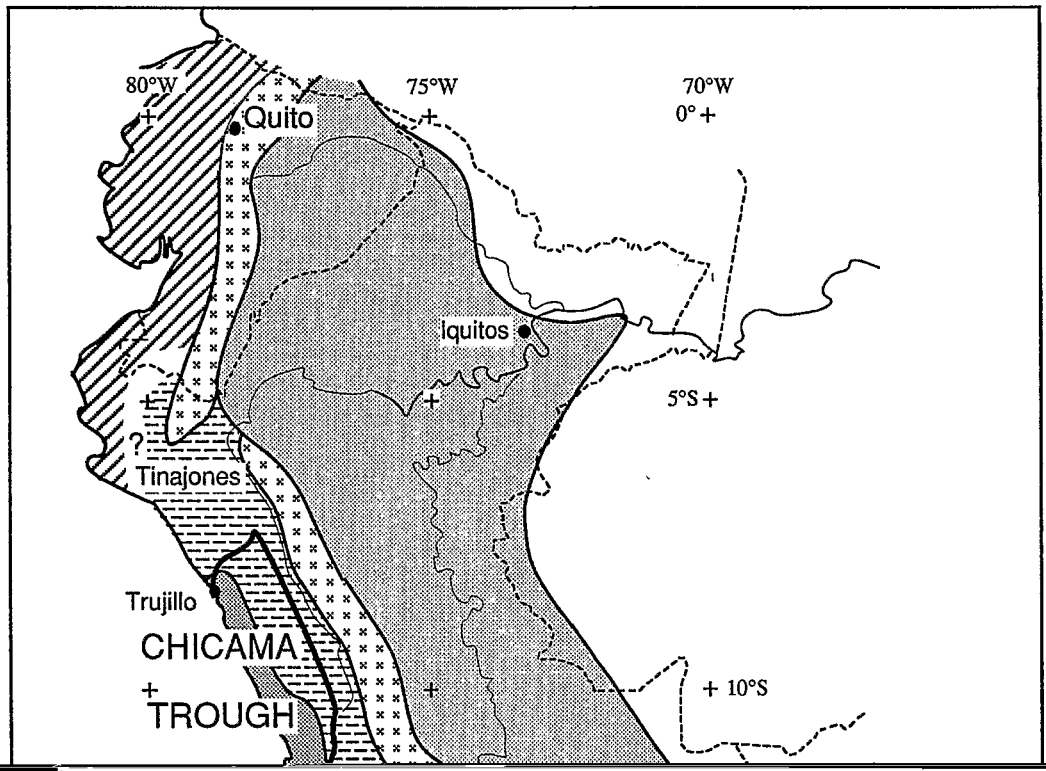
GeoResearch Forum Vols. 1-2 (1996) pp. 221-234

Upper Tithonian Ammonites and Floras from the Chicama Basin, Northern Peruvian Andes

R. Enay[1], G. Barale[2], J. Jacay[3] and E. Jaillard[4]

[1] Centre des Sciences de la Terre et URA n°11,
27-43 Boulevard du 11 Novembre 1918, F-69622 Villeurbanne Cedex, France


80°W
75°W
70°W
0°
Quito
Iquitos
5°S
?
Tinajones
Trujillo
CHICAMA
TROUGH
10°S

INTRODUCTION

During latest Jurassic time, the peruvian margin included (fig. 1): a subsident western trough with paralic to marine sedimentation, an axial threshold probably submitted to erosion, and an eastern basin, which experienced a weak subsidence and received detrital continental sediments. The late Jurassic evolution of the coastal zone is poorly known because of subsequent erosions; a volcanic arc activity is known in the Lima area. North-westernmost Peru is considered as a displaced terrane, the

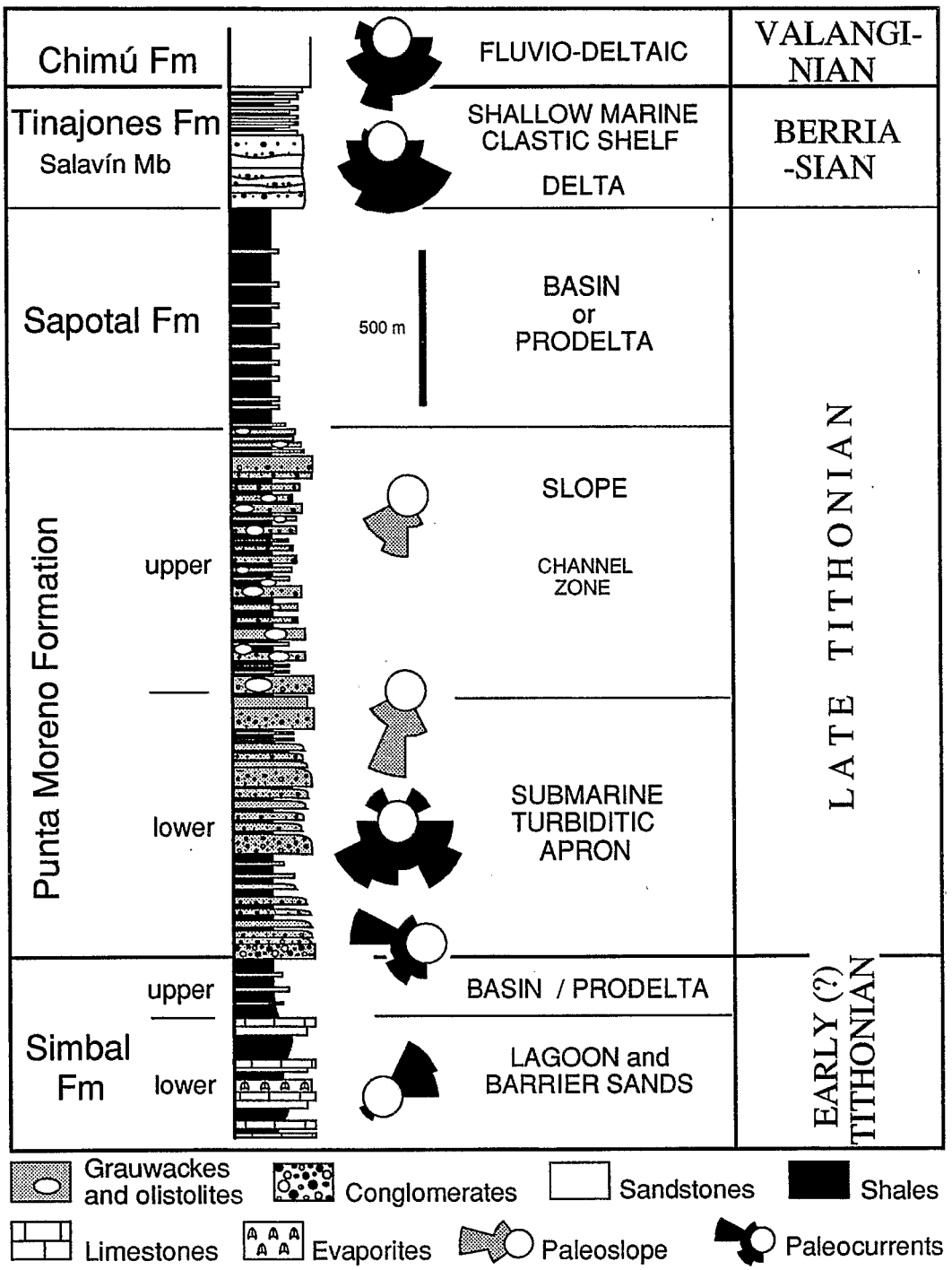


Fig. 2 - Synthetic section of Tithonian-Berriasian deposits in the Chicama basin.

evolution toward a slope environment characterized by feeding-channels, olistoliths and sedimentary

rmations - PM : Ponta Moreno ; S : Sapotal ; T : Tinajones	
ds number which yelded the opposite taxa	
AMMONITES FAUNAS	*cracanthoceras sp.*
	cracanthoceras sp. aff. *koellikeri* (Steuer non Zittel)
	rongoceras sp. cf. *lotenoense* Spath
	Iimalayites n. sp. cf. *egregius* (Steuer)
	Durangites cf. *limensis* (Lisson)
	Protacanthodiscus cf. *quadripartitus* (Steuer)
	bsteueroceras / Parodontoceras
	ravisphinctes sp.
	ulacosphinctes" cf. *subvetustus* Steuer
	elia sp.
	rodontoceras sp.
	rodontoceras sp. aff. *tenerum* (Steuer)
	rodontoceras cf. *beneckei* (Steuer)
	rodontoceras cf. *calistoides* (Behrendsen)
	rodontoceras angamarscaense (Welter)
	rodontoceras n. sp. aff. *pardoi* (Lisson)
	erriasella" cf. *bardensis* Krantz
	erriasella" gerthi Krantz
	oniceras sp. aff. *toucasi* Djanélidzé
	n. nov. sp. nov.
FLORAS	*pressinocladus* cf. *pompeckji* (Salfeld) Pons
	mites sp.
	lophyllum sp.
	lophyllum cf. *acutifolium* Morris
	lophyllum acutifolium Morris
	genopteris sp.
	Podozamites sp.
	ozamites sp. A and B

fauna presented is interesting because it is well-located along a detailed stratigraphic section, and includes species expressing significant Tethyan influences and affinities.

The list of the identified taxas has been restricted (except COM.29) to the samples determinable generically and/or specifically.

PUNTA MORENO FORMATION, UPPER MEMBER

COM.17: ? Micracanthoceras sp., very partial impression of uncertain determination.

COM.18: Micracanthoceras sp., two more complete impressions with an evolute shape;
? Substeueroceras or Parodontoceras sp., impression with fine and tight ribs.

COM.22: ?Substeueroceras or Parodontoceras sp., four fragment suggesting S. subfasciatum

[redacted]

than the type specimen.

?Protacanthodiscus cf. quadripartitus (Steuer), the body chamber of a specimen similar to the type specimen. However, the attribution to Protacanthodiscus, already proposed by Rivera (16) is uncertain.

Parodontoceras sp. aff. P. tenerum (Steuer), one impression of a small involute form, with very thin sinuous ribs and a ventral groove, similar to the type specimen.

SAPOTAL FORMATION

Ch.D.: Parodontoceras sp., example in volume very incomplete.
Ch.G.: Micracanthoceras sp., impression presenting the ventral area of an evolute specimen with strong costulation (cf. COM.51).
?Substeueroceras or Parodontoceras sp., numerous fragments or impressions, with fine and tight ribs.
JM.O.: ?Micracanthoceras sp., impression of the ventral area.

AGES AND CORRELATIONS

Ages and correlations are based upon the whole fauna, not only on the rich association of the COM.64 layer. Micracanthoceras is regularly present from the COM.17 layer up to the JM.O. bed. The less frequent associated forms do not bring much more information, except for some layers such as the COM.64 bed, where peculiar species are present. In addition to taxa considered as pacific or andean ones, others are close to the late Tithonian forms of the Tethyan regions.
After Gerth (34), Windhausen (35) and Weaver (36), Leanza (31) proposed an ammonite zonation of Pacific South America for the Tithonian, subsequently completed or slightly modified (37 ; 38 ; 39 ; 40 ; 30 ; 41 ; 19 ; 13 ; 42). Many species described were not precisely located in a stratigraphic column, and are still "out of zonation" (cf. 42) or seem to have been replaced in the reference zones without taking into account their stratigraphic succession.

Among the species determined, only "Berriasella" bardensis is well located in the Alternans Zone [= Lotenoense Zone for Wiedman (19) and Geyer (13)]. In the type-locality, it is associated with two other species present in the COM.64 bed : "B." gerthi, which is very close to "B." bardensis, and P. calistoides (43). Associated with the latter, Steuer (28) mentioned P. beneckei (its microconch ?) and "A." subvetustus. However, in more recent works, only P. calistoides is well-located and ascribed to the upper part of the late Tithonian (Koeneni Zone) by Gerth (34), Leanza (31) and then Leanza (30, 41) and Riccardi *et al.* (42).
However, it seems that the studied fauna is not younger than the Alternans Zone, and does not reach the Koeneni Zone, since the corresponding Substeueroceras genus has not been definitely identified in the material presented here. The mentions ?Substeueroceras or Parodontoceras sp. in the COM.19 to 52 and Ch.G. layers correspond to impressions that never exhibit the ventral region, and could be more probably Parodontoceras specimens. For the forms preserved in volume of the COM.60 and 64 beds, there are no doubts that Substeueroceras is absent. Finally, according to Leanza (41), the range of Parodontoceras and also Substeueroceras includes at least part of the Alternans Zone.
The Koeneni Zone would be present in the Sapotal Formation, which is supposed to have yield most

(31 ; 30 ; 41 ; 42), though no one of the recognized forms belong to the very peculiar species described by Leanza (31). This attribution is supported by the occurrence of C. cf. lotenoense (used

SAPOTAL FORMATION

CH G : Ptilophyllum sp. incomplete leaf bearing pinnae without distal part.

CH G : Ptilophyllum cf. Ptilophyllum acutifolium Morris emend. Bose and Kasat. The absence of venation of the pinnae does not allow a precise specific determination.

TINAJONES FORMATION

9 specimens have been collected and studied in lutites and reddish sandstones.

The material is fragmentary, two specimens show numerous fragmentary rests.

6 specimens collected in greyish sandstones, some being well preserved.

J.M. Ptilophyllum acutifolium Morris emend Bose et Kasat, distal part of a leaf identical with the same species figured by Bose et Kasat (50, pl. 1, fig. 1-6) from the Upper Jurassic-Lower Cretaceous of India.

J.M. two cycadophytic fragmentary fronds with no basal part and venation of the pinnae.

J.M. two axis of botanical nature but indeterminable.

J.M. Sagenopteris sp. incomplete leaf but with a typical anastomosing venation.

? Podozamites sp., isolated pinna without distal part ; the generic determination is uncertain.

Otozamites sp. A : isolated pinnae with a typical asymmetry of the pinnae base belonging to the genus Otozamites Braun. They seem similar to those described in the Lower Cretaceous flora from Peru and determinated as Otozamites zeilleri Berry (8, pl. 2, fig. 3).

Otozamites sp. B : isolated incomplete pinna with a typical base of the genus Otozamites Braun. Some affinities with Otozamites zeilleri Berry (8, pl. 2, fig. 3) from the Lower Cretaceous of Peru are possible.

The wealden flora of Peru has been studied by Neumann (51), Zeiller (52, 53), Salfed (54), Berry (8, 55, 56).

It is constituted meanly with Filicales particularly Weichselia reticulata, of Bennettitales (Otozamites, Cycadolepis) and Coniferales (Podozamites - Cupressinocladus).

The studied flora has in its systematic composition Ptilophyllum acutifolium, discovered fo the first time in Peru.

This is a typical species of indian province and distributed form Upper Jurassic to Lower Cretaceous.

The other specimens determinated are present in the inventory of previous works. Some specimens have affinities with described species. We can note the absence of Weichselia reticulata, typical from

CONCLUSIONS

Preservation of the ammonites faunas and floras from the Chicama Group is unequal, but they

(22) BELLIDO, E. (1956).- Geología del curso medio del rio Huaytara, Huancavelica. Bol. Soc. geol. Perú, 13, 49-75, Lima.
(23) VARGAS, L. (1970).- Geología del cuadrángulo de Arequipa. Bol. Inst. Geol. Min. Metal., 24 (A), 64 p., Lima.
(24) JAILLARD, E. & JACAY, J. (1989).- Les "couches Chicama" du Nord du Pérou: Colmatage d'un bassin né d'une collision oblique au Tithonique. C. R. Acad. Sci. Paris, (II), 308, 1459-1465.
(25) JACAY, J. (1992).- Estratigrafía y sedimentología del Jurásico del curso medio del valle del Chicama, y esbozo paleogeográfico del Jurásico-Cretáceo del Nor Perú (6°30'-8° Lat. Sur). Thesis Univ. Nacional Mayor San Marcos, Lima, 175 p., 2 maps h.t., unpubl.
(26) WILSON, J.J. (1984).- Geología de los cuadrángulos de Jayanca, Cutervo, Chiclayo, Chongoyape, Chota, Celendín, Pacasmayo y Chepén. Bol. Inst. Geol. Min. Metal., 38, 104 p., Lima.
(27) BENAVIDES, V. (1956).- Cretaceous system in Northern Peru. Amer. Museum Natur. Hist. Bull., 108, 352-494, New York.
(28) STEUER, A. (1897).- Argentinische Jura-Ablagerungen. Ein Beitrag zur Kenntniss der Geologie und Paläontologie der argentinischen Anden. *Paläont. Abh.*, III/3, 127-222, 24 pl., Iena.
(29) IMLAY, R.W. (1939).- Upper Jurassic ammonites from Mexico. Geol. Soc. Am. Bull., 50, 1-78, 18 pl..
(30) LEANZA, H.A. (1980).- The Lower and Middle Tithonian Ammonite fauna from Cerro Lotena, province of Neuquén, Argentina. Zitteliana, 5, 3-49, 9 pl., München.
(31) LEANZA, A. F. (1945).- Ammonites del Jurásico superior y del Cretáceo inferior de la Sierra Azul, en la parte meridional de la provincia de Mendoza. An. Museo La Plata, Paleont., A (6/1), 1-99, 23 pl..
(32) BURCKHARDT, C. (1912). -Faunes jurassiques et crétaciques de San Pedro del Gallo. Bol. Inst. Geol. Mexico, 29 : 264 p, 46 pl.
(33) DJANÉLIDZÉ, A. (1922) - Les Spiticeras du Sud-Est de la France. Mém. Carte géol. détail. France, 255 p., 22 pl., Paris.
(34) GERTH, E. (1925).- La fauna neocomiana de la Cordillera Argentina en la parte meridional de la Provincia de Mendoza. Act. Acad. Nac. Cienc. Republ. Argentina, IX, 57-132, 6 pl., Buenos-Aires.
(35) WINDHAUSEN, A. (1931). - Geologia Argentina. Part 2 : Geologia historica y regional del territorio argentino. Jacobo Peuser, Buenos Aires, 645 p., 214 fig., 58 pl., 1 carte.
(36) WEAVER, C.E. (1931). - Paleontology of the Jurassic and Cretaceous of the West Central Argentina. Mem. Univ. Washington, 1, 596 p., 62 pl.
(37) GROEBER, F.C. (1946). - Observaciones geologicas a lo largo del meridiano 7O. Hoja Chos Malal. Rev. Asoc. Geol. Argentina, 1 (3) : 177-2O8, 2 fig., 1 map, Buenos Aires..
(38) ROEBER, F.C., STIPANICIC, P. N. 1 MINGRAMM, A.R.G. (1952).- Geografia de la Republica Argentina. Soc. argent.Est. geogr. Gaea, Buenos Aires 2 (1), 541 p., 45 fig., 28 pl.
(39) LEANZA, H. A. y HUGO, C.A. 1978 - Sucession de ammonites y edad de la Formacion Vaca Muerta y sincronicas entre los paralelos 35° y 4O° l.s. Cuenca Neuquino-Mendocina. Rev. Asoc. Geol. Argentina, 32 (4) : 248-

(54) SALFELD, H. (1911). - Fossile Pflanzen aus dem obersten Jura bzw; der untersten Kreide von Peru. in : HAUTHAL, R., Reisen in Bolivien und Peru. Zeitsch. Wiss. Veröf. Gesell. Erdk. Leipzig, 7 : 211-217.
(55) BERRY, E.W. (1939). - The fossil plants from Huallanca Peru in : Contributions to the paleobotany of Middle and South America. Johns Hopkins Univ. Studies Geol., 13 : 73-93.
(56) BERRY, E.W. (1945). - The Weichselia stage in the Andean Geosyncline. Johns Hopkins Univ. Studies Geol., 14 : 151-169.