous

(b) Burrundie 1-mile.

T.T.4 : 25' below mesa top on a hill on the west side of the Pine Creek-Darwin Road; 7.0 miles north from Pine Creek.

Fossils: Plant remains

Age: Upper Jurassic or Lower Cretaceous

URAPUNGA 4-MILE SHEET:

(a) Canopy Rock 1-mile Sheet.

T.T.5 : About 4.5 miles east from Mountain Valley Road turnoff along Maranboy-Mainoru Road; 17 miles from Mainoru. Mesa on the north side of the road.

Fossils: Pelecypoda, Brachiopoda.

Age: Lower Cretaceous.

T.T.7 : Just south of the Maranboy-Mainoru Road; 18.2 miles west from Mainoru Homestead.

Fossils: Coelenterata.

Age: Lower Cretaceous.

T.T.8 : A solitary mesa 2 miles south-east from Mountain Valley Homestead.

Fossils: Pelecypoda, Brachiopoda, Echinodermata.

Age: Lower Cretaceous.

(b) Mount Throsby 1-mile Sheet.

T.T.6 : One mile from the Maranboy-Mainoru Road, on the northern side; 4½ miles from Mainoru Homestead.

Fossils: Pelecypoda, Cephalopoda (Belemnites), Coelenterata.

Age: Lower Cretaceous.

KATHERINE 4-MILE SHEET:

(a) Black Cap 1-mile Sheet.

T.T.9 : About ¼ mile at 150° from Baker Creek crossing; 7 miles north of Beswick Homestead. Baker Creek is a tributary of Waterhouse River.

Fossils: Pelecypoda, Plant remains(?), Echinodermata.

Age: Lower Cretaceous.

T.T.10: About 7 miles north-west from the Maranboy-Mainoru Road, up the west bank of the Bukalorkmi Creek.

Fossils: Pelecypoda, Cephalopoda (Belemnites).

Age: Lower Cretaceous.

T.T.11: 2 miles due north from locality T.T.10.

Fossils: Plant remains.

Age: Lower Cretaceous.

T.T.12: Solitary cone-shaped mesa about 1½ miles north of the Maranboy-Mainoru Road, about 17 miles east from Sugarbag Waterhole.

Fossils: Worm tubes

Age: ?Lower Cretaceous.

T.T.19: A scarp half way between locality T.T.10 and T.T.11.

Fossils: ?Pelecypoda, Wood fragments, Worm borings.

Age: ?Lower Cretaceous.

(b) Waterhouse 1-mile Sheet.

T.T.14: East-south-east of Sugarbag Waterhole which is situated on the Maranboy-Mainoru Road some 13 miles east of Beswick Homestead.

Fossils: Cephalopoda (Belemnites and a fragment of an ammonite.

Age: ?Lower Cretaceous.

T.T.16: About 3 miles due south of the Maranboy-Mainoru Road at a point about 6 miles east of Beswick Homestead.

Fossils: Pelecypoda, fragment of an Ammonite.

Age: ?Lower Cretaceous

T.T.17: Locality some 2 miles east-south-east from locality T.T.16.

Fossils: Cephalopoda (Ammonite)

Age: ?Lower Cretaceous.

T.T.18: 5½ miles due south of the Maranboy-Mainoru Road at a point some 10 miles east of Beswick Homestead.

Fossils: Plant remains.

Age: Upper Jurassic or Lower Cretaceous.

(c) Katherine River 1 - mile Sheet.

T.T.13: Yeuralba, 28 miles due north from Maranboy Police Station.

Fossils: Worm tubes, ?Brachiopoda, Wood fragments.

Age: ?Lower Cretaceous.

BAUHINIA DOWNS 4-MILE SHEET:

(a) Borroloola 1-mile Sheet.

T.T.20: 1½ miles west of Day's Lagoon. Approximataly 18 miles west of Borroloola. Run 2A (E-C), Ph. 5169, Pt.3.

Fossils: Pelecypoda, Gastropoda, Cephalopoda (Belemnites), Wood fragements.

Age: Lower Cretaceous.

T.T.21: 1 mile west of Ryan Bend Waterhole on Batten Creek About 20 miles at 15°S of W from Borroloola. Ph 5169, Pt.I. Run 2A (E-C);

Fossils: Pelecypoda, Cephalopoda (Belemnites).

Age: Lower Cretaceous

T.T.25: 1 mile east of Borroloola Jump Up; approximately 15 miles west of Borroloola. Run 3, Ph. 5201, Pt.6.

Fossils: Pelecypoda, Gastropoda, Cephalopoda (Belemnites).

Age: Lower Cretaceous.

T.T.26: 1¼ miles north of Borroloola. Run 3, Ph.5205, Pt.1.

Fossils: Plant remains.

Age: Upper Jurassic or Lower Cretaceous.

T.T.27: 1 mile north-west of Borroloola. Run 3, Ph.5205, Pt. 3.

Fossils: Plant remains, Worm tracks and borings.

Age: Upper Jurassic or Lower Cretaceous.

(b) Batten Creek 1-mile Sheet.

T.T.22: On Batten Creek, 4 miles south-east of Cow Lagoon (Clarke Creek). Run 5, Ph. 5311, Pt. 7.

Fossils: Pelecypoda, Cephalopoda (Belemnites).

Age: Upper Cretaceous.

T.T.28: Cliffs overlooking J. Smith's 1960 Base Camp Site. Run 7, Ph. 5277, Pt. 8.

Fossils: Pelecypoda, Cephalopoda (Belemnites).

Age: Lower Cretaceous.

T.T.34: Approximately 8 miles north-east of the Three Knobs; 6 miles north of Leila Top Crossing. Run 8, Ph.5927, Pt.7.

Fossils: Plants

Age: Upper Jurassic or Lower Cretaceous

(c) Mallapunyah 1-mile Sheet.

T.T.24: 4 miles N.E. of top Station Hill (at junction of McArthur River and Tooginginie Creek). Run 12. Ph. 5353, Pt. 14.

Fossils: Plant Remains.

Age: (?) Lower Cretaceous.

(d) Yalco Creek 1-mile Sheet.

T.T.23: Approximately 15 miles north of Cow Lagoon. Run 2 Ph. 5799, Pt. 2.

Fossils: Plant remains.

Age: Upper Jurassic or Lower Cretaceous.

(e) O.T. Downs 1-mile Sheet.

T.T.29: 5 miles west along O.T. Downs Road, going from three Knobs. Run 9, Ph. 5435, Pt. 1.

Fossils: Worm tubes

Age: ?Lower Cretaceous.

T.T.30: O.T. Downs Road. 10 miles E. of O.T. Downs. Tanumbirini Run 8, Ph. 5884, Pt. 1.

Fossils: Gastropoda.

Age: Not known.

(f) Bauhinia Downs 1-mile.

T.T.31: 5 miles at North 30° west from the Old Bauhinia Downs Homestead. Run 3A, Ph. 5107, Pt. 13.

Fossils: Pelecypoda, Plant remains.

Age: Lower Cretaceous.

T.T.32: 2 miles north-west from the old Bauhinia Downs Homestead. Run. 3A, Ph. 5107, Pt. 11.

Fossils: Plant remains.

Age: Upper Jurassic or Lower Cretaceous.

T.T.33: 5 miles north-west of the Old Bauhinia Downs Homestead ruins. Run 3A, Ph. 5107, Pt. 12.

Fossils: Gastropoda, Worm tubes.

Age: Lower Cretaceous.

MOUNT YOUNG 4-MILE SHEET:

T.T.35: 1½ miles south-east of Rosey Creek Homestead (abandoned). Run 11, Ph. 5099, Pt. 1.

Fossils: Pelecypoda, Gastropoda, Cephalopoda (Ammonite), Plants.

Age: Lower Cretaceous.

HODGSON DOWNS 4-MILE SHEET:

T.T.36: About 8 miles north-west of Tanumbirini Homestead. Just on the border of Hodgson Downs and Tanumbirini 4-mile Sheets. Run 15, Ph. 5157, Pt. 3.

Fossils: Plant remains.

Age: Lower Cretaceous.

TANUMBIRINI 4-MILE SHEET:

T.T.37: About 10 miles west of Tanumbirini Homestead.

Fossils: Worm tubes

Age: (?) Lower Cretaceous.

T.T.38: About 10 miles west of Tanumbirini Homestead (100 miles west of Borroloola). Run 2, Ph. 5046, Pt. A.

Fossils: Worm tubes.

Age: (?) Lower Cretaceous.