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BIOSTRATIGRAPHIC SUBDIVISION OF THE CALLOVIAN STAGE IN THE SUBTETHYAN
PROVINCE OF AMMONITES, CORRELATIONS WITH THE SUBBOREAL ZONAL SCHEME

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ABSTRACT. - A biostratigraphic scale of high resolution, founded on the Tethyan families, is defined in the Subtethyan province and correlated with the Subboreal zonal scheme. It has been established in the Center-West of France where the Callovian deposits are relatively complete and continuous, but for the uppermost part of the stage. Twenty three horizons of ammonites are individualized. Many biostratigraphical units present a large extent inside the Subtethyan province and some of them also in the west Tethyan realm. Further, a parallel zonal scheme based essentially on the evolution of the Tethyan Reineckeidae can be proposed.

The Callovian series of Center-West of France figures in Europe among the more continuous and more rich in ammonites. These faunas concern both sub-Mediterranean and Mediterranean provinces. Their biostratigraphic study has permitted establishment of a very detailed horizon scale of the Callovian stage (Tabl. 1). The elementary biostratigraphic unit is the horizon, defined by an association of characteristic species. This is regionally indivisible and its geographic extension proved at least at the level of the region, that is to say over a distance of the order of 300 km (CALLOMON, 1964). 23 horizons are distinguished. Their characteristics and also their composition are briefly reported. We can find greater details of the successive associations and of the reference sections in the early works (CARIOU, 1969, 1974, 1980).

A. THE SCALE OF CALLOVIAN HORIZONS OF THE CENTER-WEST OF FRANCE

In the successive associations, some species are more characteristic because of their frequency or their strict localization in a horizon. They are distinguished by an asterisk. The Boreal forms are rare or absent in several levels.

I. Bullatus horizon (OPPEL, 1857 ; emend CARIOU, 1974)

**Bullatimorphites* (*Kheraicerias*) *bullatus* (D'ORB.) is very abundant, but we found also *Macrocephalites macrocephalus* ZITTEL, **M. subtrapezinus* (WAAG.), *Kamptokephalites rotundus* (QU.), **K. grantanus* (OPP.), **K. elephantinus* CORROY

English scale : Subboreal province (after J.H. CALLOMON and R.M. SYKES, 1964-1980)			Zonation of the Center-West of France : Subtethyan province			
SUBSTAGES	ZONES	Subzones	Horizons		Subzones	ZONES
UPPER	LAMBERTI	Lamberti	lacuna		Poculum	LAMBERTI
		Henrici	Athletoides	XX		
			Subtense	XIX		
	ATHLETA	Spinosum	Collotiformis	XVII	Collotiformis	ATHLETA
			Piveteaui	XVI		
		Proniae	trezeense	XV	Trezeense	
MIDDLE	CORONATUM	Phaeinum	Rota	XVI	Rota	CORONATUM
			Grossouvrei	Waageni	XIIIb	
		Leuthardt		XIIIa		
		Obductum	Baylei	XII	Baylei	
	Villanyensis		XI			
	JASON	Jason	Richei	Xb	Tyranniformis	ANCEPS
			Blyensis	Xa		
		Medea	Turgidum	IX	Stuebeli	
Bannense			VIII			
LOWER	CALLOVIENSE	Enodatium	Kiliani	VIIb	Patina	GRACILIS
			Boginense	VIIa		
		Calloviense	Michalskii	VI	Michalskii	
			Laugieri	V	Laugieri	
			Pictava	IV	Pictava	
		Koenigi	Rehmanni	III	Rehmanni	
	MACROCEPHALUS		Kamptus	Prahecquense	II	Prahecquense
		Macrocephalus	Bullatus		I	

Tab. 1 - Zonation of the Callovian Stage in the Center-West of France and its correlation with the Subboreal scale.

non J.C. SOW., *"*M.*" *sauvagei* PETITC., **Homeoplanulites subbackeriae* (D'ORB.).
Reference section : quarry of Pamproux (Deux-Sèvres), bed 1.

II. Prahecquense horizon (CARIOU, 1974)

Bullatimorphites (K.) *bullatus* (D'ORB.) has disappeared. The horizon is characterised by the abundance of large *Homeoplanulites*.

**Bomburites prahecquense* (PETITC.), **Bullatimorphites* (K.) *quenstedti* (ROEM.), *Macrocephalites macrocephalus* ZITT. and SCHL., *Kamptokephalites* aff. *kheraensis* SPATH, *K. chrysoolithicus* (WAAG.), **K. cossmanni* (PETITC.), *K.* aff. *dimerus* (WAAG.), **Homeoplanulites furcula* (NEUM.), *H. funatus* (OPP.).

Reference section : Pamproux, beds 2 to 6a.

III. Rehmanni horizon (= Petitclerci horizon, CARIOU, 1974, 1980)

The first Reineckeinae make their appearance in large number and also the genus *Proplanulites*.

**Rehmannia rehmanni* (OPP.), **Rehm. grossouvrei* (PETITC.), **Choffatia* (Subgr.) *cardoti* (GEMM.), *Proplanulites* aff. *majesticus* BUCKM., *Bullatimorphites* (Kher.) sp., *Macrocephalites macrocephalus* SCHL. and ZITT.

Reference section : Pamproux (Deux-Sèvres), bed 6b.

IV. Pictava horizon (CARIOU, 1974)

Horizon of giant Reineckeinae ; the subgenus *Chanasia* (*Hecticoceratinae*) originates.

**Reineckeia* (*Tyrannites*) *pictava* (BOURQ.), **R. (T.) tyranna* (NEUM.), **R. (T.) convexa* CAR., *Oxycerites subcostarius* (OPP.), *Hecticoceras* (*Chanasia*) *pleurocyra* PAR. et BON., *H. (Ch.) pseudochanaziense* LEM., *Macrocephalites macrocephalus* ZITT. non SCHL.

Reference section : Pamproux, bed 7.

V. Laugieri horizon (CARIOU, 1974)

The first *Indosphinctes* are found and the first *Oecoptychius*.

**Rehmannia laugieri* BOURQ., **Reineckeia (T.) franconica* (QU.), **Grossouvreia sciutoi* (GEMM.), **Indosphinctes subpatina* (PETITC.), *I. caroli* (GEMM.), *Proplanulites trifurcatus* BUCKM., *Macrocephalites compressus* (QU.) and its forme *gracilis* (microconch), **Hecticoceras (Ch.) barbieri* (PETITC.), *H. (Ch.) pseudochanaziense* LEM., *H. (Ch.) paronai* (ZEISS), *H. (Jean.) malbosi* (ELMI), *Oecoptychius refractus* (REIN.), *Oxycerites subcostarius* (OPP.).

Reference section : Pamproux, bed 8a.

VI. Michalskii horizon (= Ardescicum subzone, ELMI, 1967)

It corresponds to the acme of *Chanasia*. The horizon is a part of the "Ardescicum" subzone (= fauna 8, ELMI, 1967).

**Hecticoceras (Ch.) michalskii* LEW., **H. (Ch.) chartroni* PETITC., **H. (Ch.) navense* ROM., *H. (Ch.) bonyi* PETITC., *H. (Jean.) anomalum* (ELMI), *Macrocephalites compressus* (QU.) and its forme *gracilis* (microconch), *Kamptokephalites* cf. *folliiformis* (BUCKM.), **Indosphinctes zelleri* (PETITC.), *I. caroli* (GEMM.).

Reference section : Pamproux, beds 8b to 10.

VIIa. Boginense horizon (= horizon of Proximum a, CARIOU, 1980)

It is characterised by the birth of number of genera or subgenera : *Reineckeia* s. st., *Collotia* (*Reineckeinae*), *Zieteniceras* and *Hecticoceras* s.st. (*Hecticoceratinae*).

**Hecticoceras boginense* PETITC., *H. proximum* ELMI, *H. (Z.) pseudolunula* (ELMI), *H. (Jean.) girodi* BON., **Paralcidia mamertensis* (WAAG.), **Collotia oxyptycha* (NEUM.), **Reineckeia turgida* CAR., *Rehmannia frei* (JEAN.), *Indosphinctes roberti* (PETITC.), *I. choffati* (PAR. et BON.), **Choffatia poisoti* (PETITC.), *Grossouvria chanaziense* MANG.

Reference section : Pamproux, bed 11.

VIIb. Kiliani horizon (= horizon of *Proximum* b, CARIOU, 1980)

Indosphinctes and *Choffatia* are very frequent with new species. The subgenus *Lunuloceras* (*Hecticoceratinae*) originates.

Hecticoceras proximum ELMI, **H. (Ziet.) kiliani* PETITC., *H. (Z.) striatum* (ELMI), *H. (Lunuloceras) sp.*, **H. (Ch.) hartmanni* ZEISS, *H. (Jean.) perlatum* ZEISS, **I. joffrei* (LEM.), **I. pseudopatina* (PAR. and BON.), *I. rusticus* SPATH, *I. roberti* (PETITC.), **I. patina* (NEUM.), **Choffatia prorsocostata* (SIEM.), **Ch. leptonata* SPATH, **Grossouvria cheyensis* (PETITC.), **G. revoli* (PETITC.), **Reineckeia spinosa* JEAN., **Collotia pamprouxensis* CAR., *C. oxyptycha* (NEUM.), **Macrocephalites boonei* PETITC., *M. lamellosus* (SOW.), *Kosmoceras (Z.) enodatum* (NIK.).

Reference section : Pamproux, beds 12 to 16.

VIII. Bannense horizon (CARIOU, 1974)

Hecticoceras s.st. has disappeared. *Hecticoceratinae* macroconchs (*Chanasia*, *Zieteniceras*) of large size are found. Among the *Reineckeinae*, the subgenus *Loczyceras* is individualized.

**Hecticoceras* (Ch.) *bannense* ELMI, *H. (Ch.) hartmanni* ZEISS, **H. (Z.) couffoni* R. DOUV., *H. (Z.) aff. alternans* ELMI, *H. (Z.) karpinskyi* (TSYT.), *H. (Lunuloceras) sp.*, *Kamptokephalites tumidus* (REIN.), *Macrocephalites lamellosus* (SOW.), *Indosphinctes drevermanni* (TILL), *Grossouvria steinmanni* (PAR. et BON.), *Reineckeia anceps* (REIN.), **R. stuebeli* STEINM., *Rehmannia (Loczyceras) segestana* (GEMM.), **Collotia discus* (BOURQ.), *Kosmoceras (Z.) medea* (CALL.).

Reference section : Pamproux, beds 17-18.

IX. Turgidum horizon (= *Medea* horizon, CARIOU, 1980)

The subgenera *Putealiceras*, *Rossienceras*, *Sublunuloceras* (*Hecticoceratinae*) appear.

**Hecticoceras* (Ch.) *turgidum* LOCZ. succeeds *H. (Ch.) hartmanni* ZEISS, **H. (Z.) karpinskyi* TSYT., **H. (Z.) alternans* ELMI, **H. (Rossienceras) loczyi* ZEISS, *H. (R.) metomphalum*, *H. (R.) rossiense* ZEISS., *H. (Putealiceras) arkelli* ZEISS, *H. (Put.) krakoviense rectangulare* TSYT., **H. (Subl.) gerardi* PETITC., **H. (Lunuloceras) calloviensis* ROM. et LEM., *"*Paralcidia*" *alberti* (R. DOUV.),

Phl. lachati PAR. et BON., *Ch. subbalinensis* (SIEM.), *Indosphinctes* sp., *Rehmannia* (L.) *segestana* (GEMM.), **Rehm.* (L.) *reissi* STEINM., **Rehm.* (L.) *britannica* ZEISS, **Reineckeia stuebeli* STEINM., *R. anceps* (REIN.), *Collotia discus* (BOURQ.), *Kamptokephalites tumidus* (REIN.), *Kosmoceras* (Z.) *medea* (CALL.).

Reference section : Pamproux; bancs 19 to 22.

Xa. Blyensis horizon (= horizon of Jason a, CARIOU, 1980)

The Macrocephalitidae disappear. The horizon is marked by the birth of new species.

Hecticoceras (Ch.) aff. *turgidum* LOCZ., *H.* (R.) *pseudocracoviense* TSYT., *H.* (R.) *laubei* (NEUM.), *H.* (R.) *metomphalum* BON., *H.* (L.) *lahuseni* TSYT., *Phlycticeras cristagalli* (D'ORB.), *Phl. pustulatum* (REIN. ; D'ORB.), *Choffatia subbalinensis* (SIEM.), *Indosphinctes* sp., *Grossouvria evoluta* MANG., *Reineckeia anceps* (REIN.), *R. anceps elmii* BOURQ., **R. tyranniformis* SPATH, **Rehmannia* (L.) *blyensis* BOURQ., *R.* (L.) *hungarica* (TILL), *Rehm.* (L.) *greppini* (OPP.), **Rehm.* (L.) *balusseaui* CAR., *Collotia multicostata* (PETITC.), *Kosmoceras* (Z.) *jason* (REIN. ; D'ORB.).

Reference section : quarry of Doux (Deux-Sèvres), bed 3b.

Xb. Richei horizon (= horizon of Jason b, CARIOU, 1980).

The genus *Flabellisphinctes* (*Pseudoperisphinctinae*) is individualized but it is not frequent. The majority of the species of the preceding horizon are found, but in addition of new species.

**Rehmannia* (L.) *richei* (FLAM.), *Rehm.* (L.) *intermedia* (BOURQ.), *Reineckeia fehlmanni* JEAN., *Flabellisphinctes* sp., *Okaites polonicus* (SIEM.), *Indosphinctes planus* TILL, **Hecticoceras* (Z.) *janus* ZEISS, *H.* (Z.) *sarasini* TSYT., *H.* (*Brightia*) *difforme* TSYT., *Phlycticeras suevicum* (QU.), *Kosmoceras* (Z.) *jason* (REIN. ; D'ORB.).

Reference section : Doux, beds 3b, 4.

XI. Villanyensis horizon (CARIOU, 1974)

The index species has been chosen because of its great frequency but its stratigraphic range is not restricted to the horizon. The genus *Flabellisphinctes* and certain *Hecticoceratinae* (*Lunuloceras*, *Rossienceras*, *Brightia*) are abundantly represented. The genus *Erymnoceras* is found for the first time.

**Flabellisphinctes villanyensis* (TILL), *F. variabiliferus* (LOCZ.), **Choffatia neumayri* (SIEM.), *Grossouvria kontkiewiczzi* (SIEM.), *Reineckeia anceps* (REIN.), *R. anceps elmii* BOURQ., *R. tyranniformis* SPATH, *R. fehlmanni* JEAN., *Rehmannia* (L.) *intermedia* (BOURQ.), *Rehm.* (L.) *corrugis* (BOURQ.), **Collotia gigantea* (BOURQ.), *Hecticoceras* (L.) *prealpinum* ZEISS, *H.* (L.) *sinuicostatum* (ZEISS), *H.* (B.) *leii* TSYT., *H.* (B.) *nodosum* (QU.), *H.* (B.) *tenuinodosum* ZEISS, *H.* (R.) *pseudonodosum* TSYT., *Kosmoceras* (Z.) *obductum* (BUCKM.), *Erymnoceras* s.st.

Reference section : Le Grand-Breuil (Deux-Sèvres), quarry Les Moulins, beds 49 to 68.

XII. Baylei horizon (CARIOU, 1974)

The *Erymnoceras* s.st. becomes abundant and the subgenus *Erymnocerites* is differentiated, but it is rare. The first bituberculate *Reineckeinae* (subgenus *Loczyceras*) appear. In addition of the species of preceding horizon are found : *Rein.* cf. *polycosta* KUHN, **R. crassivenia* (BOURQ.), *Rehmannia* (L.) *crassicastrata* (LOCZ.), *Rehm.* (L.) *vesuntiana* (BOURQ.), **Erymnoceras baylei* JEAN. (microconch in BAYLE, 1878, pl. 54, fig. 1, holotype; macroconch the evolute form figured by JEANNET, 1951, taf. 36, fig. 3 for example, wrongly attributed to the D'ORBIGNY species), *E. triplicatum* (TILL), *E. (Erymn.) argoviensis* JEAN., *Flabellisphinctes villanyensis* (TILL), *Okaites calloviensis* (LOCZ.), **Hecticoceras* (Orb.) *schloenbachi* TSYT., **H. (R.) subnodosum* TSYT.

Reference section : Le Grand-Breuil (Deux-Sèvres), Les Moulins, beds 69 to 73.

XIIIa. Leuthardt horizon (= horizon of *Waageni a*, CARIOU, 1980)

It is characterised by the frequency of the subgenus *Erymnocerites*. The index species of the Leuthardt subzone (CARIOU, 1974) is localised in this horizon.

**Erymnoceras (Erymn.) leuthardt* JEAN., **E. (Erymn.) argoviensis* JEAN., *E. coronatum* (BRUG.; D'ORB.), **Rehmannia (L.) rudis* (BOURQ.), **Rehm. (L.) theobaldi* (BOURQ.), *Reineckea fehlmanni* JEAN., *Grossouvria leptoides* (TILL), *Hecticoceras (R.) multicostatum* TSYT., etc...

Reference section : Poitiers (Vienne), quarry of Les Lourdines, beds 7 to 10.

XIIIb. Waageni horizon (CARIOU, 1974 ; = horizon of *Waageni b*, CARIOU, 1980)

The *Erymnocerites* probably has disappeared ; the genus *Distichoceras* appears.

**Choffatia waageni* (TEISS.) frequent, *Flabellisphinctes* aff. *villanyensis* (TILL), *Collotia spathi* (BOURQ.), **Hecticoceras (Z.) angulatum* TSYT., **H. (Z.) bituberculatum* TSYT., *H. (Put.) subrossiense* TSYT., *Distichoceras* sp., *Erymnoceras coronatum* (BRUG.; D'ORB.) succeeds *E. baylei* JEAN. The index species of the *Coronatum* zone is distinguished by more involute coiling and a section which is very depressed until close of the growth.

Reference section : Poitiers (Vienne). Les Lourdines, beds 12 to 16.

XIV. Rota horizon (CARIOU, 1974)

The *Distichoceras* become numerous associated with new genera and subgenera (*Rollieria*, *Pseudopeltoceras*, *Orionoides*). The bituberculation appears at the same time in the *Reineckea* and *Collotia (Reineckeinae)*. The genus *Erymnoceras* continues.

**Rehmannia* (L.) *rota* (BOURQ.), **Rehm.* (L.) *jeanneti* (ZEISS), *Reineckeia* nov. sp. with two rows of tubercules, **Collotia gaillardi* (ROM.), **Pseudopeltoceras* aff. *chauvinianum* (D'ORB.), *Orionoides* sp., *Distichoceras zeissi* THEOB., *D. pasdejeuensis* (GER. and CONT.), *Paralcidia* (*Rollieria*) aff. *frei* (JEAN.), **Hecticoceras* (L.) *michailowense* ZEISS, *H.* (Subl.) *gigas* (QU.), **H.* (R.) *regulare* TILL, *Kosmoceras* cf. *fibuliferum* (BUCKM.), *K.* (Z.) cf. *zugium interpositum* (BUCKM.), *Erymnoceras* sp. juv.

Reference section : quarry of Pas-de-Jeu (Deux-Sèvres), bed 4.

XV. Trezeense horizon (CARIOU, 1969)

It corresponds to an important renewal of ammonite faunas. There are found new genera and subgenera : *Peltoceras*, *Hamulisphinctes*, *Taramelliceras* s.st. The abundance of *Pseudopeltoceras* and large *Hecticoceratinae* (*Sublunuloceras*, *Orbignyiceras*, *Putealicerias*) is notable. *Erymnoceras* has disappeared.

**Hecticoceras* (O.) *trezeense* (GER. and CONT.), *H.* (Subl.) aff. *dynastes* (WAAG.), **H.* (R.) *uhligi* TILL, *H.* (Put.) *trilineatum* (WAAG.), **Taramelliceras taurimontanus* ERNI, *Distichoceras bicostatum* (STAHL). *Horioceras baugieri* (D'ORB.), **Orionoides termieri* GER. and CONT., **O. monestieri* GER. and CONT., *Hamulisphinctes hamulatus* BUCKM., *Binatisphinctes giganteus* GER. and CONT., *Pseudopeltoceras famulum* (BEAN.), **Peltoceras athleta* (PHILL.), "*Collotia ni-vernensis* BOURQ., **Rehm.* (L.) *horrida* CAR.

Reference section : Pas-de-Jeu (Deux-Sèvres), beds 5-6.

XVI. Piveteau horizon (CARIOU, 1974)

Among the new forms appearing, some are localised in this horizon.

**Orionoides piveteau* GER. and CONT., **O. lanquinei* GER. and CONT., *Peltoceras regularis* GER. and CONT., **Collotia odysseus* (MAY.), *Paralcidia* (*Rollier.*) *pattei* (GER. and CONT.), *Kosmoceras* (Z.) cf. *kuklikum* (BUCKM.).

Reference section : Montreuil-Bellay (Maine-et-Loire), beds 5 and lower part of 6.

XVII. Collotiformis horizon (BOUQUIN and CONTINI, 1968 ; CARIOU, 1969)

It corresponds to the maximum frequency of the bituberculate *Reineckeinae*.

* *Collotia collotiformis* (JEAN.), **C. falloti* (GER. and CONT.), *C. fraasi* (OPP.), *C. oxytychoides* (SPATH), **Orionoides raguini* GER. and CONT., **O. cayeuxi* GER. and CONT., *Peltoceras retrospinatum* GER. and CONT., **Hecticoceras* (P.) *intermedium* (SPATH), **H.* (O.) *hirtzi* (COLL.), *H.* (Subl.) *dynastes* (WAAG.), *H.* (S.) *nodosulcatum* LAH., *Kosmoceras geminatum* (BUCKM.), *K.* aff. *spoliatum* (QU.).

Reference section : Montreuil-Bellay (M. et L.), bed 6 (upper part).

XVIII. Nodulosum horizon (CARIOU, 1974)

It is marked by several new genera or subgenera : *Pseudobrightia* (Hecticeratinae), *Mirosphinctes*, *Properisphinctes* (Perisphinctidae), *Euaspidoceras* (Aspidoceratidae). The Reineckeidae are less frequent.

**Distichoceras nodulosum* (QU.), *D. bicostatum* (STAHL), *Hecticoceras* (O.) *frederici* ZEISS, **H.* (R.) aff. *daghestianum* (NEUM.), *H.* (? *Neocampylites*) *secula* (SPATH), *Paralcidia* (Roll.) *couffoni* GER. and CONT., *Taramelliceras globulus* (QU.), **Orionoides anguinus* SPATH, *Mirosphinctes* sp., *Properisphinctes* aff. *latilinguatus* (NOET.), *Euaspidoceras ferrugineum* JEAN., *Collotia* sp. juv., *Kosmoceras compressum* (QU.), *K. tidmooreense* ARK., etc...

Reference section : Pointe du Grouin du Cou (Vendée), beds 51 to 70.

XIX. Subtense horizon (CARIOU, 1980)

In Poitou the appearance of the subgenus *Poculisphinctes* coincides with the arrival of the first boreal *Quenstedtoceras*. Aspidoceratinae and large *Pseudobrightia* (Hecticeratinae) are numerous.

**Peltoceras subtense* (BEAN.), **Euaspidoceras hirsutum* (BAYLE), *E.* cf. *ferrugineum* JEAN., *Properisphinctes latilinguatus* (NOET.), **Orionoides poculum* (LECK.), *Hecticoceras* (Pseud.) *subpunctatus* (SPATH), **H.* (Put.) *thirriai* PETITC., *Distichoceras frei* (JEAN.), *Q. henrici* DOUV., etc...

Reference section : Montreuil-Bellay (M. et L.), bed 8.

XX. Athletoides horizon (CARIOU, 1980)

The subgenus *Putealicer* (Hecticeratinae) is abundant ; some species are new. The Pachyceratinae are not rare. The horizon is also characterised by less known large Perisphinctidae of a strong oxfordian affinity.

**Peltoceras athletoides* LAM., **Euaspidoceras ferrugineum* JEAN., **Hecticoceras* (Put.) *douvillei* (JEAN.), *H.* (P.) *puteale* (LECK.), *H.* (P.) *mathayense* KIL., *H.* (Subl.) *inerme* (R. DOUV.), **Pachyceras lalandeanum* (D'ORB.), *Orionoides* (Poc.) *poculum* (LECK.), *Quenstedtoceras praelamberti* (R. DOUV.), *Perisphinctidae* as *Properisphinctes*, *Kosmoceras tidmooreense* ARK.

The Callovian of Poitou is incomplete at the top. The break seems to correspond the deposit of beds H3-H5a of Marnes de Dives, in Normandy (DOUVILLE, 1912).

B. ZONATION TABLE OF SUBTETHYAN CALLOVIAN

The value of this scale of horizons transcends beyond the regional level, because of the very wide distribution of the ammonite species within the west Tethyan realm. In fact, it has already been proved that number of horizons defined in the Center-West of France have wide geographic extension (CARIOU, 1980). This is the reason why these are raised to the status of subzone (Tab. 1). By

SUBSTAGES	Subboreal province		Subtethyan province and tethyan province <i>pro parte</i>	
	ZONES	Subzones	Subzones	ZONES
UPPER	LAMBERTI	Lamberti	?	LAMBERTI
		Henrici	Angustilobata	
	ATHLETA	Spinorum	Collotiformis	ATHLETA
		Proniae	Nivernensis	
MIDDLE	CORONATUM	Phaeinum	Gaillardi	CORONATUM
		Grossouvrei	Spathi	
		Obductum	Gigantea	
	JASON	Jason	Multicostata	ANCEPS
		Medea	Discus	
LOWER	CALLOVIENSE	Enodatum	Pamprouxensis	GRACILIS
			Oxyptycha	
		Calloviense	Laugierii	
		Koenigi	Pictava	
	MACROCEPHALUS	Kamptus	Rehmanni	MACROCEPHALUS
		Macrocephalus	Prahecuense	
			Bullatus	

Tab. 2 - Parallelism between the Subboreal scale of *Kosmoceratidae* and a parallel subtethyan scale found essentially on the evolution of the tethyan family *Reineckeidae*.

the way, I must specify that since 1980, I have noted the large extension of the horizons of *Rehmanni* and *Pictava* up to Portugal.

The subzones are regrouped in zones in the zonation table which can be applied not only to the Subtethyan province but also in part to the large west Tethyan realm. The utilisation of the very classic *Anceps* zone as exact Tethyan equivalent of the Subboreal Jason zone seems necessary since *Reineckeia anceps* (REIN.) has been redefined (CARIOU, 1980). This zone must be accepted in a sense more restricted than originally defined by OPPEL (1857), because the range of this common species of wide distribution in the Tethyan realm. It seems possible to propose subdivision of the *Anceps* zone into *Stuebeli* subzone and *Tyranniformis* subzone, equivalent to the Boreal *Medea* subzone and Jason subzone. Further, in the absence of Boreal *Quenstedtoceras* in the Tethys and the different composition of ammonite faunas for comparison, it is desired to replace in the future the index *Quenstedtoceras lamberti* (SOW.) by a Tethyan form.

CORRELATION WITH THE SUBBOREAL SCHEME

The important probleme of correlation persists at the base of the Callovian, because of the very marked differentiation in ammonite faunas of Subtethyan and

Subboreal provinces. At the beginning of the top of Lower Callovian on the contrary, the stratigraphic correlation between the two provinces becomes more easy because of the southward extension of Subboreal Kosmoceratidae.

A PARALLEL ZONAL SCHEME BASED ON THE EVOLUTION OF THE TETHYAN REINECKEIIDAE

The Subboreal zonal scheme, excepting at the base and the top of the stage, is found on the evolution of a single ammonite family Kosmoceratidae. In a major part, it is a homochronologic scale. The recent revision of the Reineckeinae (CARIOU, 1980) shows that it is possible to present a parallel Subtethyan scheme, based essentially on the evolution of this subfamily (Tab. 2) and more particularly on the development of the genus *Collotia* appearing at the top of the Lower Callovian. At the beginning of this level, the correspondance with the Subboreal scheme is more easy and it is remarkable to note that the precision in dividing the Callovian is comparable with either of the family. This parallel zonation brings to light the chronostratigraphic value of Reineckeinae. Because of the frequency and the wide distribution of the species, this ammonite subfamily shall permit good stratigraphic correlation within the large Tethyan realm. However, in spite of the great interest, this parallel scale may not supersede the zonation defined by the successive species associations. This type of scale presents in fact two advantages from comparison with a homochronologic scale : it is sometimes more precise ; the biostratigraphic units are more helpful for identification because of great number of taxa which these are composed of.

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