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Decision on the Eocene–Oligocene boundary stratotype

The Global Stratotype Section and Point for the Eocene–Oligocene boundary has been agreed upon. The new boundary is defined in the Massignano section near Ancona, Italy

Introduction

The first coordinated, worldwide study of the Eocene–Oligocene boundary was undertaken by the International Geological Correlation Programme's (IGCP) Project 174 (1980–1985), led by Charles Pomeroy and Isabella Premoli Silva. At the final meeting of IGCP Project 174 in Paris in 1985, the project's participants decided to publish a volume of the papers presented at the meeting (Pomeroy and Premoli Silva, 1986). Following this initial work, the Subcommittee on Paleogene Stratigraphy continued the search for a suitable boundary stratotype. This involved (1) a worldwide postal survey followed by (2) the establishment of the international Working

Group on the Eocene–Oligocene Boundary and (3) close collaboration with both IGCP Project 196 (Calibration of the Phanerozoic Time Scale) and the Subcommittee on Geochronology (G S Odin, Chairman, France).

An international meeting of the Subcommittee on Paleogene Stratigraphy was held in Ancona, Italy, in 1987 to consider the Eocene–Oligocene boundary. The meeting was attended by 38 participants, and 18 papers were published in a special volume known as the Ancona Volume (Premoli Silva and others, 1988). The participants concluded that the Massignano section, about 10 km southeast of Ancona, was the best available stratotype for the Eocene–Oligocene boundary. Subsequently, the Eocene–Oligocene working group, having been provided with the necessary details of the Bath section in Barbados and the Massignano section in Italy, concluded that the Massignano section was the best choice for the Eocene–Oligocene boundary stratotype and Global Stratotype Section and Point (GSSP). Ten of the members were in favour, one was undecided, and one did not reply.

Prior to the International Geological Congress in Washington DC in 1989, the 20 voting members of the Subcommittee on Paleogene Stratigraphy were provided with copies of the Ancona Vol-

Figure 1.—The Massignano section, located in a quarry about 10 km south-east of Ancona, Italy, at latitude $43^{\circ}32'13''$ N and longitude $13^{\circ}35'36''$ E. The numbers in the photograph of the section are distances in metres above the base of the measured section. The Eocene–Oligocene boundary GSSP is at 19 m. Contours on the map are in metres.

Abbreviations
E Eocene
O Oligocene.

Taken from Coccioni and others (1988).

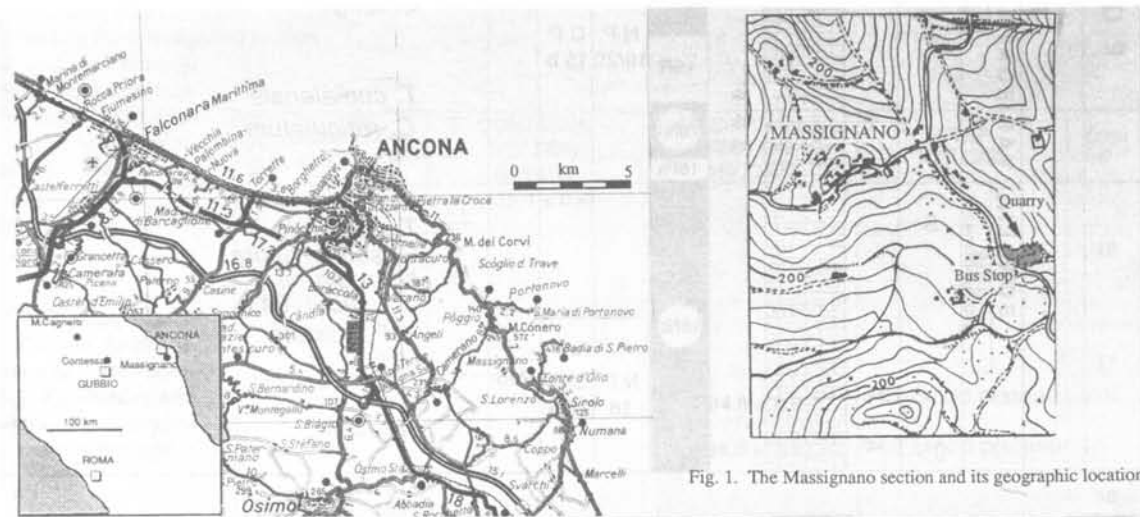


Fig. 1. The Massignano section and its geographic location.



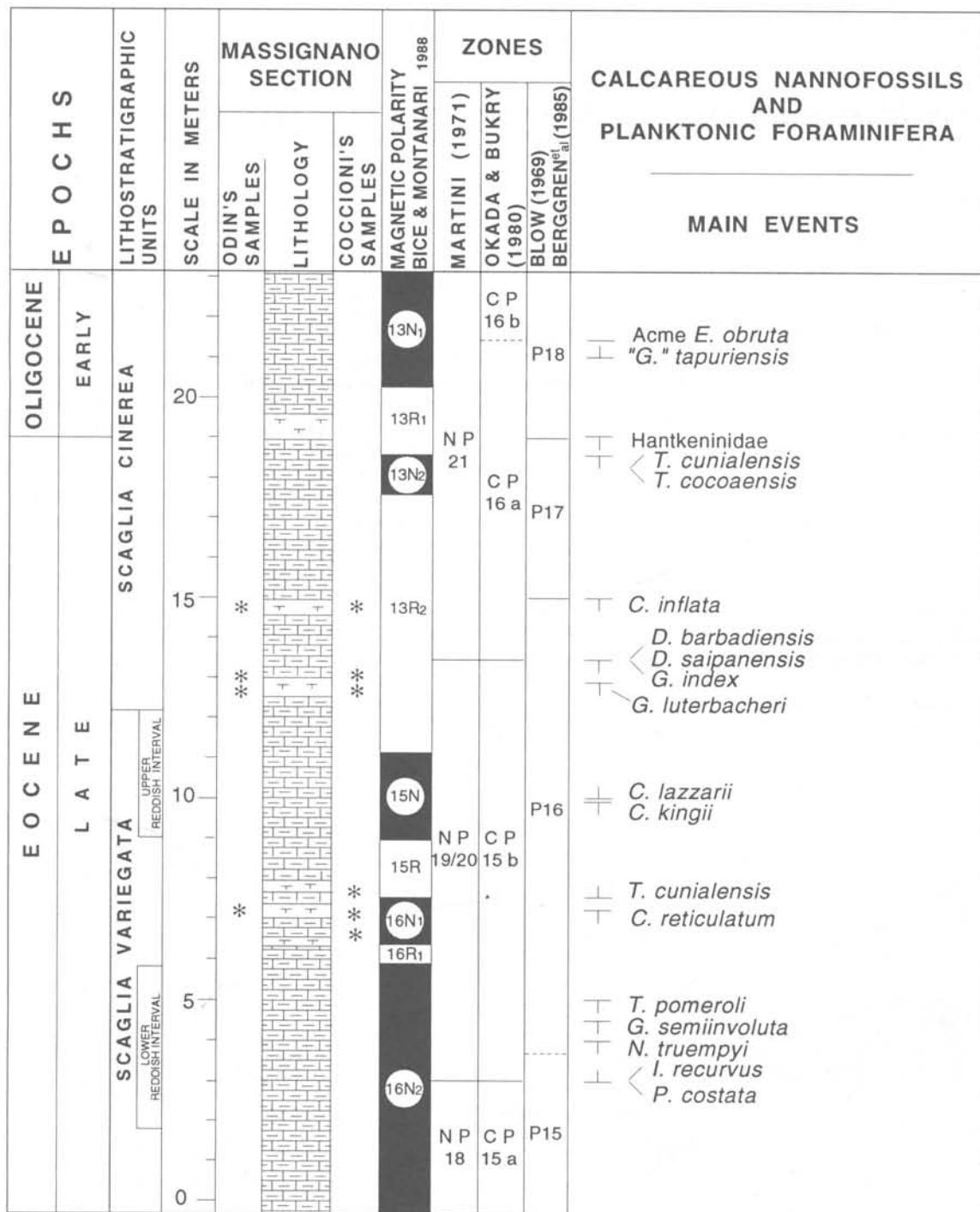


Figure 2.—Calcareous nannofossil and planktonic foraminiferal events in the Massignano section plotted against chrono-, litho-, magneto- and biostratigraphy.

Abbreviations

- N₁, N₂ normal
R, R₁, R₂ reverse
NP nannofossil zone
CP calcareous nannofossil zone
P planktonic foraminiferal zone
Modified from Coccioni and others (1988).

ume and were asked to vote on the suitability of the Massignano section. Fifteen voted for it, none voted against it, one abstained, and four did not vote.

In 1992, the International Commission on Stratigraphy voted in favour of the Massignano section, and this was ratified by the International Union of Geological Sciences at the International Geological Congress in Kyoto in 1992.

Boundary stratotype (GSSP)

The Massignano section is located on the Adriatic coast of Italy in the Monte Conero area. It is an abandoned quarry on the east side of the Ancona-Sirolo road near the village of Massignano (figure 1). On the geological map of Italy (F.118, Ancona), the section is located at latitude 43°32'13"N and longitude 13°35'36"E. The quarry face is up to 4 metres high and does not constitute any serious hazard to vis-

itors. It is part of the Monte Conero protected area, and is thereby preserved from damage. The exposed section, marked by a metal plate, is shown in figure 1, where the GSSP is drawn in the photograph at 19 m above the base of the section.

The Massignano section, which covers the late Eocene to early Oligocene, is 23 m thick and consists of reddish and greenish grey marls and calcareous marls (figure 2). The lower part is in the Scaglia Variegata Formation (12.3 m), and above this is the Scaglia Cinerea Formation (10.7 m). The sediments of the Massignano section are entirely marine, and no evidence exists of any hiatus or structural complexity in the sequence. The GSSP is at the base of a greenish grey marl bed 0.5 m thick. At this level, both the planktonic foraminifera *Hantkenina* and *Cribohantkenina*, Eocene genera of the Hantkeninidae, become extinct (figure 2). The stratigraphic ranges of planktonic foraminifera and calcareous nannofossils have been detailed by Coccioni and others (1988), and of the benthonic foraminifera by Parisi and Coccioni (1988). The sequence has been correlated with the established calcareous nannofossil zones NP21 of Martini (1971) and CP16a of Okada and Bukry (1980), as well as with the planktonic foraminiferal boundary of zones P17 and P18 of Blow (1969) and Berggren and others (1985).

The magnetostratigraphy of the Massignano section has been documented by Bice and Montanari (1988), who have been able to correlate it with the Contessa section in Gubbio, northern Italy (figure 3). The Massignano section lies within magnetic polarity reversal 13R.

Radiometric ages (K-Ar and ^{40}Ar - ^{39}Ar) have been obtained from biotites (Montanari and others, 1985; Montanari and others, 1988; and Odin and others, 1988b). The date of 34.6 ± 0.3 Ma at 14.7 m above the base of the section indicates that the age of the GSSP at 19 m is younger and is estimated to be 34 Ma (figure 4).

Additional published data on the Massignano section include sedimentological and geochemical data (Odin and others, 1988a), and strontium isotope data (Capo and DePaolo, 1988). Further details can be found in the Ancona Volume (Premoli Silva and others, 1988).

Conclusion

The Oligocene-Eocene GSSP in the Massignano section is within calcareous nannofossil zones NP21 and CP16a and within magnetic polarity reversal 13R1. It coincides with the planktonic foraminiferal boundary of zones P17 and P18. The radiometric age is estimated to be 34 Ma.

Figure 4.—Stratigraphic levels and radiometric dating of volcanoclastic biotites (asterisks) in the Contessa quarries near Gubbio and at the Massignano section. Bold numbers are from Odin and others (1988), and the rest are from Montanari and others (1985) and Montanari and others (1988).

Abbreviations

CP calcareous nannofossil zone
P planktonic foraminiferal zone
CQ-ETT sample from the Contessa section
Taken from Odin and others (1988).

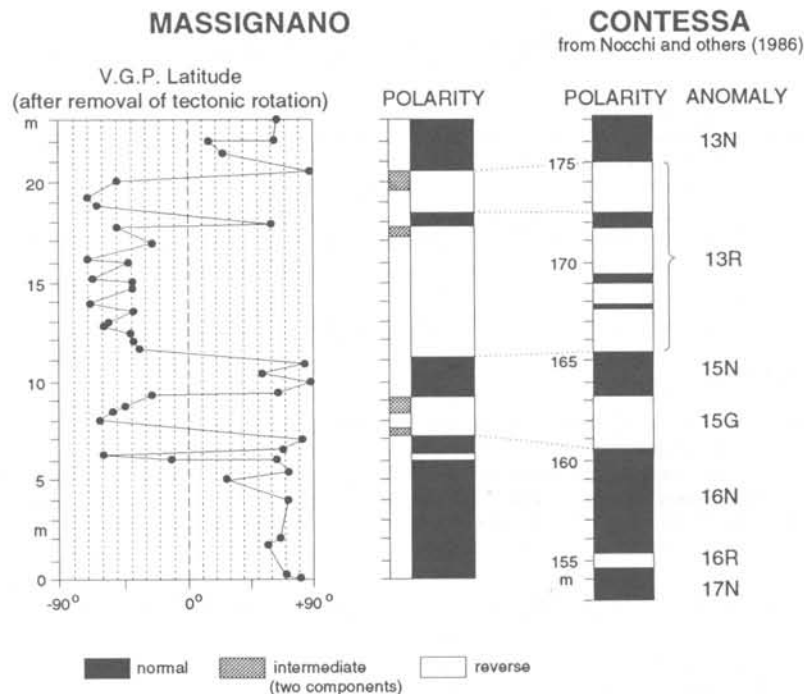


Figure 3.—Massignano section's virtual geomagnetic pole (V.G.P.) latitude correlated with the Contessa Highway III section (Nocchi and others, 1986).

Abbreviations

N normal R reverse G intermediate.

Taken from Bice and Montanari (1988).

EPHOC	ANOM-ALY	Zone CP	CONTESSA SECTION GUBBIO	MASSIGNANO SECTION ANCONA	STEP HEATING	Zone P
OLIGOCENE	13	16b	* (35.4 ± 0.4)			18
		16a		* 34.6 ± 0.3	34.1 Good plateau	17
				* 34.3 ± 0.2	34.9 Good plateau	
EOCENE	15	15b				16
	16		?)* (36.0 ± 1.0) (level CQ-ETT)	* 35.5 ± 0.3	(36.6) No plateau (level CQ-ETT)	
	17	15a	* 36.4 ± 0.3			15
	18					14

Acknowledgments

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