

The Albian, Cenomanian and Turonian Stages in their type-regions

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In recent years, several contributions have led to a better knowledge of the Mid-Cretaceous stages which type-regions are in France: Aube for the Albian (Rat et al., 1975), Sarthe for the Cenomanian (Juignet 1980), Saumurois and Touraine for the Turonian (Robaszynski et al. 1982). Some results of these recent investigations are summarized on three charts, where a synthetic lithological sequence for each area is related to the vertical distribution of the main ammonites.

The present paper includes data from F. Amédéo, P. Juignet and F. Magniez-Jannin.

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Aptian-Albian boundary

In the Aube area, the base of the “Argiles tégulines” contains *Hypacanthoplites* aff. *milleltianus*, which represents the older ammonite-zone of the Paris Basin but is not the oldest of the Lower Albian. No ammonites were recorded from the “sables glauconieux” below the “Argiles tégulines”. *Prolemyeriella schrammeni* which is considered to mark the base of the Albian is absent in the Aube.

Note: If the substage boundaries proposed during the Copenhagen Symposium were to be accepted (with first appearance of *Lyelliceras lyelli* for the base of Middle Albian and *Dipoloceras cristatum* for the base of Upper Albian, cf. fig. 4), then fig. 1 would have to be modified as follows: the Middle Albian should be placed at the base of *Hoplites benettianus* Zone and the Upper Albian at the base of *Dimorphoplites silenus* Zone.

Albian-Cenomanian boundary

In the Sarthe area, it seems that there is a lithological transition between Upper Albian and Lower Cenomanian detected in borings. However, at present there are no exposures available as reference sections to produce a sequence of ammonites or planktonic microfossils.

Cenomanian-Turonian boundary

In the Saumurois-Touraine area, the Lower Turonian *Watinoceras coloradoense* zone has been found but with no evidence of the Upper Cenomanian *Neocardioceras juddii* zone.

Dansk sammendrag

Resultater af nye stratigrafiske undersøgelser af de franske typeområder for albien, cenomanien og turonien er syntetiseret i et antal oversigtsfigurer.

Selected references

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Robaszynski, F., Amédéo, F. et al. 1980: Synthèse biostratigraphique de l'Aptien au Santonien du Boulonnais à partir de sept groupes paléontologiques. *Rev. Micropal.*, 22, 195–321, 28 figs., 20 pls.

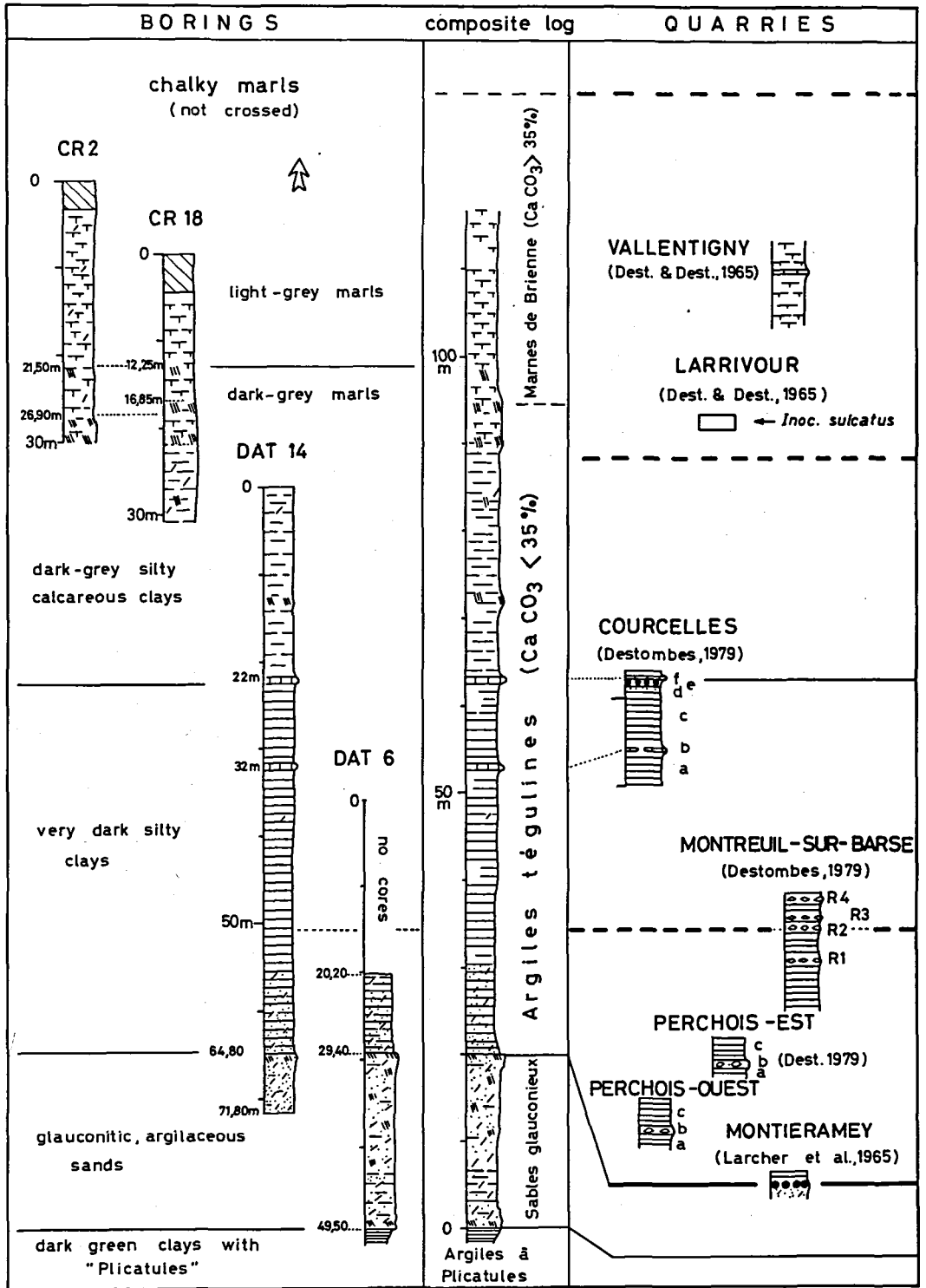


Fig. 1. Lithology and vertical distribution of some ammonites for the type Albian Stage (data from F. Amédéo and F. Magniez-Jannin).

Selected ammonites	AMMONITES ZONES			CEN		
	DESTOMBES, 1979	AMEDRO, this paper	AMEDRO in ROBAS, 1980			
	Zones	Subzones	Mant. cantianum			
<p>— <i>P.(P.) inflata</i> (SOW.)</p> <p><i>Douvillerias mammillatum</i> (SCHLOTHEIM)</p> <p><i>Cleoniceras floridum</i> CASEY</p> <p><i>Sonneratia</i> aff. <i>dutempleana</i> (d'ORBIGNY)</p> <p><i>P.(Hemisonneratia) puzozianus</i> (d'ORB.) var. <i>gallicus</i> (BREISTR.)</p> <p><i>Otohoplites larcheri</i> DESTOMBES</p> <p>" " <i>bulliensis</i> DESTOMBES</p> <p>" " <i>normanniae</i> DEST., JUIGNET & RIOULT</p> <p><i>Hoplites (Isohoplites) eodentatus</i> CASEY</p> <p>" " <i>(Hoplites) benettianus</i> (SOWERBY)</p> <p>" " <i>dentatus</i> (SOWERBY)</p> <p><i>Anahoplites intermedius</i> SPATH</p> <p><i>Lyellicerias lyelli</i> (d'ORBIGNY)</p>			<i>Pervinquieria perinflata</i>	Stoliczkaia dispar auct.	ALBIAN	
						<i>Pervinquieria fallax</i>
		<i>Calliohoplites auritus</i>	<i>P.(Pervinquieria) inflata</i>	<i>Pervinquieria inflata</i>		UPPER ALBIAN
			<i>P.(P.) pricei</i>	<i>Pervinquieria pricei</i>		
				<i>Dimorphoplites silenus</i>		MIDDLE ALBIAN
				<i>Dimorphoplites bipticus</i>		
				<i>Dimorphoplites niobe</i>		
				<i>Anahoplites intermedius</i>		MIDDLE ALBIAN
		<i>A. intermedius</i>	<i>A. intermedius</i>	<i>Hoplites dentatus</i>		
		<i>Hoplites spathi</i>	<i>H. (Hoplites) dentatus</i>	<i>Hoplites benettianus</i>		
	<i>Lyellicerias lyelli</i>	<i>H. (Hoplites) benettianus</i>	<i>Isohoplites eodentatus</i>		LOWER ALBIAN	
	<i>Isohoplites eodentatus</i>	<i>H. (Isohoplites) eodentatus</i>	<i>Otohoplites normanniae</i>			
		<i>O. normanniae</i>	<i>Otohoplites bulliensis</i>			
	<i>Otohoplites bulliensis</i>	<i>Otohoplites bulliensis</i>	<i>Otohoplites auritifformis</i>		LOWER ALBIAN	
	<i>Otohoplites larcheri</i>	<i>Otohoplites larcheri</i>	<i>Otohoplites larcheri</i>			
		<i>O. raulinianus</i> ?	<i>P.(Hemisonneratia) puzozianus</i>			
	<i>Otohoplites larcheri</i>	<i>Otohoplites larcheri</i>	<i>Cleoniceras floridum</i>			
	<i>P.(H.) puzozianus</i>	<i>P.(H.) puzozianus</i>	<i>Sonneratia kitchini</i>			
	<i>C. floridum</i>	<i>C. floridum</i>	<i>Leymeriella regularis</i>			
	<i>L. regularis</i>	<i>L.(N.) regularis</i> + <i>H.millefioides</i>	<i>Hypacanthoplit. millefioides</i>			
			<i>Farnhamia farnhamensis</i>			
no ammonite record			?			
			<i>Desh. deshayesi</i>		U. UAP? / LAL	

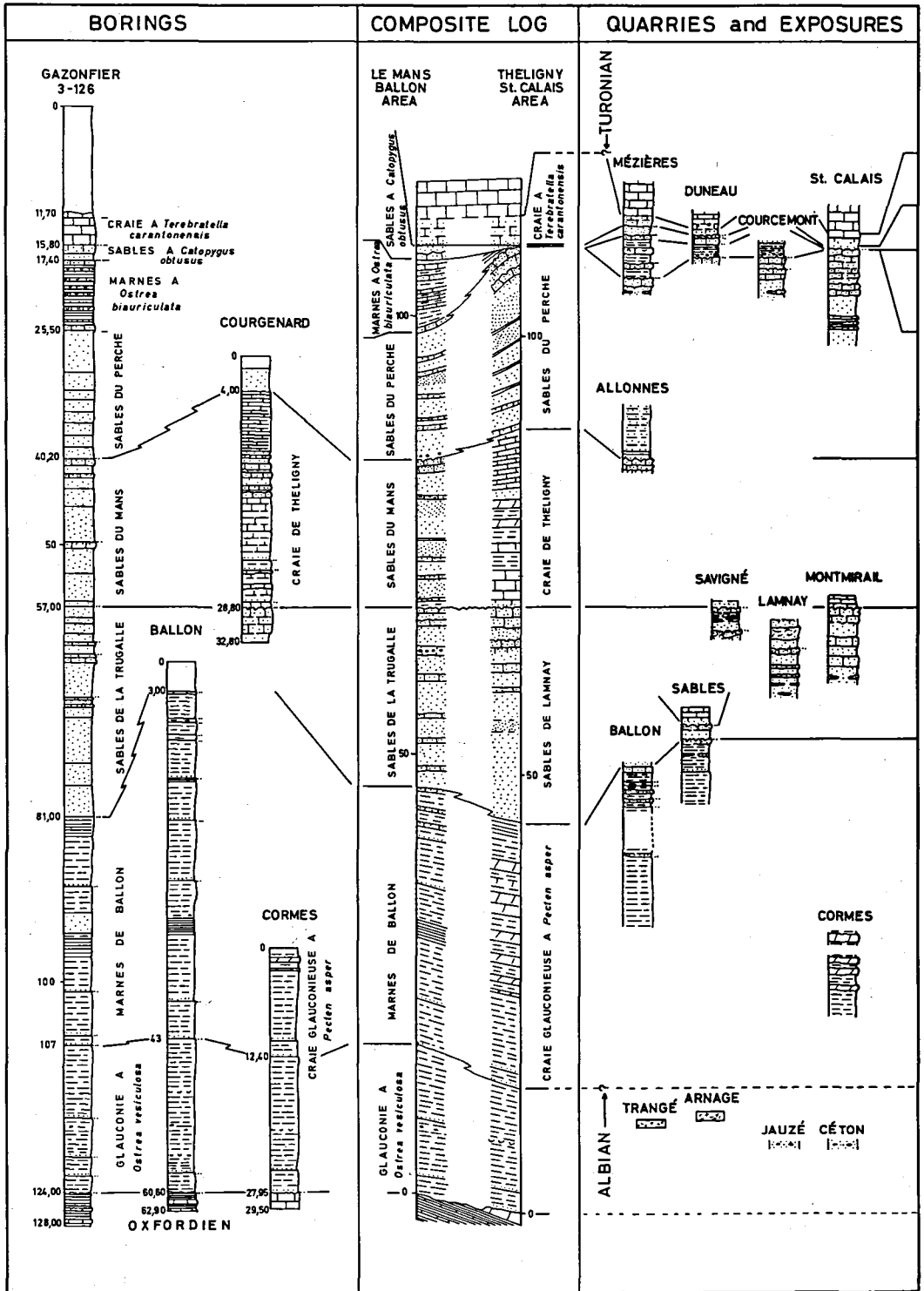


Fig. 2. Lithology and vertical distribution of some ammonites for the type Cenomanian Stage (data from P. Juignet).

SELECTED AMMONITES		AMMONITES ZONES		
		P. JUIGNET <i>Mammifera nodosoides</i>	F. AMEDRO <i>M. nodosoides</i>	LOW. TURO.
		<i>Walinoceras coloradoense</i>	<i>W. colorado.</i>	
		<i>Neocardioceras juddii</i>	<i>N. juddii</i>	UPPER CENOMANIAN
		<i>Meloicoceras gestlinianum</i>	<i>M. gr. gestlinian.</i>	
		<i>Eucalycoceras pentagonum</i>	<i>Calycocer. naviculare</i>	
		<i>Acanthoceras jukesbrowni</i>	<i>Acanth. jukesbrown.</i>	MIDDLE CENOMANIAN
		<i>Turrillites acutus</i>	<i>Acanth. rhotomag.</i>	
		<i>Turrillites costatus</i>		
		<i>Mantelliceras dixonii</i>	<i>Mantell. gr. dixonii</i>	LOWER CENOMANIAN
		<i>Mantelliceras saxbii</i>	<i>Mantell. canlianum</i>	
		<i>Neostlingoceras carcitanensis</i>		
		<i>Stoliczkaia dispar</i>	<i>Pervingu. perinflata</i> <i>Pervingu. fallax</i>	UPPER ALB.
		<i>Mortonicerces inflatum</i>	<i>Pervingu. inflata</i>	OXF.
<i>Mortonicerces inflatum</i> (J. Sowerby) <i>Callihoplites aff. auritus</i> (J. Sowerby) <i>Keramoceras kolbajense</i> (Sokolov) <i>Callihoplites cratus</i> (Seeley)	<i>Acompsoceras renevieri</i> (Sharpe) <i>Turrillites scheuchzerianus</i> Bosc <i>Turrillites costatus</i> Lamarck <i>Euomphaloceras cunningtoni</i> (Sharpe) <i>Sciponoceras baculae</i> (Mantell) <i>Turrillites acutus</i> Passy <i>Calycoceras gentoni</i> (Brongniart) <i>Acanthoceras</i> gr. <i>rhotomagense</i> (Brongniart) <i>Scaphites equalis</i> J. Sowerby <i>Calycoceras newboldi</i> (Kossmat) <i>Acanthoceras jukesbrowni</i> (Spath) <i>Calycoceras emmanense</i> (d'Archiac) <i>Calycoceras naviculare</i> (Mantell) <i>Calycoceras guerangeri</i> (Spath) <i>Pseudocalycoceras</i> gr. <i>harpa</i> (Stoliczka) <i>Thomelites somayi</i> (Thomel) <i>Eucalycoceras pentagonum</i> (Jukes-Browne) <i>Sciponoceras gracile</i> (Shumard) <i>Euomphaloceras septemseriatum</i> (Cragin) <i>Meloicoceras gestlinianum</i> (d'Orbigny) <i>Vascoceras diarlianum</i> (d'Orbigny) <i>Neocardioceras juddii</i> (Barrois et Guerne) <i>Mammifera nodosoides</i> (Schlothelm)	<i>Mantelliceras dixonii</i> <i>Mantelliceras saxbii</i> <i>Neostlingoceras carcitanensis</i> <i>Stoliczkaia dispar</i> <i>Mortonicerces inflatum</i>	<i>Mantell. gr. dixonii</i> <i>Mantell. canlianum</i>	LOW. TURO. UPPER CENOMANIAN MIDDLE CENOMANIAN LOWER CENOMANIAN UPPER ALB. OXF.
<i>Mariella dorsalis</i> (Spath) <i>Idlohamites ellipticus ellipticus</i> (Mantell) <i>Neostlingoceras carcitanensis</i> (Matheron) <i>Sharpeiceras fasciolum</i> (Sharpe) <i>Mantelliceras couloni</i> (d'Orbigny) <i>Mantelliceras saxbii</i> (Sharpe) <i>Mantelliceras tenue</i> Spath <i>Mantelliceras canlianum</i> Spath <i>Mantelliceras mantelli</i> (J. Sowerby) <i>Mantelliceras costatum</i> (Mantell) <i>Hypoturrillites gravestanus</i> (d'Orbigny) <i>Hypophoplites costosa</i> Wright et Wright <i>Mantelliceras dixonii</i> Spath <i>Acompsoceras sarthense</i> (Guéranger)				

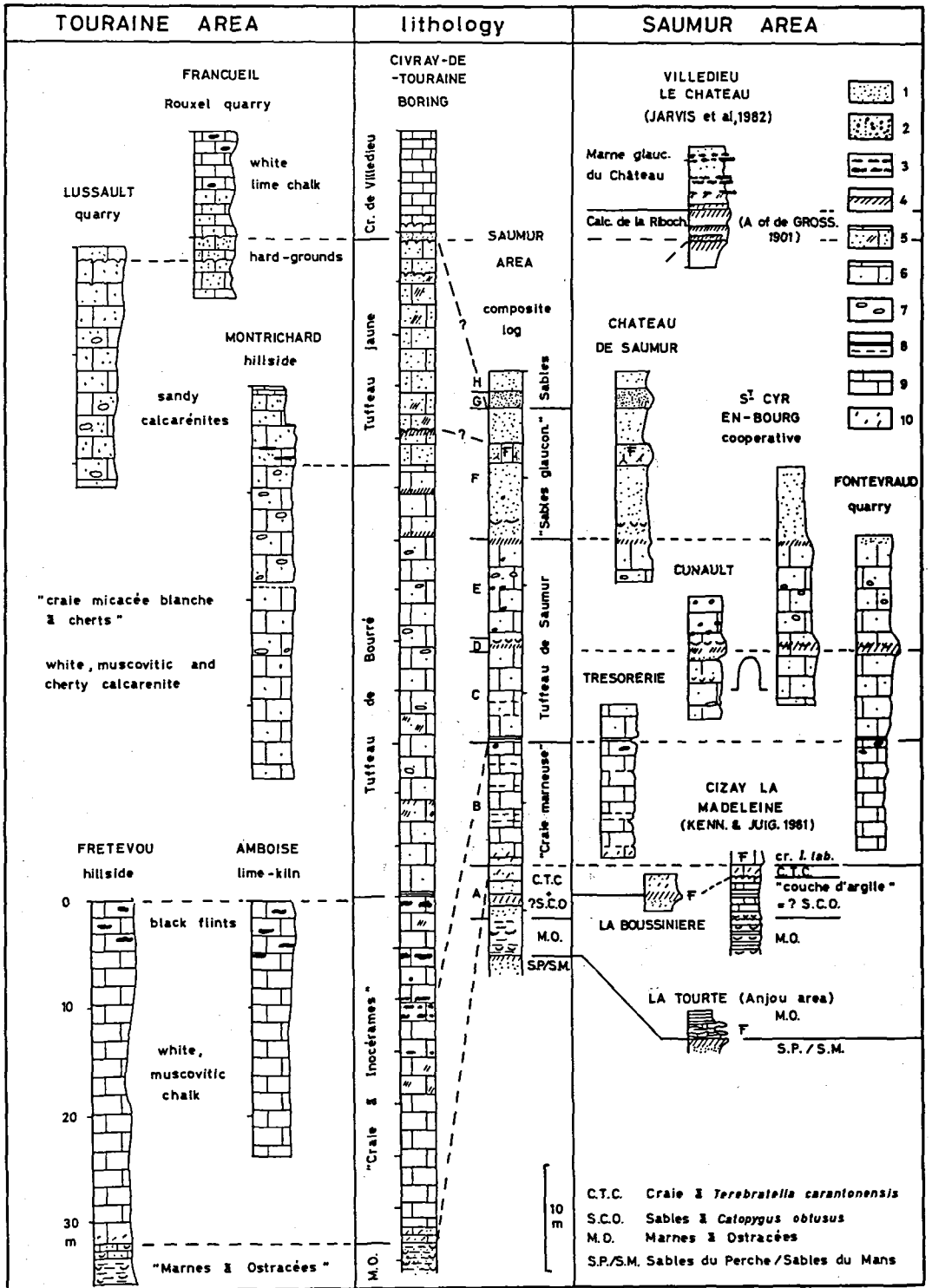


Fig. 3. Lithology and vertical distribution of some ammonites for the type Turonian Stage (data from F. Robaszynski et al. 1982).

AMMONITES		AMMONITES ZONES						
<p><i>Calycocheras bruni</i> (FABRE)</p> <p><i>Pseudocalycocheras mousteriensis</i> THOMEL</p> <p><i>Thomelites sornayi</i> (THOMEL)</p> <p><i>Thomelites perusticum</i> (THOMEL)</p> <p><i>Metoicoceras geslinianum</i> (D'ORBIGNY)</p> <p><i>Euomphaloceras</i> (Kan.) <i>septemseriale</i> (CRAGIN)</p> <p><i>Sciponoceras gracile</i> SHUMARD</p> <p><i>Watinoceras</i> sp.</p> <p><i>Mammites nodosoides</i> (SCHLOTHEIM)</p> <p><i>Lewasiceras perampalum</i> (MANTELL)</p> <p><i>Spathites</i> (Jeannot) <i>reveliereanum</i> (COURTILLER)</p> <p><i>Kamerunoceras turoniense</i> (D'ORBIGNY)</p> <p><i>Neoptychites cephalotus</i> (COURTILLER)</p> <p><i>Collignonoceras woollgari</i> (MANTELL)</p> <p><i>Leconitriceras costatum</i> KENN, WRIGHT, HANCOCK</p> <p><i>Spathites</i> (L.) <i>combei</i> (SORNAY)</p> <p><i>Fagalis rudra</i> (STOLICZKA)</p> <p><i>Neoptychites aciriformis</i> PERVINQUIERE</p> <p><i>Collignonoceras carolinum</i> (D'ORBIGNY)</p> <p><i>Leconitriceras fleuriusianum</i> (D'ORBIGNY)</p> <p><i>Romaniceras interm. kallesi-ornatissimum</i></p> <p><i>Romaniceras</i> (Yub.) <i>ornatissimum</i> (STOLICZKA)</p> <p><i>Romaniceras deverioide armata</i> H. K., WRIGHT</p> <p><i>Pseudotissolia</i> (Ps.) <i>galliennei</i> (D'ORBIGNY)</p> <p><i>Collignonoceras canthus</i> (SORNAY)</p> <p><i>Collignonoceras turoniense</i> (SORNAY)</p>	<p><i>Romaniceras deverianum</i> (D'ORBIGNY)</p> <p><i>Collipoceras requienianum</i> (D'ORBIGNY)</p> <p><i>Subprionocyclus neptuni</i> (GEINITZ)</p> <p><i>Forresteria</i> (Harl.) <i>petrocoriense</i> (COQUAND)</p> <p><i>Peroniceras subtricerinatum</i> (D'ORBIGNY)</p> <p><i>Paratexanites zeileri</i> (de GROSSOUVRE)</p> <p><i>Gauthiericeras margae</i> (SCHLÜTER)</p> <p><i>Tissolia ewaldi</i> (BUCH)</p> <p><i>Proplacenticeras fritschi</i> (de GROSSOUVRE)</p>	<p>(1) <i>Subprionocyclus neptuni</i></p> <p>(2) <i>Subprionocycl. neptuni</i></p>	<p><i>Paratexanites serratomargin.</i></p> <p><i>Gauthiericeras margae</i></p> <p><i>Peroniceras tridorsatum</i></p> <p><i>Forresteria</i> (H.) <i>petrocoriense</i></p>	SANTON				
				<p><i>Romaniceras ornatissimum</i></p>	<p><i>Romaniceras deverianum</i></p>	<p>---</p>	<p>---</p>	CONIAC.
								<p><i>Romaniceras kallesi</i></p>
				<p><i>Mammites nodosoides</i></p>	<p><i>Watinoceras coloradoense</i></p>	<p>---</p>	<p>---</p>	
								<p><i>Neocardioceras juddii</i></p>
				<p><i>Calycocheras naviculare</i></p>	<p>---</p>	<p>---</p>	<p>---</p>	

(1) distribution of ammonites given by F. AMEDRO in ROBASZYNSKI et al (1982)

(*) ammonites cited by KENNEDY, WRIGHT & HANCOCK (1983) and JARVIS, GALE & CLAYTON (1982)

(1) phyletic zones after F. AMEDRO in ROBASZYNSKI et al (1982)

(2) zones after KENNEDY, WRIGHT & HANCOCK (1983)

stages	macrofauna (ammonites, inoceramids)	microfauna calcareous nannoplankton(C.N.) planktonic foraminifera (P.F.)	proposed boundary stratotypes
CONIACIAN	<p>↑ <i>Forresteria(Harleites) petrocoriensis</i></p> <p>↑ <i>Inoceramus walters-dorfensis hannoversis</i></p>	<p>↑ <i>Marthasterites furcatus</i> (C.N.)</p>	<p>Priesener Schichten (Czechoslovakia)</p>
TURONIAN	<p><i>Mytiloides</i></p> <p>↑ <i>Watinoceras coloradoense</i></p> <p>↑ <i>Mammilles nodosoides</i> Z.</p> <p>↑ <i>Wal. coloradoense</i> Z.</p> <p>↑ <i>Inoceramus pictus</i></p> <p>↑ <i>Neocardioceras juddii</i> Z.</p> <p>↑ (unnamed <i>Thomasites</i> Z.)</p> <p>↑ <i>Meloic. gestinianum</i> Z.</p>	<p>↑ <i>Helvetoglobotruncana gr. helvetica</i> (P.F.)</p> <p>↑ <i>Whiteinella archaeocretacea</i> (P.F.)</p>	<p>Texas or New Mexico (U.S.A.)</p>
CENOMANIAN	<p>↑ <i>Neostingoceras schneegansi</i></p> <p>↑ <i>genus Mantelliceras</i></p>	<p>↑ <i>Rotalipora cushmani</i> (P.F.)</p>	<p>Monts du Mellègue (Tunisia)</p>
upp.	<p>↑ <i>Dipoloceras cristatum</i></p>	<p>↑ <i>Eiffelithus turrisseiffeli</i> (C.N.)</p> <p>↑ <i>Planomalina buxtorfi</i> (P.F.)</p> <p>↑ <i>Ticinella breggiensis</i> (P.F.)</p>	<p>Hoplitids: Folkestone (U.K.)</p> <p>Brancoceratids: Texas (U.S.A.)</p>
ALBIAN mid.	<p>↑ <i>Lyelliaceras lyelli</i></p>	<p>↑ <i>Ticinella primula</i> (P.F.)</p>	<p>Aube (France)</p>
low.	<p>↑ <i>Leymeriella(Proleymeriella)schrammeni</i></p>	<p>↑ <i>Prediscosphaera columnata</i> (C.N.)</p>	<p>Vohrun (Germany)</p>
APTIAN		<p>↑ <i>Planomalina chenourensis</i> (P.F.)</p>	

Fig. 4. Mid Cretaceous stage boundaries defined by index fossils as proposed during the Cretaceous Stage Boundaries Symposium in Copenhagen.