

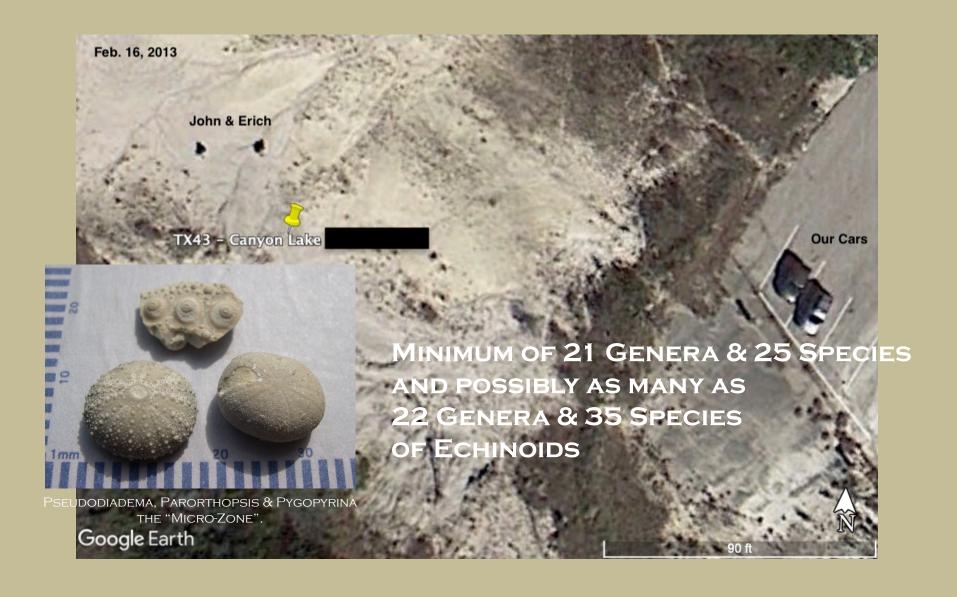
GLEN ROSE FORMATION, TRINITY GROUP, COMANCHEAN SERIES ALBIAN STAGE (LOWER CRETACEOUS) ~ 115 TO 110 MYA

KEY REFERENCE PAPER PUBLISHED 10 YEARS AGO:

ECHINOID DIVERSITY, PRESERVATION POTENTIAL AND SEQUENCE STRATIGRAPHICAL CYCLES IN THE GLEN ROSE FORMATION (EARLY ALBIAN, EARLY CRETACEOUS), TEXAS, USA, ANDREW B. SMITH AND WILLIAM L. RADER, PALAEOBIOLOGY PALAEOENVIRONMENTS (2009) 89:7-52

ALL SPECIMENS COLLECTED BY ERICH ROSE & JOHN JACKSON FROM VARIOUS LOCATIONS IN BLANCO, COMAL, HAYS, KENDALL AND TRAVIS COUNTIES.

GLEN ROSE FORMATION= VARIETY



RECORDED OCCURRENCE

(LIST AND CHART FROM SMITH & RADER, 2009)

> Species/genera found by E. Rose to date from Smith and Rader's (2009) list of known echinoids in the GR.

> Paracidaris(?) texanus	spines common
> Balanocidaris(?) strombecki	rare, spines only
> Parorthopsis comalensis	common
> Pseudodiadema aguilerai	rare
> Goniopygus whitneyi	common
> Goniopygus sp.	rare
> Leptosalenia texana	abundant
> Leptosalenia sp. cf. texana	rare
> Hyposalenia phillipsae	common
> Loriolia rosana	abundant
> Polydiadema travisensis	few
> Tetragramma tenerum	rare
> Tetragramma sp.	few
> Phymosoma texanum	few
> Codiopsis (H.) pulchella	rare
> Coenholectypus planatus	abundant
> Coenholectypus ovatus	rare
> ?Pygaster sp.	rare
> Pygopyrina hancockensis	common
> Plagiochasma texanum	few
> Pliotoxaster comanchei	common

abundant

> Heteraster (E.) obliquatus

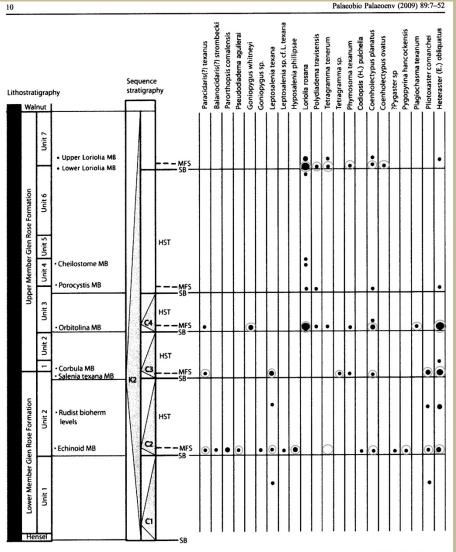


Fig. 2 Stratigraphic chart and ranges of echinoid species in the Glen Rose Formation. Lithostratigraphic framework comes from Stricklin et al. (1971), with additions from Ward and Ward (2007). The sequence stratigraphic framework is a composite taken from Scott et al. (2007)

and Ward and Ward (2005, 2007). Marker Beds (MB) referred to in the text are indicated. The size of the dot indicates relative abundance of species from rare (small dot) to abundant (large dot)

PARICIDARIS(?) TEXANUS (WHITNEY & KELLUM)

[RANGE: LWR UNIT 2 - UPR UNIT 3 ORBITOLINA MB]

COMPLETE TESTS ARE RARE, PLATES & SPINES RELATIVELY COMMON



"SALENIA" TEXANA ZONE, TOP OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.



ECHINOID MARKER BED, BASE OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.



ECHINOID MARKER BED, BASE OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.

BALANOCIDARIS(?) STROMBECKI (DESOR)

[RANGE: LWR UNIT 2 ECHINOID MB - UPR UNIT 3*]

COMPLETE TESTS UNKNOWN, INDIVIDUAL SPINES ARE NOT UNCOMMON



MICRO ZONE, BASE OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.



UNIT 3, UPPER MEMBER, GLEN ROSE FM.

*NOTE THIS OCCURRENCE EXTENDS THE

KNOWN RANGE WITHIN THE FORMATION

PARORTHOPSIS COMALENSIS (WHITNEY & KELLUM)

[RANGE: LWR UNIT 2, ECHINOID MB]

GENERALLY SMALL WITH WELL PRESERVED APICAL DISC





ECHINOID MARKER BED, BOTTOM OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.



ECHINOID MARKER BED, BOTTOM OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.

PSEUDODIADEMA AGUILERAI (MALDONADO)

[RANGE: LWR UNIT 2 ECHINOID MB]

COMPLETE SPECIMENS ARE RARE



ECHINOID MARKER BED, BOTTOM OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.

GONIOPYGUS WHITNEYI SMITH & RADER

[RANGE: UPR UNIT 3 ORBITOLINA MB]

COMMON IN SOME LOCATIONS



ORBITOLINA MARKER BED, BOTTOM OF UNIT 3, UPPER MEMBER, GLEN ROSE FM.

GONIOPYGUS SP. SMITH & RADER

[RANGE: LWR UNIT 2 ECHINOID MB]

SPECIMENS ALL APPEAR TO BE IMMATURE



ECHINOID MARKER BED, BOTTOM OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.

LEPTOSALENIA TEXANA (CREDNER)

[RANGE: LWR UNIT 1 - LWR UNIT 2 SALENIA TEXANA ZONE]

COMMON TO ABUNDANT IN THE LOWER MEMBER



"SALENIA" TEXANA ZONE, TOP OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.

HYPOSALENIA PHILLIPSAE (WHITNEY & KELLUM)

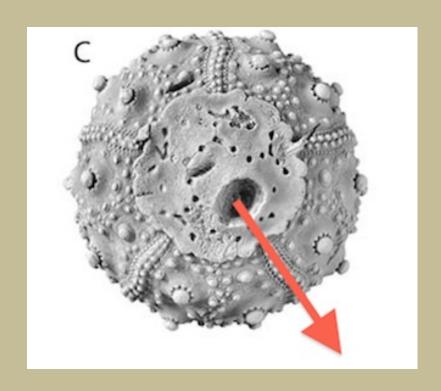
[RANGE: LWR UNIT 2 ECHINOID MB]

ALWAYS SMALLER THAN LEPTOSALENIA

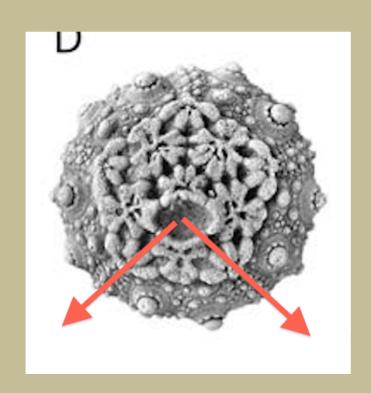


ECHINOID MARKER BED, BOTTOM OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.

LEPTOSALENIA OR HYPOSALENIA?



LEPTOSALENIA
PERIPROCT OFFSET &
ALIGNED WITH AMB



HYPOSALENIA
PERIPROCT IS CENTERED
BETWEEN AMBS

LORIOLIA ROSANA COOKE

[RANGE: UPR UNITS $3-7^*$]

VERY COMMON, SMALL, BUT USUALLY BEAUTIFUL, ECHINOID



LOWER LORIOLIA MARKER BED, TOP OF UNIT 6, UPPER MEMBER, GLEN ROSE FM.

POLYDIADEMA TRAVISENSIS SMITH & RADER

[RANGE: UPR UNITS 3 - 6]

EASILY MISTAKEN FOR LORIOLIA





POROCYSTIS MARKER BED, UNIT 4, UPPER MEMBER, GLEN ROSE FM.

TETRAGRAMMA TENERUM SMITH & RADER

[RANGE: UPR UNITS 3 - 7]

SMALL FOR THIS GENUS



Orbitolina Marker Bed, bottom of Unit 3, Upper Member, Glen Rose Fm.

TETRAGRAMMA SP.

[Range: Salenia Texana zone of Lwr Unit 2]

NOTE: BILL THOMPSON HAS NAMED 4 NEW POSSIBLE SPECIES OF TETRAGRAMMA FROM THE GLEN ROSE FM.



SALENIA TEXANA ZONE, TOP OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.

TETRAGRAMMA SP.

THERE MAY BE SEVERAL SPECIES (OR POSSIBLY GROWTH STAGES) OF THIS GENUS OCCURRING IN THE FORMATION — FURTHER STUDY IS NEEDED



ECHINOID MARKER BED, BOTTOM OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.*

^{*}SMITH & RADER DID NOT LIST A TETRAGRAMMA FROM THIS UNIT

PHYMOSOMA SP. CF. TEXANUM (ROEMER)

[RANGE: LWR UNIT 2 - UPR UNIT 7*]

THIS SPECIES IS BETTER KNOWN FROM YOUNGER STRATA*

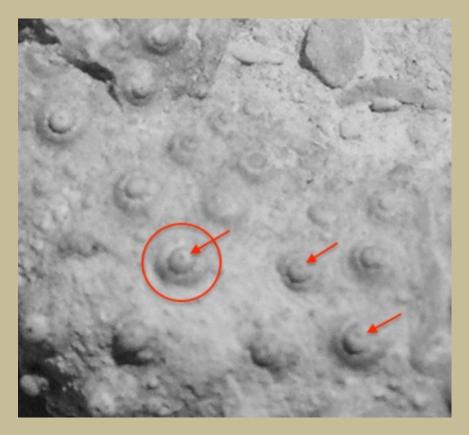


ECHINOID MARKER BED, BASE OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.

ECHINOID MARKER BED, BASE OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.

^{*}EXTENDS UP INTO THE FREDERICKSBURG GROUP

TETRAGRAMMA OR PHYMOSOMA?



PERFORATE TUBERCLES
= HOLES

IMPERFORATE TUBERCLES

= No Holes

NOTE THAT MANY OTHER ECHINOIDS HAVE PERFORATE TUBERCLES

CODIOPSIS (HEMICODIOPSIS) PULCHELLA SMITH & RADER

[RANGE: LWR UNIT 2 ECHINOID MB]

DEFINITELY ONE OF THE RARE ECHINOIDS



ECHINOID MARKER BED, BASE OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.

COENHOLECTYPUS PLANATUS (ROEMER)

[RANGE: LWR UNIT 2 — UPR UNIT 7*]

THIS SPECIES IS COMMON THROUGH OUT THE GLEN ROSE



LORIOLIA MARKER BED, TOP OF UNIT 6, UPPER MEMBER, GLEN ROSE FM.

ORBITOLINA MARKER BED, UNIT 3, UPPER MEMBER, GLEN ROSE FM.

^{*}EXTENDS UP INTO THE FREDERICKSBURG GROUP

COENHOLECTYPUS OVATUS (WHITNEY & KELLUM)

[RANGE: LWR UNIT 2 — UPR UNIT 6]



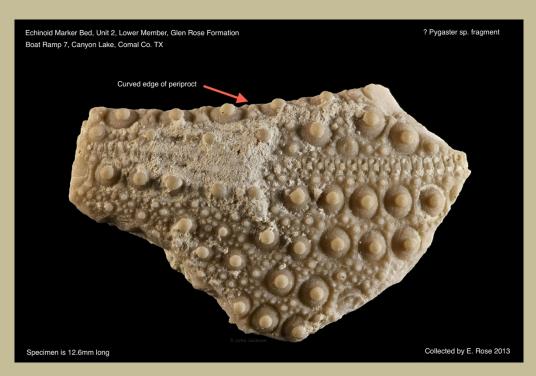


LORIOLIA MARKER BED, TOP OF UNIT 6, UPPER MEMBER, GLEN ROSE FM.

?PYGASTER SP. SMITH & RADER

[RANGE: LWR UNIT 2 ECHINOID MB]

SMITH & RADER NOTED THE PRESENCE OF PYGASTER BASED UPON A SINGLE FRAGMENT





ECHINOID MARKER BED, BASE OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.

PYGOPYRINA HANCOCKENSIS (WHITNEY & KELLUM)

[RANGE: LWR UNIT 2 ECHINOID MB]

NUMEROUS IN SOME LOCATIONS





ECHINOID MARKER BED, BOTTOM OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.

PLAGIOCHASMA TEXANUM SMITH & RADER

[RANGE: UPR UNIT 3 ORBITOLINA MB]

RELATIVELY UNCOMMON











Orbitolina Marker Bed, bottom of Unit 3, Upper Member, Glen Rose Fm.

PLIOTOXASTER COMANCHEI (CLARK)

[Range: Lwr Unit 1 - 2*]

RELATIVELY COMMON



"SALENIA" TEXANA ZONE, TOP OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.

^{*} Possibly found in Younger Strata

HETERASTER (ENALLASTER) OBLIQUATUS (CLARK)

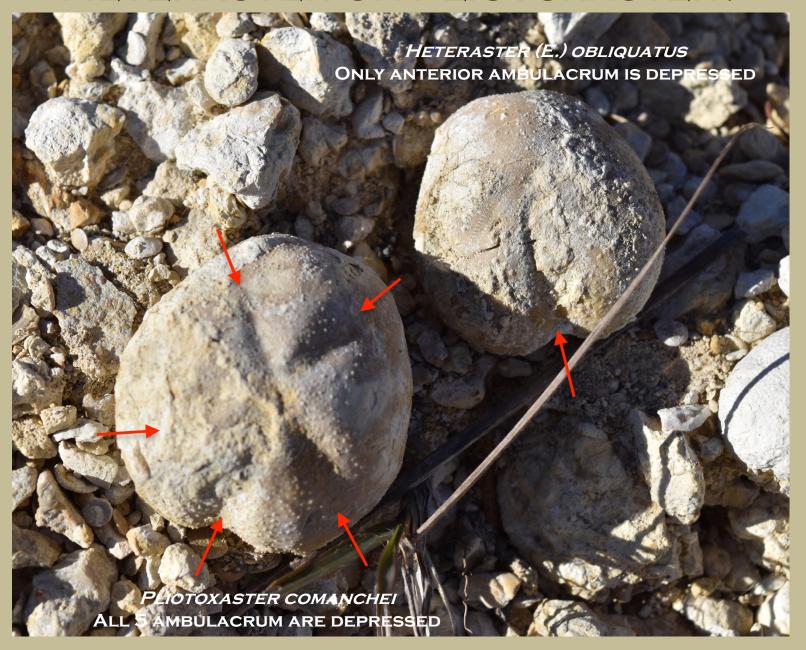
[RANGE: ENTIRE FORMATION]

MOST COMMON ECHINOID OF THE GLEN ROSE FM.

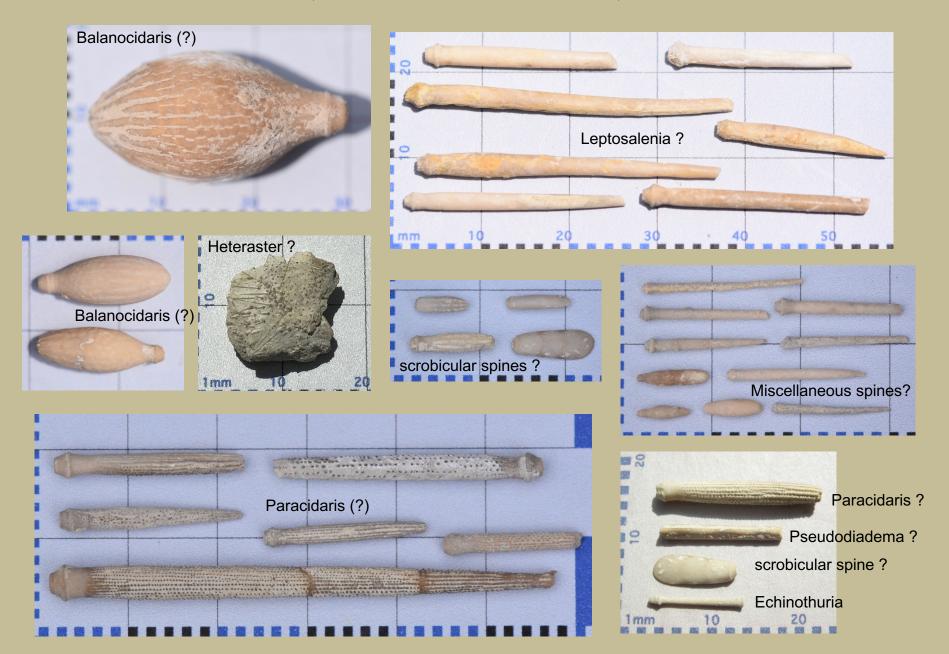


"SALENIA" TEXANA ZONE, TOP OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.

HETERASTER OR PLIOTOXASTER?



ECHINOID SPINES



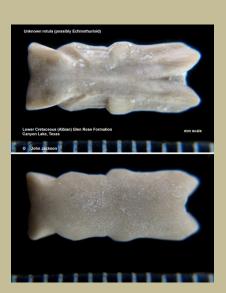
MISCELLANEOUS ECHINOID LANTERN PARTS

SPECIMENS ARE ALL FAIRLY COMMON IN THE ECHINOID MARKER BED

SCATTERED AND NOT DIRECTLY ASSOCIATED WITH ANY ONE SPECIES







INDIVIDUAL HEMIPYRAMIDS





ROTULA © John Jackson

Тоотн

COMPASS

ALL FROM THE ECHINOID MARKER BED, BASE OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.

NEW AND UNDESCRIBED GENERA AND SPECIES

SINCE THE PUBLICATION IN 2009 OF SMITH & RADER'S PAPER, NUMEROUS NEW FOSSILS HAVE BEEN COLLECTED BY MYSELF AND OTHERS THAT ADD TO THE LIST OF GLEN ROSE ECHINOIDS.

IN 2016 BILL THOMPSON PUBLISHED AND NAMED THE FOLLOWING NEW GLEN ROSE SPECIES:

ECHINOTHURIA MCCALLAE* - UNUSUAL LOOSE PLATES AND SMALL SPINES FROM UNIT 2

GONIOPYGUS QUARTUS - VERY SMALL DIFFERENCES FROM G. WHITNEYI

LEPTOSALENIA HANCOCKENSIS, L. HINTEI, L. INFLATA - ALL VERY SIMILAR TO L. TEXANA

L. SMITHI* - THOMPSON SUGGESTS THIS IS L. SP. CF. TEXANA (CREDNER) OF SMITH & RADER

PYGORYHNCHUS STEPHENSONI* - DISTINCT GENUS FOUND IN UNIT 3

SALENIA SUPERA - VERY SIMILAR TO L. TEXANA

TETRAGRAMMA ADAMI - DESCRIPTION BASED ON SINGLE SPECIMEN

T. DONALDTRUMPI, T. GLENROSENSIS, T. HAMMERSCHMIDTI - ALL VERY SIMILAR

*THESE 3 ARE CERTAINLY NEW SPECIES. I HAVE NOT BEEN ABLE TO PERSONALLY STUDY THE OTHERS WELL ENOUGH TO CONFIRM THEIR STATUS. I BELIEVE THEY REQUIRE FURTHER PEER REVIEW.

In addition to those above, I have collected at least two other Salenia-like echinoids that are not described (for Texas/North America) as far as I can determine.

UNDESCRIBED HETEROSALENIA SP. FROM THE MICRO ZONE OF UNIT 2
UNDESCRIBED (?) LEPTOSALENIA SP. FROM THE MICRO ZONE OF UNIT 2

ECHINOTHURIA MCCALLAE THOMPSON 2016 FAMILY ECHINOTHURIDAE

IDENTIFICATION BASED ON A FEW ASSOCIATED & MANY LOOSE PLATES

GENUS ECHINOTHURIA KNOWN FROM LATE CRETACEOUS OF ENGLAND













ECHINOID MARKER BED, BASE OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.

PYGORHYNCHUS STEPHENSONI THOMPSON 2016

ONE OF THE NEW SPECIES IN BILL THOMPSON'S BOOK

GENUS IDENTIFIED BY ANDREW SMITH BMNH





Orbitolina Marker Bed, Unit 3, Upper Member, Glen Rose Fm.

SEE BILL'S BOOK FOR COMPLETE SPECIMENS

HETEROSALENIA SP.

BROUGHT TO MY ATTENTION AND IDENTIFIED BY JOHN JACKSON

CURRENTLY BEING DESCRIBED BY JOHN W. M. JAGT, Ph.D.,
NATUURHISTORISCH MUSEUM MAASTRICHT



ECHINOID MARKER BED, BASE OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.

?LEPTOSALENIA SP.

LARGEST "SALENIA" I HAVE ENCOUNTERED IN THE MICRO-ZONE

VERY DISTINCT AMBULACRA & NUMEROUS TUBERCLES IN THE INTERAMBULACRA



ECHINOID MARKER BED, BASE OF UNIT 2, LOWER MEMBER, GLEN ROSE FM.

SPECIES NOW CONSIDERED OUT-OF-DATE

AKERS & AKERS (1987) LIST THE FOLLOWING SPECIES FOR THE "LK TRINITY GROUP"

THEY HAVE BEEN FOUND TO BE SYNONYMOUS OR DO NOT OCCUR IN THE GLEN ROSE

HETERASTER TEXANUS THIS IS A FREDERICKSBURG GROUP SPECIES IN ALL OTHER REFERENCES HOLECTYPUS ENGERRANDI (= COENHOLECTYPUS PLANATUS) PER MORGAN, 2016

LORIOLIA TEXANA (= LORIOLIA ROSANA) PER SMITH & RADER, 2009

MACRASTER SOLITARIENSIS (= PLIOTOXASTER COMANCHEI) PER SMITH & RADER, 2009

PALHEMIASTER COMANCHEI (= PLIOTOXASTER COMANCHEI) PER SMITH & RADER, 2009

PHYLLACANTHUS TEXANUS (= PARACIDARIS(?) TEXANAUS) PER SMITH & RADER, 2009

PHYLLACANTHUS TYSONI (? = BALANOCIDARIS) THIS ONE IS STILL NOT CLEAR

PHYMOSOMA HILLI ? THIS IS AN UPPER CRETACEOUS SPECIES IN ALL OTHER REFERENCES

PSEUDODIADEMA TEXANUS (= LORIOLIA ROSANA) PER SMITH & RADER, 2009

PSEUDODIADEMA ELEVATUS (= LORIOLIA ROSANA) PER SMITH & RADER, 2009

SALENIA MEXICANA THIS IS A FREDERICKSBURG GROUP SPECIES IN ALL OTHER REFERENCES

TETRAGRAMMA TEXANUM (? = TETRAGRAMMA SP.) PER SMITH & RADER, 2009

TETRAGRAMMA HILLI ? THIS IS AN UPPER CRETACEOUS SPECIES IN ALL OTHER REFERENCES



ASTEROIDEA (STARFISH)

ALL UNIDENTIFIED SPECIES







ASTEROIDEA (STARFISH)

ALL UNIDENTIFIED SPECIES











OPHIUROIDEA (BRITTLE STARS)



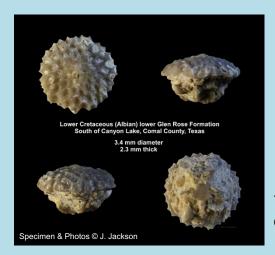
TENTATIVE IDENTIFICATION:

OPHIODORIS HOLTERHOFFI THUY ET AL

SPECIES KNOWN FROM THE SAME HORIZON

Thuy, B., Gale, A. S., Stohr, S., Wiese, F., 2013 "Shallow-water Brittle-Star (Echinodermata: Ophiuroidea) assemblages from the Aptian (Early Cretaceous) of the North Atlantic: first insights into bathymetric distribution patterns"

CRINOIDEA (SEA LILIES)



? SOLANOCRINITES SP. COMATULID CRINOID



ISOCRINUS ANNULATUS ROEMER
ECHINOID MARKER BED, BASE OF UNIT 2,
LOWER MBR. GLEN ROSE FM.



UNIDENTIFIED COMATULID "SALENIA" TEXANA ZONE, UNIT 2, LOWER MBR. GLEN ROSE FM.

KEY REFERENCES USED FOR ECHINOID IDENTIFICATIONS:

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