Bollettino della Società Paleontologica Italiana	23 (1)	1984	91-102	2 pls.	Modena, Aprile 1985

Halobia zones in the pelagic Late Triassic sequences of the Central Mediterranean area (Greece, Yugoslavia, Southern Apennines, Sicily)

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KEY WORDS — Pelecipoda (Halobia), *Conodonts, Late Triassic, Central Mediterranean area, Bio- and chronostratigraphy.*

ABSTRACT — The study of forty three Late Triassic sections in pelagic facies measured in the Central Mediterranean area (Pindos basin, Greece; Budva-Kotor basin, Yugoslavia; Lagonegro basin, Southern Apennines; Imerese and Sicano basins, Sicily) allows the definition of nine Halobia *range zones.*

They are, from bottom to top: Halobia lenticularis *zone* (*Tuvalian 2 ? - 3*); H. styriaca *zone* (*Lacian 1*); H. mediterranea *zone* (*Lacian 2 - Alaunian 1*); H. mojsisovicsi *zone* (*Alaunian 1*); H. rajkae *zone* (*Alaunian 1*); H. darwini *zone* (*Alaunian 1*); H. halorica *zone* (*upper part of Alaunian 2*); H. norica *zone* (*upper part of Alaunian 2*); H. distincta *zone* (*top of Alaunian 2*).

Their chronostratigraphy has been determined, when possible, by the associated conodonts.

RIASSUNTO — [Zone ad *Halobia* nelle successioni pelagiche del Trias superiore dell'area centro-mediterranea (Grecia, Iugoslavia, Appennino meridionale, Sicilia)] — *Sulla base dei dati stratigrafici ottenuti dallo studio di 43 sezioni ubicate nell'area centro-mediterranea (bacino del Pindos, Grecia; bacino di Budva-Kotor, Iugoslavia; bacino di Lagonegro, Appennino meridionale; bacini Imerese e Sicano, Sicilia) (fig. 1) vengono istituite nel Trias superiore pelagico nove zone ad* Halobia *(fig. 3), che sono, dal basso verso l'alto: zona ad* Halobia lenticularis (*Tuvalico 2 ? - 3*); *zona ad* H. styriaca (*Lacico 1*); *zona ad* H. mediterranea (*Lacico 2 - Alaunico 1*); *zona ad* H. mojsisovicsi (*Alaunico 1*); *zona ad* H. rajkae (*Alaunico 1*); *zona ad* H. darwini (*Alaunico 1*); *zona ad* H. halorica (*Alaunico 2, parte alta*); *zona ad* H. norica (*Alaunico 2, parte alta*); *zona ad* H. distincta (*parte terminale dell'Alaunico 2*).

Le zone ad H. lenticularis, *ad* H. styriaca, *ad* H. mediterranea, *ad* H. halorica *e ad* H. norica *sono state parzialmente o totalmente riconosciute in tutti o quasi tutti i bacini studiati; le altre zone sono state invece individuate solo nella sezione di M. Cammarata (Sicani, Sicilia). Quando possibile, la cronostratigrafia delle zone è stata definita in base ai conodonti presenti in associazione.*

Vengono inoltre illustrate le Halobie riconosciute nelle successioni del Pindos, Grecia (tavv. 1, 2).

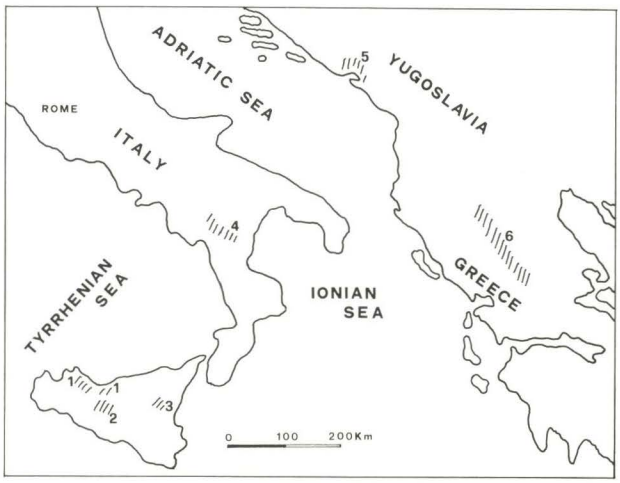
Colonne stratigrafiche generalizzate relative ai quattro bacini studiati sono illustrate in fig. 2. I dati stratigrafici relativi ai bacini di Lagonegro, di Budva-Kotor, Imerese e Sicano sono contenuti in de Capoa Bonardi, 1970; Cafiero & de Capoa Bonardi, 1980 a, b, 1982.

INTRODUCTION

The Late Triassic « Alpine » deposits are mainly represented by shallow water carbonates and evaporites, interfingering with deeper-water pelagic limestones, commonly known as *Halobia* limestones. The latter contain pelagic pelecypods (*Halobia, Posidonia*), more rarely ammonites, and scarce conodonts.

The *Halobia* limestones consist of pelagic limestones with chert and calcareous turbidites, with interbedded rare mafic lavas and hyaloclastites, or of nodular limestones like Ammonitico Rosso (Hallstat beds in the Eastern Alps); they outcrop in narrow belts, presently more or less disconnected, from Greece to Sicily (Pindos basin in Greece; Budva-Kotor basin in Yugoslavia; Lagonegro basin in the Southern Apennines; Imerese and Sicano basins in Sicily) (Scandone, 1975).

The *Halobia* limestones have been considered both as markers of an oceanic Palaeo-Tethys (Wezel, 1970; Dewey *et al.*, 1973) and as markers of « seaways », founded on continental crust and branching out from



Text-fig. 1 - Main outcrops of the *Halobia* limestones in the Central Mediterranean area. 1) Imerese basin; 2) Sicano basin; 3) unified Imerese-Sicano basin; 4) Lagonegro basin; 5) Budva-Kotor basin; 6) Pindos basin.

an eastern oceanic Palaeo-Tethys (Bernoulli and Jenkins, 1974; Scandone, 1975; Laubscher and Bernoulli, 1977).

During the last fifteen years the biostratigraphic study of the *Halobia* limestones of the Central Mediterranean area (text-fig. 1) has been carried out (Scandone and de Capoa, 1966; de Capoa Bonardi, 1970, 1983; Cafiero and de Capoa Bonardi, 1980 a, b, 1982). Forty three sections, the richest in fossils of which are the sicilian ones, particularly the Cammarata Mt. section, have been studied. The results of these studies are reported in this paper.

BIOSTRATIGRAPHY OF THE CENTRAL MEDITERRANEAN *HALOBIA* LIMESTONES

1 - Sections of Pindos, Greece (Pindos basin)

A generalized stratigraphic column of the Upper Triassic Pindos sequences is shown in text-fig. 2.

The studied samples have been collected by P. Scandone.

Specimens could be identified at species level only in three sections out of the five measured by P. Scandone (unpublished data, personal communication). They are the Moscophyton section, from which come *Halobia halorica* Mojsisovics and *H. norica* Mojsisovics; the Kriakura section, that fournished *H. austriaca* Mojsisovics (pl. 2, figs. 1-4), *H. radiata radiata* Gemmellaro (pl. 1, figs. 2-4), *H. halorica, Monotis salinaria* Bronn (pl. 2, fig. 9), (*M. salinaria* seems to be restricted to the lower part of the Upper Norian or Sevatian, according to Krystyn, 1973, 1974, and to Tozer, 1979); the Kalarrhytis section, that provided *H. austriaca.*

Moreover I had the possibility to examine Triassic samples, sent me by Proff. Bonneau, Dercourt, Davidson and Tsoflias from Crete, Tilos and Karpathos (Southern Dodecanese). In the samples from Crete *Halobia beyrichi* (Mojsisovics) (pl. 1, fig. 5), *H. styriaca* (Mojsisovics), *H. superba* Mojsisovics, *H. charlyana* Mojsisovics (pl. 1, fig. 6), *H. austriaca, H. halorica, H. norica* could be identified.

A sample lithologically and paleontologically identical to the Porphyrit-Hornstein Formation, bearing *Daonella indica* Bittner (p. 1, fig. 1) and fragments of *Daonella pichleri* Mojsisovics also comes from Crete. *H. styriaca, H. superba, H. austriaca* have been recognized in the Tilos Island, and *H. styriaca* in Karpathos.

Renz (1955) quotes in the « Olonos-Pindos Schichten » *Halobia lenticularis, H. radiata, H. insignis* (synonym of *H. halorica* according to de Capoa Bonardi, 1970), *H. styriaca, H. superba,* besides several dubious species.

2 - Sections of Crna-Gora, Yugoslavia (Budva-Kotor basin)

A generalized stratigraphic column of the Upper Triassic yugoslavian successions is shown in text-fig. 2. Detailed stratigraphic columns and lithostratigraphic descriptions of the Budva-Kotor area successions are published in Cafiero and de Capoa Bonardi, 1980 a, b, to which reference is made.

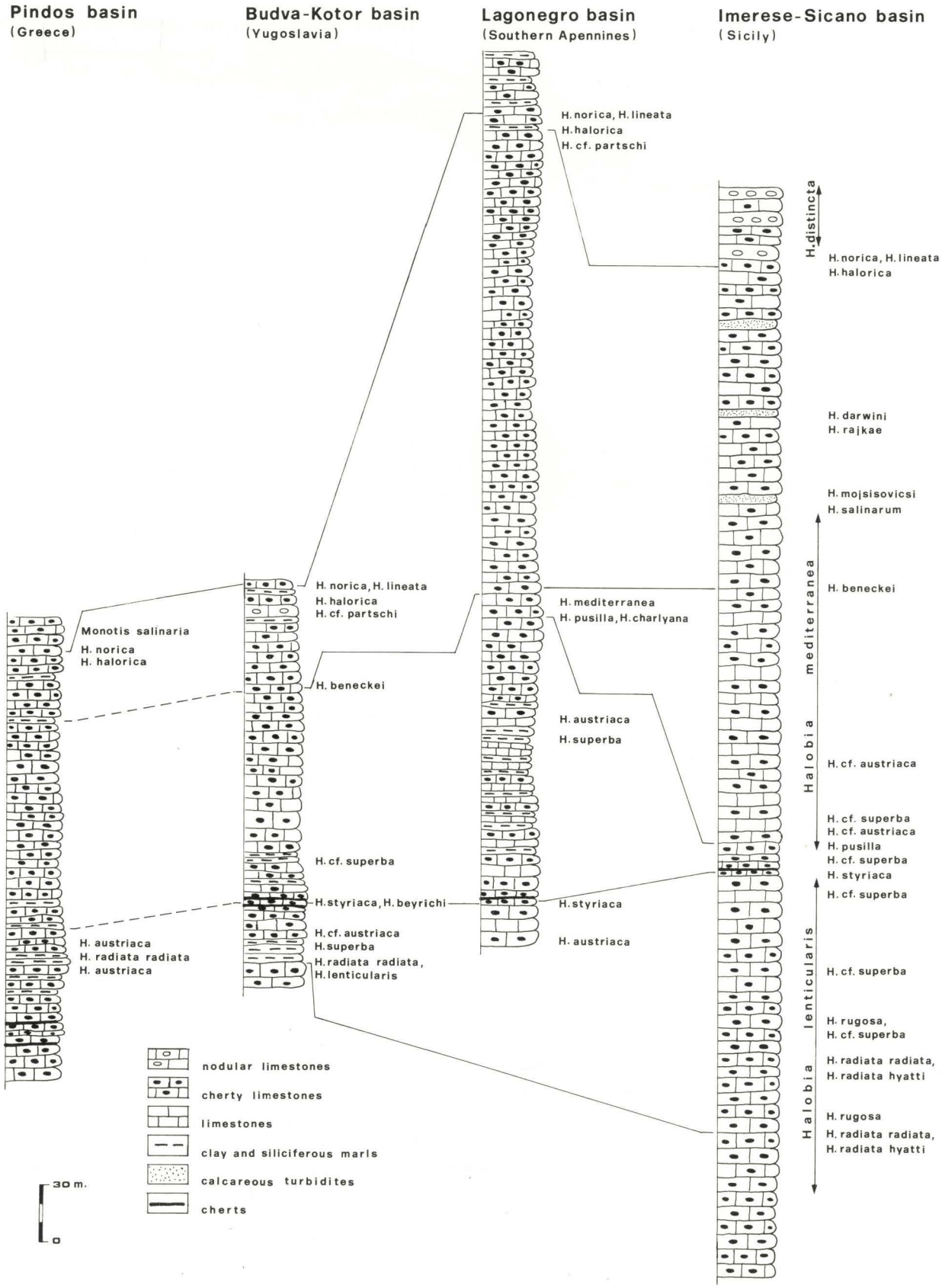
3 - Sections of Lucania, Southern Apennines (Lagonegro basin)

A generalized stratigraphic column of the Upper Triassic lucanian successions is shown in text-fig. 2. Detailed stratigraphic columns and lithostratigraphic descriptions of the lucanian successions are published in de Capoa Bonardi, 1970.

4 - Sections of NW and E Sicily (Imerese and Sicano basins)

A generalized stratigraphic column of the Upper Triassic sicilian successions is shown in text-fig. 2. Detailed stratigraphic columns and lithostratigraphic

Text-fig. 2 - Generalized statigraphic Late Triassic columns of Pindos, Budva-Kotor, Lagonegro and Imerese and Sicano basins, and their correlations. Thickness and lithologies are referred to the axial zones of each basin.


Pindos basin
(Greece)
Budva-Kotor basin
(Yugoslavia)
Lagonegro basin
(Southern Apennines)
Imerese-Sicano basin
(Sicily)
Monotis salinaria
H. norica
H. halorica
H. austriaca
H. radiata radiata
H. austriaca
H. norica, H. lineata
H. halorica
H. cf. partschi
H. beneckei
H. cf. superba
H. styriaca, H. beyrichi
H. cf. austriaca
H. superba
H. radiata radiata,
H. lenticularis
H. norica, H. lineata
H. halorica
H. cf. partschi
H. mediterranea
H. pusilla, H. charlyana
H. austriaca
H. superba
H. styriaca
H. austriaca
H. distincta
H. norica, H. lineata
H. halorica
H. darwini
H. rajkae
H. mojsisovicsi
H. salinarum
H. beneckei
H. cf. austriaca
H. cf. superba
H. cf. austriaca
H. pusilla
H. cf. superba
H. styriaca
H. cf. superba
H. cf. superba
H. rugosa,
H. cf. superba
H. radiata radiata,
H. radiata hyatti
H. rugosa
H. radiata radiata,
H. radiata hyatti
Halobia mediterranea
Halobia lenticularis
nodular limestones
cherty limestones
limestones
clay and siliciferous marls
calcareous turbidites
cherts
30 m.
0

descriptions of the sicilian sequences are published in Cafiero and de Capoa Bonardi, 1982.

LATE TRIASSIC *HALOBIA* ZONES

On the basis of the biostratigraphic study of the Late Triassic pelagic central-mediterranean sequences, the definition of *Halobia* zones can be attempted. The chronostratigraphy of the nine recognized zones is based on the *Halobia* species, on conodonts, and on the very rare ammonites associated.

These *Halobia* zones are characterized as total range zones with respect to the Central Mediterranean area. Some of them, recognized only in the Cammarata Mt. section, are to be considered as tentative zones.

The stratigraphic distribution of the Late Triassic conodonts is discussed in Cafiero and de Capoa Bonardi, 1980 b.

The bio-zones (text-fig. 3) are characterized as follows:

1 - *Halobia lenticularis* zone (range zone)

Definition — The zone is characterized by the association of *Halobia lenticularis* (Gemmellaro) with *H. rugosa* Gümbel, *H. radiata radiata* Gemmellaro, *H. radiata hyatti* Kittl. *Halobia* cf. *superba* Mojsisovics and *H.* cf. *austriaca* Mojsisovics, together with *Hoplotropites* sp. and the conodonts *Gondolella polygnathiformis* Budurov and Stefanov, *Epigondolella nodosa* (Hayashi) *sensu* Krystyn, 1973, *E. parva* (Kozur), *E. permica* (Hayashi) *sensu* Krystyn, 1973, are also found.

The base and the top of the zone are defined by the first and the last occurrence of *H. lenticularis,* respectively.

Discussion — The presence of *Hoplotropites* sp. and of the previously quoted conodonts allows to assign the *H. lenticularis* zone to the uppermost Carnian (Tuvalian 3). The base of the zone might fall in the Tuvalian 2. I found *H. radiata radiata* and *H. radiata hyatti* only in the lower part of the zone, and *H. rugosa* in the lower-middle part. However at least *H. rugosa* has a larger stratigraphic extent (Julian 2 - Lacian 1 according to Gruber, 1976).

Halobia austriaca is surely present in the *H. lenticularis* zone, although I found only a fragmentary specimen, which can doubtely be attributed to *H. austriaca,* in the Cammarata Mt. succession. In fact I found *H. austriaca* (pl. 2 figs. 1-4) at bottom and top of the strata bearing *H. radiata radiata* (pl. 1 figs. 2-4) in the Kriakura succession (Pindos basin).

Geographic distribution — The *H. lenticularis* zone has been entirely recognized only in the Cammarata Mt. succession; in the Triona Mt. (Sicano basin) succession, where the zone is well represented, *H. lenticularis* extends perhaps lower than Visscher and Krystyn, 1978, fig. 3, and De Wever *et al.,* 1979, fig. 5, indicate.

I found some of the species typical of this zone (*H. lenticularis, H. radiata radiata*) also in other sicilian (Capo Grosso, Imerese basin; Judica Mt., unified Imerese-Sicano basin), yugoslavian (Bijela, Banic-Obalica, Budva-Kotor basin) and greek (Kriakura, Pindos basin) successions. In the Judica Mt. sequence *H. rugosa* is also present.

Stratigraphic extent — The *H. lenticularis* zone extends throughout the uppermost Carnian (Tuvalian 3); its base is perhaps in the upper part of Tuvalian 2.

2 - *Halobia styriaca* zone (range zone)

Definition — The zone is characterized by the presence of *Halobia styriaca* (Mojsisovics), sometimes associated with *Halobia beyrichi* (Mojsisovics). The conodonts *Epigondolella abneptis* (Huckriede) *sensu* Krystyn, 1973 and *E. nodosa* are also present.

The base and the top of *H. styriaca* zone are defined by the first and the last occurrence of *H. styriaca,* respectively.

Discussion — The Hallstatt *H. styriaca* has been attributed by Krystyn, 1973, to the Lower Norian (*Mojsisovicsites kerri* zone, Lacian 1) on the basis of the associated ammonites. *Epigondolella abneptis, E. nodosa* and *E. permica* are the conodonts quoted by Krystyn in the *M. kerri* zone.

The strata bearing *H. styriaca* do not contain, in all the studied sections, either ammonites or significant conodonts. In the Rebro (Yugoslavia) and Cammarata

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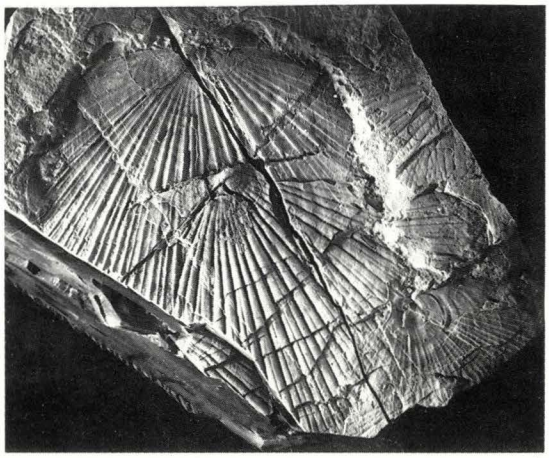
EXPLANATION OF PLATE 1

Fig. 1 - *Daonella indica* Bittner. Specimens of Prof. Dercourt. Crete Island (Greece).
Figs. 2-4 - *Halobia radiata radiata* Gemmellaro. Kriakura section (Pindos, Greece).
Fig. 5 - *Halobia beyrichi* (Mojsisovics). Specimen of Prof. Bonneau. Ziros, Crete Island (Greece).
Fig. 6 - *Halobia charlyana* Mojsisovics. Specimen of Prof. Dercourt. Crete Island (Greece).
Fig. 7 - *Halobia styriaca* (Mojsisovics). Specimens of Prof. Marcoux. Lower Antalya nappe, Turkey.
All specimens x 1.



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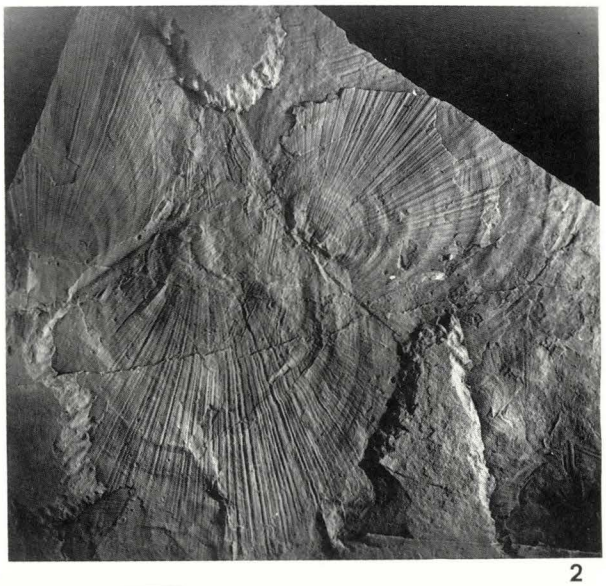

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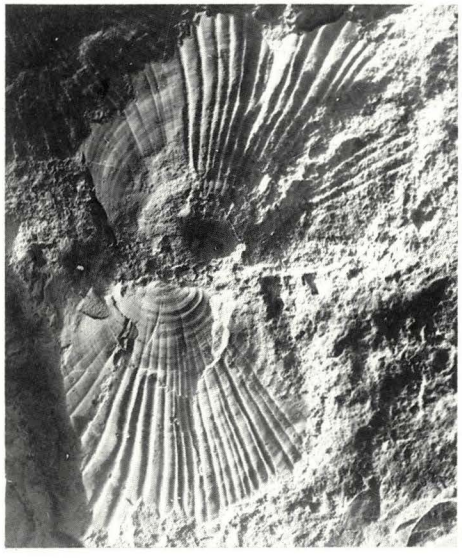

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STAGES	SUBSTAGES	HALOBIA ZONES	ASSOCIATED HALOBIA SPECIES	ASSOCIATED CONODONTS
NORIAN	ALAUNIAN 2	H. distincta		E. abneptis, E. bidentata, E. postera
		H. norica	H. lineata	E. abneptis, E. permica, E. postera, E. bidentata, G. navicula steinbergensis
		H. halorica		E. abneptis, E. permica, E. postera, E. bidentata, E. multidentata
	ALAUNIAN 1	H. darwini		E. permica, E. postera
		H. rajkae		E. abneptis
		H. mojsisovicsi		
	LACIAN 3	H. mediterranea	H. salinarum	
	LACIAN 2		H. beneckei	G. navicula navicula, E. abneptis, P. sweeti sweeti G. navicula navicula, E. abneptis, E. permica
			H. pusilla, H. charlyana	
	LACIAN 1	H. styriaca	H. beyrichi	E. abneptis, E. nodosa
CARNIAN	TUVALIAN 3	H. lenticularis	H. rugosa	G. polygnathiformis, E. nodosa, E. parva, E. permica
			H. radiata radiata, H. r. hyatti, H. rugosa	

Text-fig. 3 - Stratigraphic extent of the recognized *Halobia* zones.

(Sicily) sections *Epigondolella abneptis* (Huckriede) *sensu* Krystyn, 1973, is present. The presence of *Hoplotropites* sp. (det. Krystyn, Tuvalian 3) at Cammarata Mt., some 30 m below *H. styriaca,* suggests that the age of the latter species should be Early Norian also in Sicily, and probably in the whole Central Mediterranean area.

Both Visscher and Krystyn, 1978, and De Wever *et al.*, 1979, in their generalized stratigraphic columns of Triona Mt. and of Triona - Cammarata Mts. respectively, place a *H. austriaca* level a few m below *H. styriaca.* I did not find specimens surely attributable to *H. austriaca* in the sicilian successions; in Lucania (Sorgente Acero section, Lagonegro basin, Southern Apennines) however the latter species is present both below and above the strata bearing *H. styriaca. H. austriaca* seems therefore to extend stratigraphically throughout the Tuvalian 3 (upper part) and the Lacian 1 together with *H. superba* (which however seems to appear sooner), reaching the lower part of the *H. mediterranea* zone.

Geographic distribution — The *H. styriaca* zone has been recognized in Sicily (Cammarata Mt. and Triona Mt., Sicano basin; Scalpello Mt., unified Imerese-Sicano basin), in Lucania (I Cozzi, Sorgente Acero, Picco dell'Armizzone sections, Lagonegro basin), in Jugoslavia (Lastva, Bijela, Rebro sections, Budva-Kotor basin). Although I found *H. styriaca* only in the Tilos and Karpathos Islands of Greece (see p. 2), this species is also present in the Pindos Mts., according to Renz, 1955. In Turkey (Lower Antalya nappe) a Lower Norian (Lacian 1) *H. styriaca* (pl. 1, fig. 7) has been reported (Marcoux, 1976 and personal communication; see also Allasinaz *et al.,* 1974; Poisson, 1977).

Stratigraphic extent — Lower Norian (Lacian 1).

3 - *Halobia mediterranea* zone (range zone)

Definition — The zone is characterized by the association of *Halobia mediterranea* Gemmellaro with *H.*

charlyana Mojsisovics, *H. pusilla* Cafiero and de Capoa Bonardi, *H. austriaca* Mojsisovics, *H. superba* Mojsisovics, *H. beneckei* Gemmellaro, *H. salinarum* Bronn. *Halobia* cf. *superba* and *H.* cf. *austriaca* are also present. In the strata bearing *H. beneckei* of the Bijela section (Budva-Kotor basin, Yugoslavia) the conodonts *Gondolella navicula navicula* (Huckriede), *Epigondolella abneptis* (Huckriede) *sensu* Krystyn, 1973 and *Prioniodina sweeti sweeti* Kozur and Mock are present.

The base and the top of the zone are defined by the first and the last occurrence of *H. mediterranea,* respectively.

Of the associated species, *H. charlyana* and *H. pusilla* seem to be characteristically restricted to the lower part of the *H. mediterranea* zone, *H. beneckei* to the middle and *H. salinarum* to the upper part.

Discussion — Only the Bijela section (Budva-Kotor basin) provided conodonts from the *H. mediterranea* zone. The strata of the Bijela sequence bearing *H. beneckei* contain in fact the previously quoted conodont. Moreover, from the strata just below *H. beneckei* come *Gondolella navicula navicula, Epigondolella abneptis, E. permica* (Hayashi) *sensu* Krystyn, 1973. This conodont association cover the stratigraphic interval Lacian 1 - Alaunian 2. However, since the subsequent *H. halorica* zone can be attributed to the Alaunian 2 on the basis of the associated conodonts, the *H. mediterranea* zone is tentatively assigned to the stratigraphic interval Lacian 2 - Alaunian 1.

Geographic distribution — The entire assemblages of the *H. mediterranea* zone has been recognized only in the Cammarata Mt. succession. In other sections I found *H. mediterranea* (Triona Mt., Sicano basin, together with *H. beneckei*; Judica Mt., Scalpello Mt., unified Imerese-Sicano basin; Lama Mt., Nicola Mt., Lagonegro basin, together with *H. charlyana* and *H. pusilla*), or *H. beneckei* (Bijela, Budva-Kotor basin). *H. salinarum* has been found in the Triona Mt. section only.

Stratigraphic extent — Lower-Middle Norian (Lacian 2 - Alaunian 1).

4 - *Halobia mojsisovicsi* zone (range zone)

Definition — The zone is characterized by the presence of *Halobia mojsisovicsi* Gemmellaro. Its base and top are defined by the first and the last occurrence of *H. mojsisovicsi,* respectively.

Discussion — No conodonts have been found in the *H. mojsisovicsi* zone. The latter is only tentatively assigned to the Alaunian 1, being stratigraphically below the *H. halorica* zone, which can be attributed to the Alaunian 2 on the basis of the associated conodonts.

Geographic distribution — The *H. mojsisovicsi* zone has been recognized until now only in the Cammarata Mt. and Triona Mt. successions (Sicano basin, NW Sicily).

Stratigraphic extent — Middle Norian (Alaunian 1).

5 - *Halobia rajkae* zone (range zone)

Definition — The zone is characterized by the presence of *Halobia rajkae* Cafiero and de Capoa Bonardi. Its base and top are defined by the first and the last occurrence of *H. rajkae,* respectively. *Epigondolella abneptis* (Huckriede) *sensu* Krystyn, 1973 is also present.

Discussion — Significant conodonts are lacking in the *H. rajkae* zone. The associated *E. abneptis* covers the stratigraphic interval Tuvalian 2 - Rhaetian. Therefore the zone is only tentatively assigned to the Alaunian 1, being stratigraphically below the *H. halorica* zone, which can be attributed to the Alaunian 2 on the basis of the associated conodonts.

Geographic distribution — The *H. rajkae* zone has been until now recognized in the Cammarata Mt. succession only.

Stratigraphic extent — Middle Norian (Alaunian 1).

6 - *Halobia darwini* zone (range zone)

Definition — The zone is characterized by the presence of *Halobia darwini* Cafiero and de Capoa Bonardi. The conodonts *Epigondolella permica* (Hayashi) *sensu* Krystyn, 1973 and *E. postera* (Kozur and Mostler) *sensu* Krystyn, 1973 are also present.

The base and the top of the zone are defined by the first and the last occurrence of *H. darwini,* respectively.

Discussion — The conodonts *Epigondolella permica* and *E. postera,* which have been recognized in the *H. darwini* zone, cover the stratigraphic interval Lacian 3 - Alaunian 2. Therefore the *H. darwini* zone is only tentatively assigned to the Alaunian 1, being stratigraphically below the *H. halorica* zone, which can be attributed to the Alaunian 2 on the basis of the associated conodonts.

Geographic distribution — The *H. darwini* zone is known until now in the Cammarata Mt. succession only.

Stratigraphic extent — Middle Norian (Alaunian 1).

7 - *Halobia halorica* zone (range zone)

Definition — The zone is characterized by the presence of *Halobia halorica* Mojsisovics. In the Cammarata Mt. succession the strata bearing *H. halorica* contain also the conodonts *Epigondolella abneptis* (Huckriede) *sensu* Krystyn, 1973, *E. permica* (Hayashi) *sensu* Krystyn, 1973 and *E. postera* (Kozur and Mostler) *sensu* Krystyn, 1973. In some yugoslavian successions (Bijela, Lacica) *Epigondolella bidentata* Mosher and *E. multidentata* Mosher are also present.

The base and the top of the zone are defined by the first and the last occurrence of *H. halorica,* respectively.

Discussion — The presence in the *H. halorica* zone of the conodonts *Epigondolella abneptis, E. permica, E. postera, E. multidentata* allows to assign the zone to the Alaunian 2. The occurrence of *Epigondolella bidentata* limits this attribution to the upper part of the Alaunian 2.

Geographic distribution — The zone has been recognized in the Sicano basin, NW Sicily (Triona Mt., Cammarata Mt.); in the Lagonegro basin, Lucania, Southern Apennines (Sirino Mt., Lama Mt., Burrone Carraruncedde, Castagnereto Mt., Gianni Griecu Mt., Sasso di Castalda); in the Budva-Kotor basin, Crna-Gora, Yugoslavia (Bijela, Lacica); in the Pindos basin (Kriakura, Moscophyton).

Stratigraphic extent — Middle Norian (upper part of the Alaunian 2).

8 - *Halobia norica* zone (range zone)

Definition — The zone is characterized by the presence of *Halobia norica* Mojsisovics, frequently associated with *Halobia lineata* (Münster). In the Cammarata Mt. (Sicily) and Lacica (Yugoslavia) successions the conodonts *Epigondolella abneptis* (Huckriede) *sensu* Krystyn, 1973, *E. permica* (Hayashi) *sensu* Krystyn, 1973 and *E. postera* (Kozur and Mostler) *sensu* Krystyn, 1973 are present; in the Bijela succession (Yugoslavia) *Gondolella navicula steinbergensis* (Mosher) and *Epigondolella bidentata* Mosher have been found.

The base and the top of the zone are defined by the first ant the last occurrence of *H. norica,* respectively.

Discussion — Together with *H. norica* and *H. lineata* the conodonts *Gondolella navicula steinbergensis, Epigondolella abneptis, E. permica, E. postera, E. bidentata* have been found. This conodont association allows to assign the *H. norica* zone to the upper part of the Alaunian 2.

Geographic distribution — The *H. norica* zone has been recognized in the Sicano basin, NW Sicily (Triona Mt., Cammarata Mt.) and in the unified Imerese-Sicano basin, E Sicily (Scalpello Mt.); in the Lagonegro basin, Lucania, Southern Apennines (Sirino Mt., Lama Mt., Castagnereto Mt., Vulturino Mt., Burrone Carraruncedde, Sasso di Castalda, Serra di Calvello); in the Budva-Kotor basin, Crna-Gora, Yugoslavia (Bijela, Rebro, Lacica); in the Pindos basin (Moscophyton).

Stratigraphic extent — Middle Norian (upper part of the Alaunian 2).

9 - *Halobia distincta* zone (range zone)

Definition — The zone is characterized by the presence of *Halobia distincta* Mojsisovics. The conodonts *Epigondolella abneptis* (Huckriede) *sensu* Krystyn, 1973, *E. bidentata* Mosher and *E. postera* (Kozur and Mostler) *sensu* Krystyn, 1973 are also present.

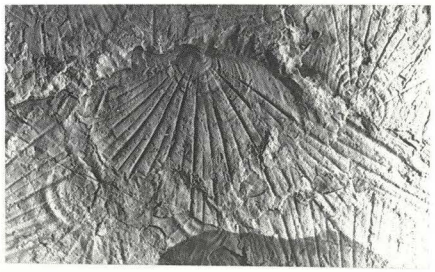
The base and the top of the zone are defined by the first and the last occurrence of *H. distincta,* respectively.

Discussion — The *H. distincta* zone is assigned to the uppermost Alaunian 2 on the basis of the associated conodonts (*Epigondolella abneptis, E. postera, E.*

EXPLANATION OF PLATE 2

Figs. 1-4 - *Halobia austriaca* Mojsisovics. Kriakura section, Pindos (Greece).
Figs. 5-7 - *Halobia austriaca* Mojosisovics. Specimens of Prof. Dercourt. Crete Island (Greece).
Fig. 8 - *Halobia austriaca* Mojosisovics. Specimen of Prof. Tsoflias. Tilos Island (Greece).
Fig. 9 - *Monotis salinaria* Bronn. Kriakura section. Pindos (Greece).
All specimens x 1.

1



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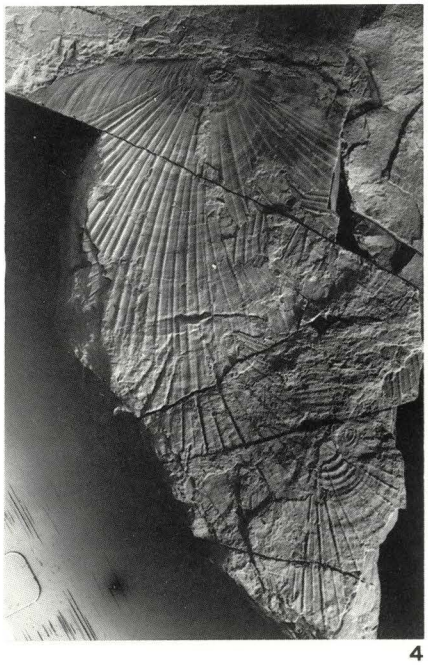

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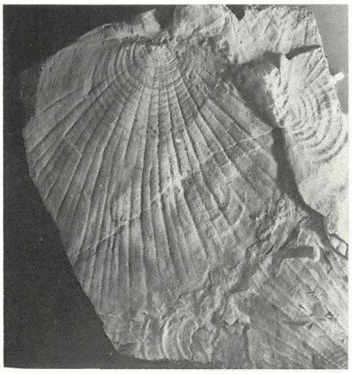

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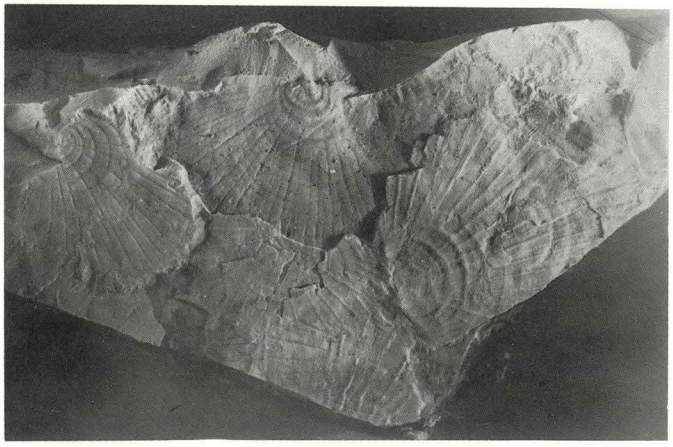

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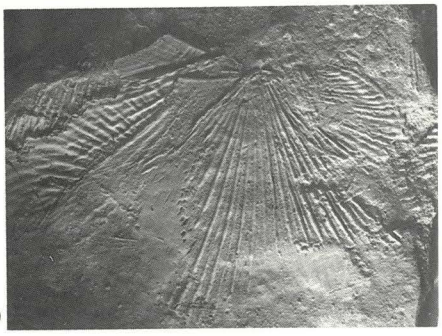

9

bidentata) and of its stratigraphic position, above the *H. norica* zone (upper part of the Alaunian 2).

Geographic distribution — The *H. distincta* zone is known until now in the Cammarata Mt. succession only.

Stratigraphic extent — Middle Norian (top of the Alaunian 2).

CONCLUSIVE REMARKS

Condensation and fissure filling phenomena discovered in the Hallstatt limestones (Wendt, 1970; Krystyn *et al.*, 1971) reproposed the problem of the pelagic Triassic stratigraphy, founded on Mojsisovics's studies (1874, 1893, 1902) of the pelagic macrofaunas of the Hallstatt limestones. Consequently, the stratigraphic distribution of the Triassic cephalopods and Halobiids has been deeply revised in the last fifteen years.

Important contributions to the revision of the Triassic cephalopods and Halobiid stratigraphy are the works of Assereto (1969, 1971, 1974), Gruber (1975, 1976, 1978), Krystyn (1970, 1973, 1974, 1978) Silberling and Tozer (1968) and Tozer (1967, 1971, 1978, 1979).

The biostratigraphic studies of the pelagic sequences of the Central Mediterranean area are a contribution to a better knowledge of the Late Triassic bio- and chronostratigraphy. Unfortunately, the ammonites are almost totally lacking in the successions investigated; their absence represents a serious limit to a stratigraphic study of Triassic pelagic successions. On the contrary, the conodonts, although scarce and not always present, provided an important stratigraphic control.

The nine recognized *Halobia* zones are chronostratigraphically defined by means of the associated conodonts. However in some of them, that is in the *H. mediterranea* zone and in the younger *H. mojsisovicsi, H. rajkae* and *H. darwini* zones, I did not find any stratigraphically significant conodonts, so that they are only tentatively assigned to substages. Moreover I cannot exclude that some of the associated *Halobia* species may cover a stratigraphic interval larger than that assumed in the present paper.

Further studies will undoubtely detail, and eventually correct, the present first attempt to distinguish *Halobia* zones in the pelagic Late Triassic of the Central Mediterranean area.

ACKNOWLEDGMENTS

My thanks are due to the colleagues and friends Giovanni Arnone, Bruna Cafiero, Vincenzo Liguori, Rajka Radoičić and Paolo Scandone for the many days of commun work on the field. I am particularly indebted to Paolo Scandone, whose geological reconstruction was an essential support to this work.

I wish to thank Professors Maria Bianca Cita, Earth Sciences Department, Milan University, Maurizio Gaetani, Earth Sciences Department, Milan University, and Maria Moncharmont Zei, Institute of Paleontology, University of Naples, for the critical review of the paper.

I am also grateful to Mr. Bruno Pastore, Institute of Paleontology, Naples University, for his technical assistance.

This work is supported by M.P.I., 1982.

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(manuscript received October 28, 1983
accepted December 22, 1983)

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