



Il Progetto Europeo GeoMol

Inquadramento geologico dell'Area Pilota Italiana

Giovanni Muttoni
Università degli Studi di
Milano

UN OCCHIO ESPERTO NEL SOTTOSUOLO DELLA PIANURA PADANA
Milano, 23 aprile 2015



Bayerisches Landesamt für
Umwelt



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Federal Office of Topography swisstopo



ISPRa
Istituto Superiore per la Protezione
e la Ricerca Ambientale



Géosciences pour une Terre durable
brgm

Geologische Bundesanstalt

Regione Emilia-Romagna



REPUBLIQUE
ET CANTON
DE GENEVE



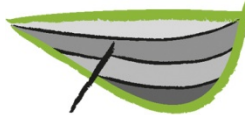
Schweizerische Eidgenossenschaft
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Confederaziun svizra

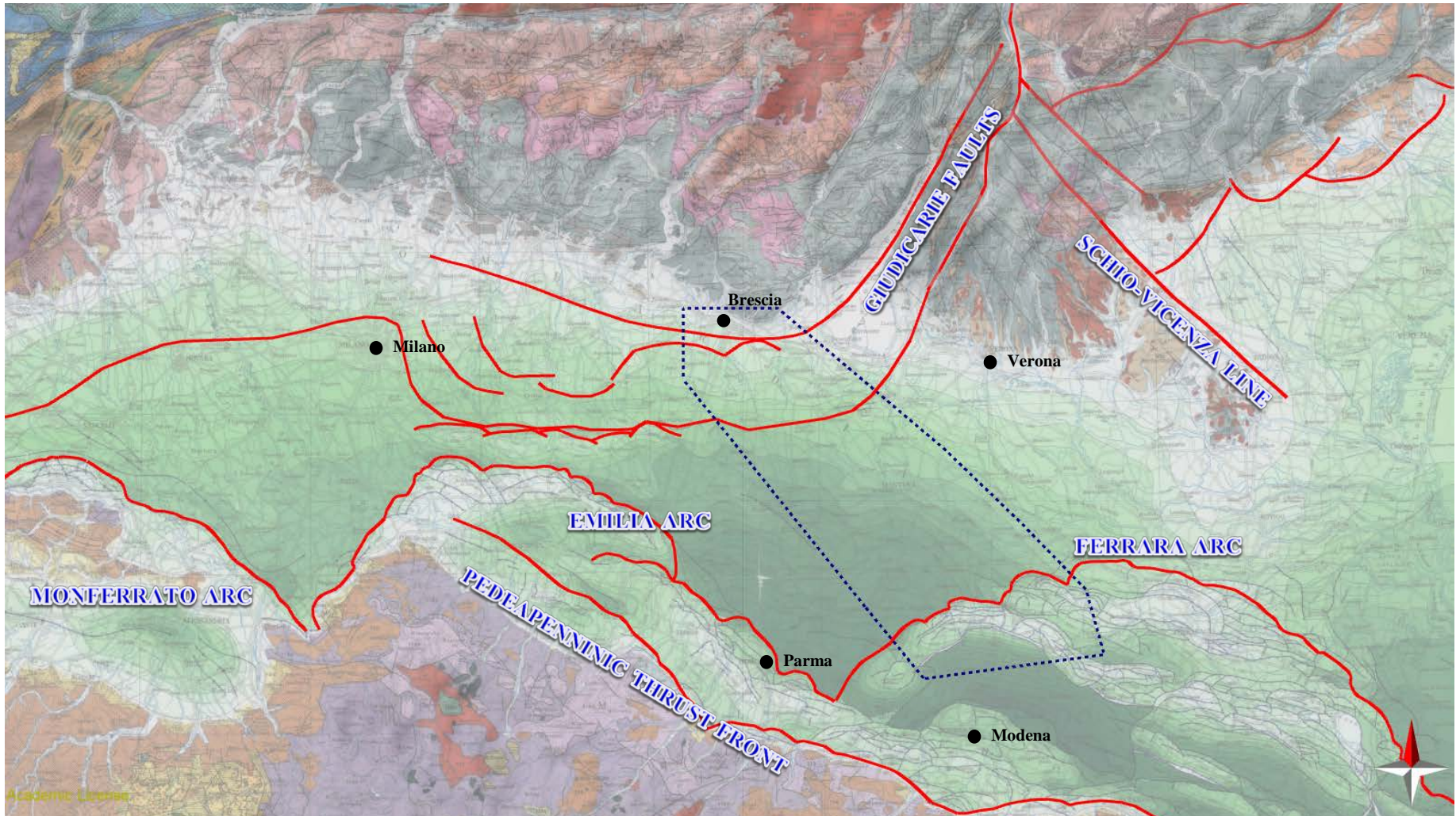
Swiss Federal Office of Energy SFOE



Regionalverband
Bodensee-Oberschwaben

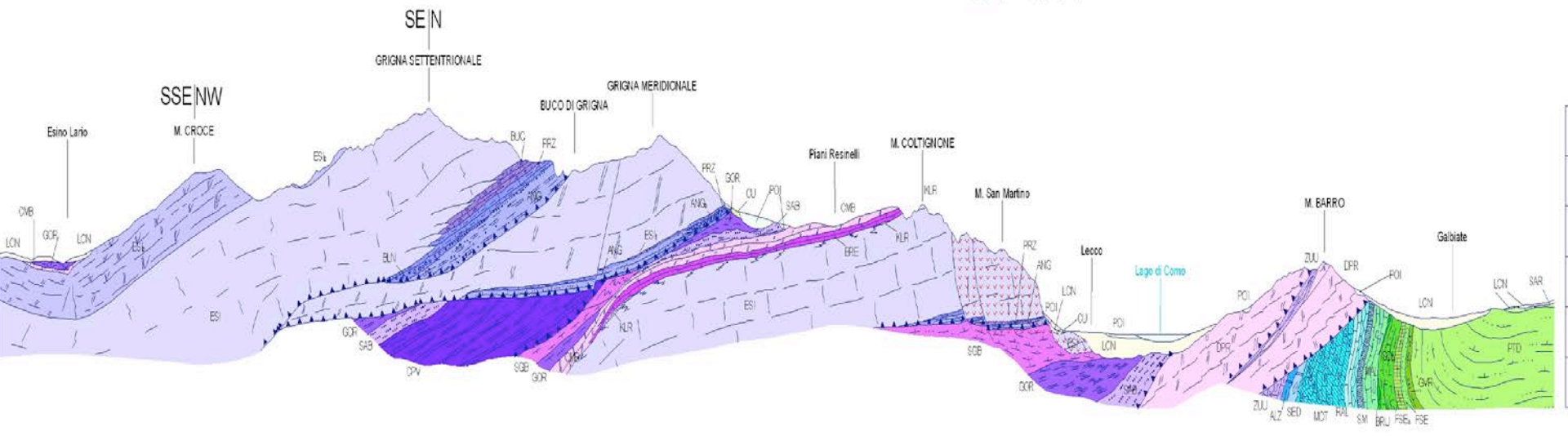
Regione
Lombardia

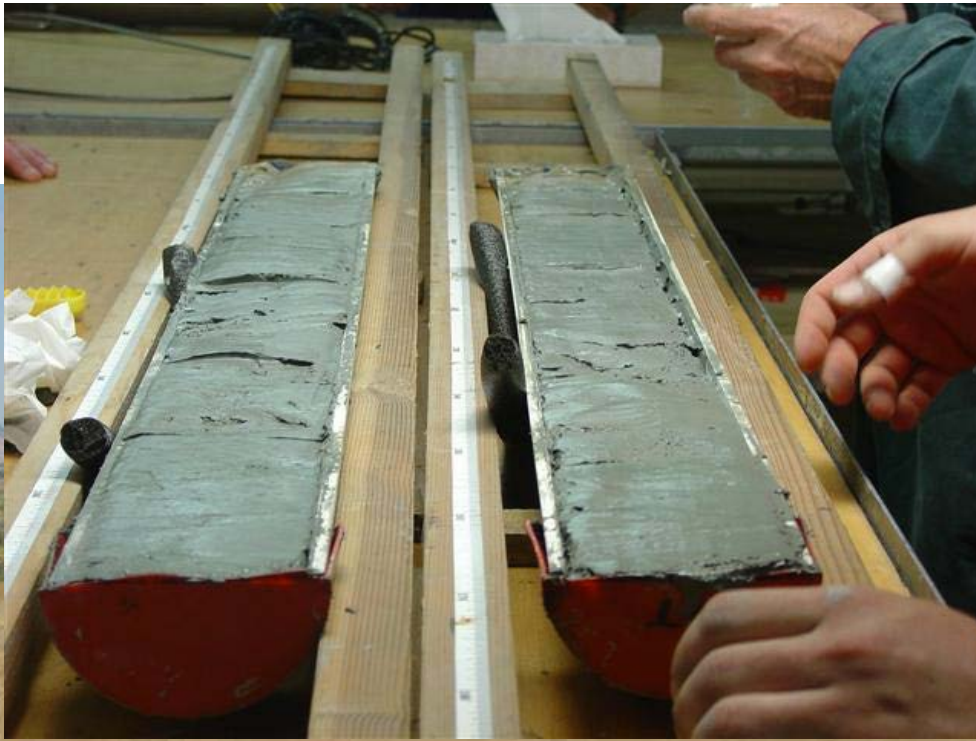




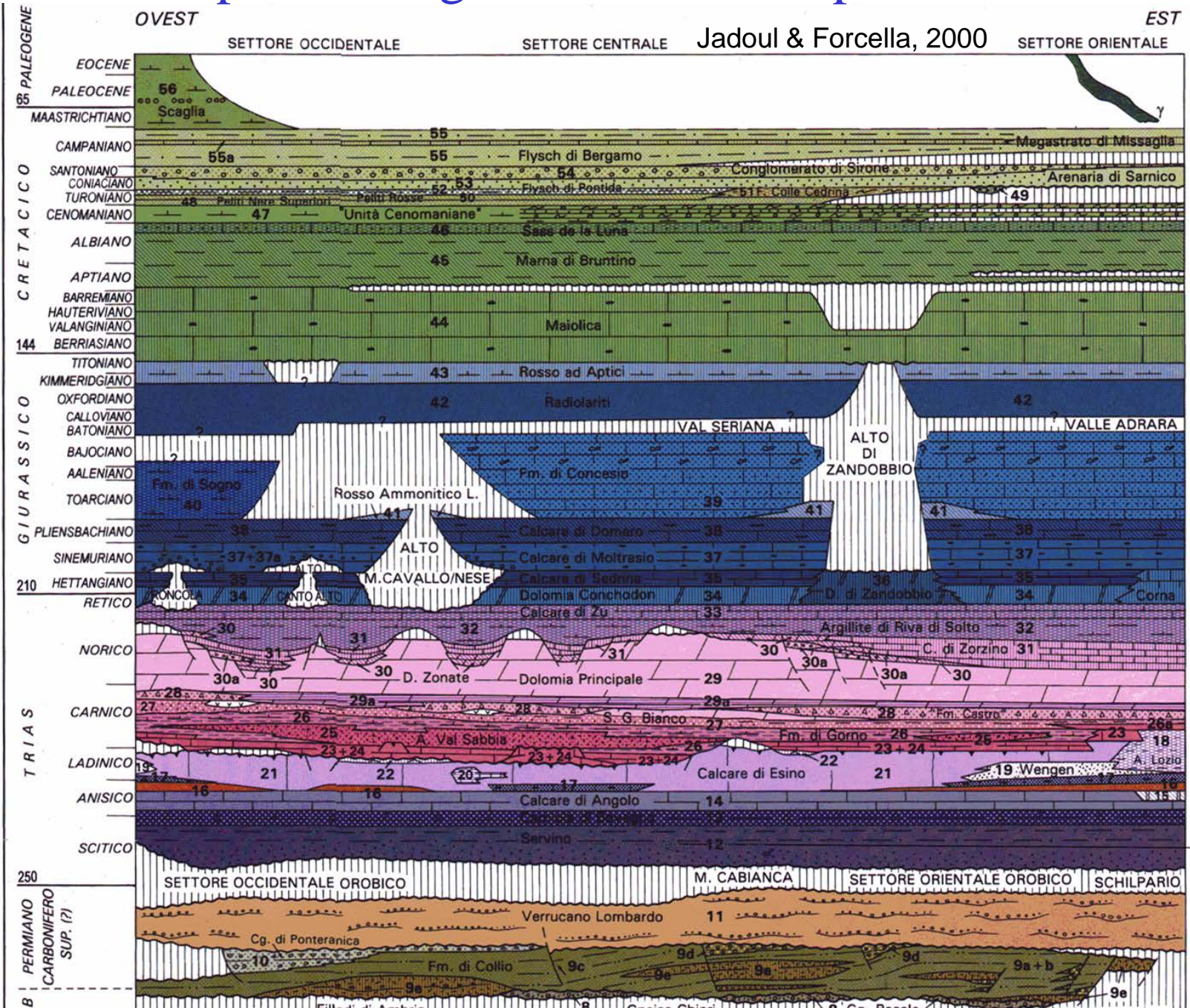


Depositi di scioglimento e ghiaccio prevalenti





Aspetti stratigrafici delle Prealpi Lombarde

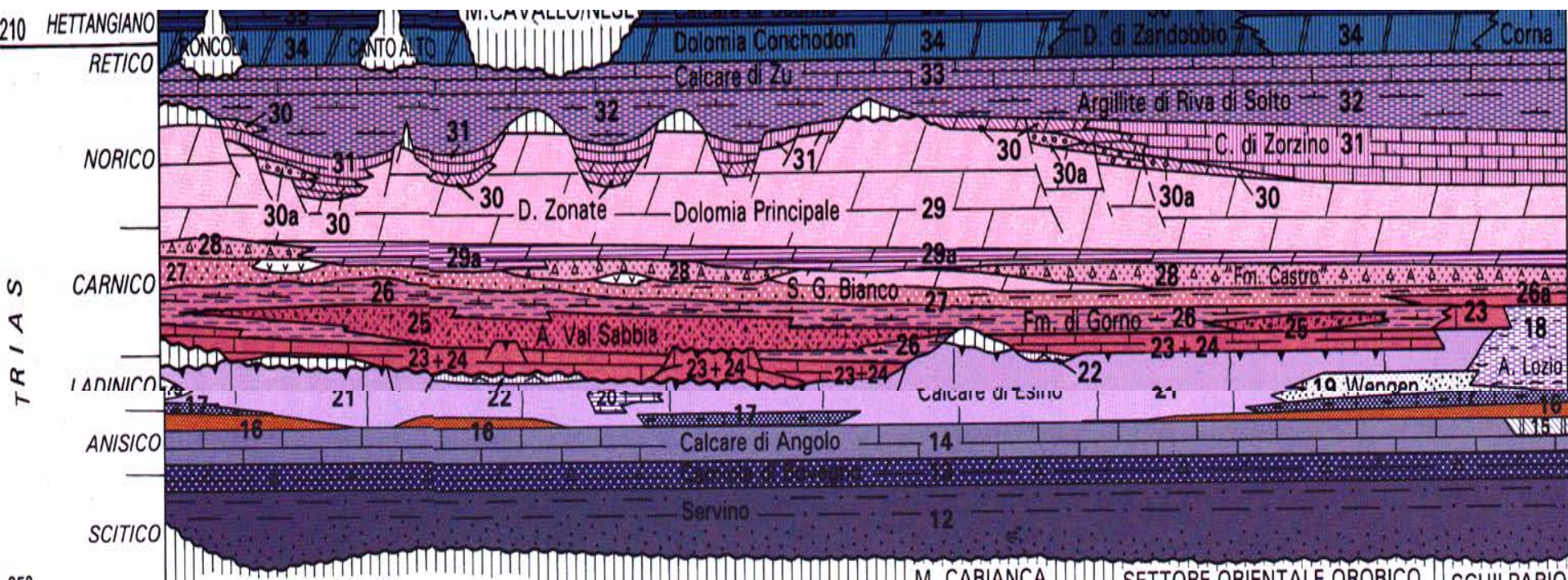




Sezioni e schema
stratigrafico tratte dal
Modello 3D GeoMol

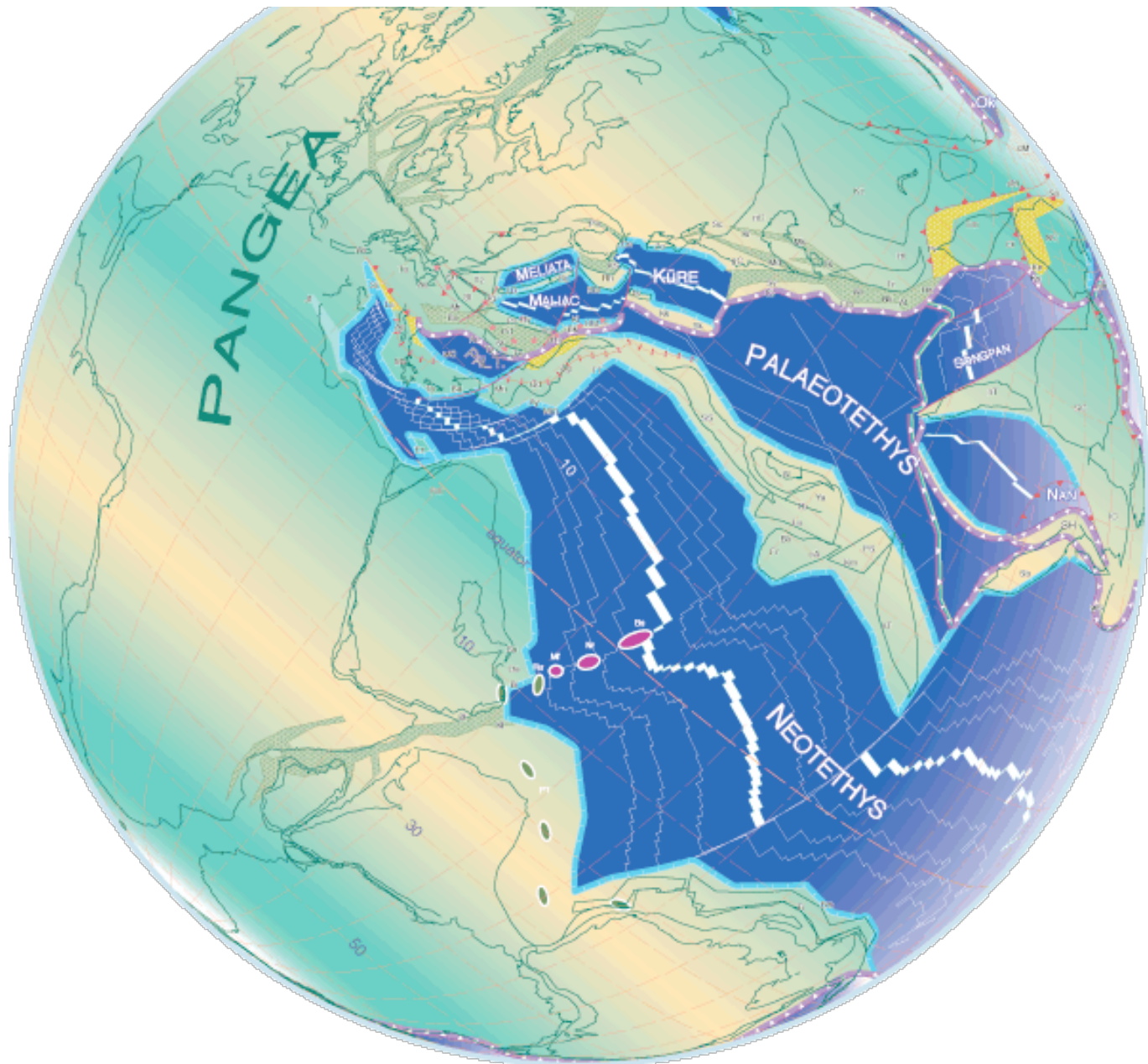
	UNIT NAME	HORIZON NAME
Pleistocene	PLCc	QC3
	PLCb	QC2
	PLCa	QC1
	PLMd	QM3
	PLMc	QM2
	PLMb	QM1
	PLMa	GEL
Pliocene	PL <i>Porto Corsini Porto Garibaldi Argille Santerno</i>	PL
Upp Miocene	MESb <i>Sergnano Fusignano</i>	ME3
	MESa <i>Gessoso-solfifera Marna di Gallare</i>	ME1
Upper Miocene	MIO <i>Gonfolite Marna di Gallare</i>	MLW
Eocene	EO-OL <i>Marna di Gallare Scaglia cinerea</i>	SCA
Early Cret Paleocene	K-PAL <i>Scaglia marna del Cerro brecce di Cavone Marna a fucoidi</i>	MAI
Middle Jurassic Early Cretaceous	J-K <i>Maiolica Calcarei aptici Rosso ammonitico Calcarei posidonia Oolite S. Vigilio</i>	NOR
Late Triassic Early Jurassic	TR-J <i>Medolo Corna Calcarei grigi Dolomia Principale</i>	TE
Permian Carnian	P-TR <i>Anidriti di Burano</i>	

IL TRIASSICO



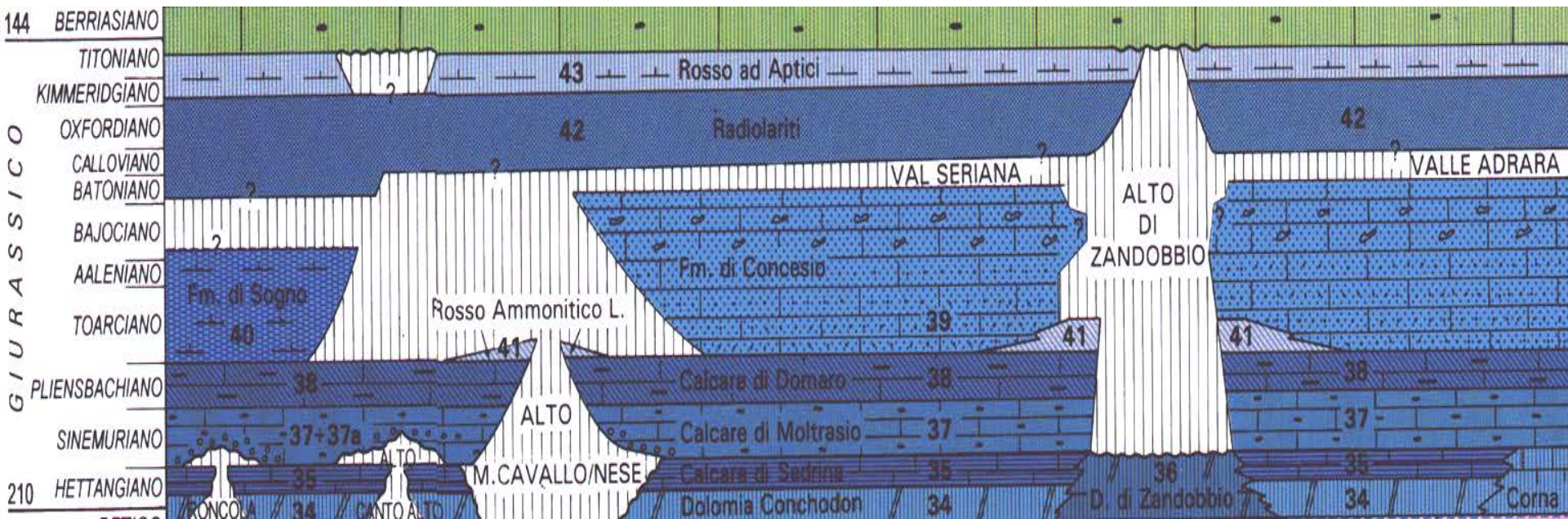
Il Trias medio e superiore presentano rocce prevalentemente carbonatiche di mare poco profondo (piattaforme carbonatiche del C. di Angolo, Esino, Dolomia Principale) e, localmente, di bacino (C. di Prezzo, Buchenstein, Perledo Varenna, F. di Wengen, C. di Zorzino).

Latitudini tropicali = piattaforme carbonatiche



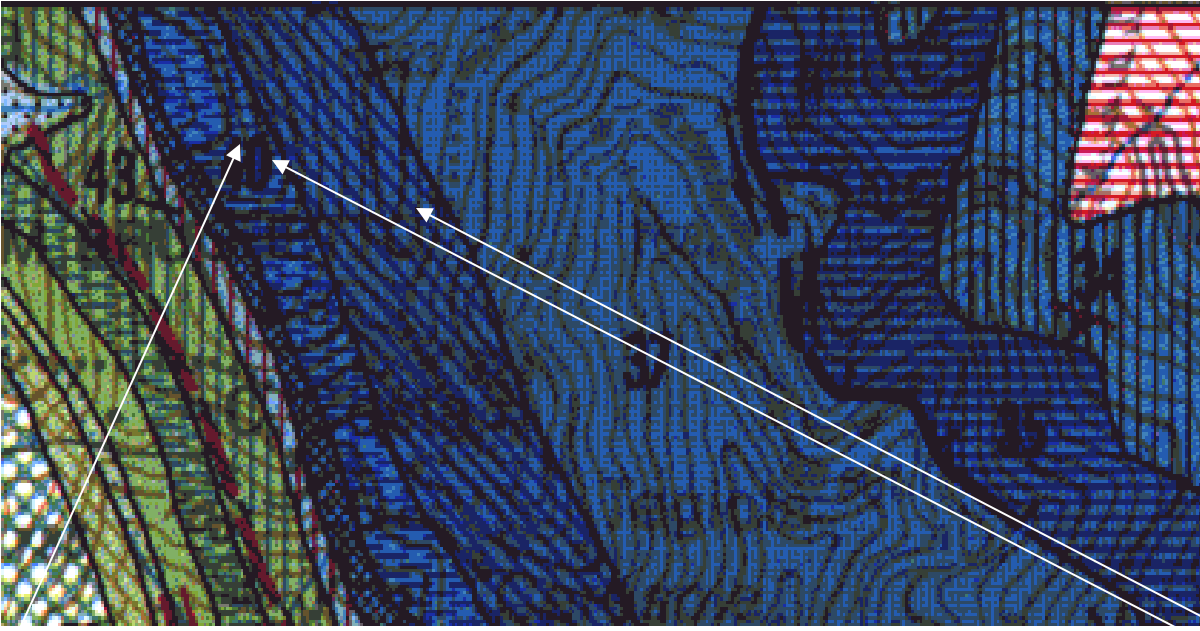
230 Ma - Ladinian

IL GIURASSICO



Il **Giurassico inferiore** (Lias) presenta successioni prevalentemente carbonatiche, stratificate, di ambiente marino via via più profondo (rifting liassico).

Il **Giurassico medio-superiore** si caratterizza per la presenza generalizzata di rocce ben stratificate calcaree fini, marnose e silicee di ambiente oceanico (Oceano Ligure-Piemontese).



La successione Liassica sup. dell'Albenza



A

Calcari marnosi e marne policrome
alla base della F. di Sogno.(39)

F. di Sogno



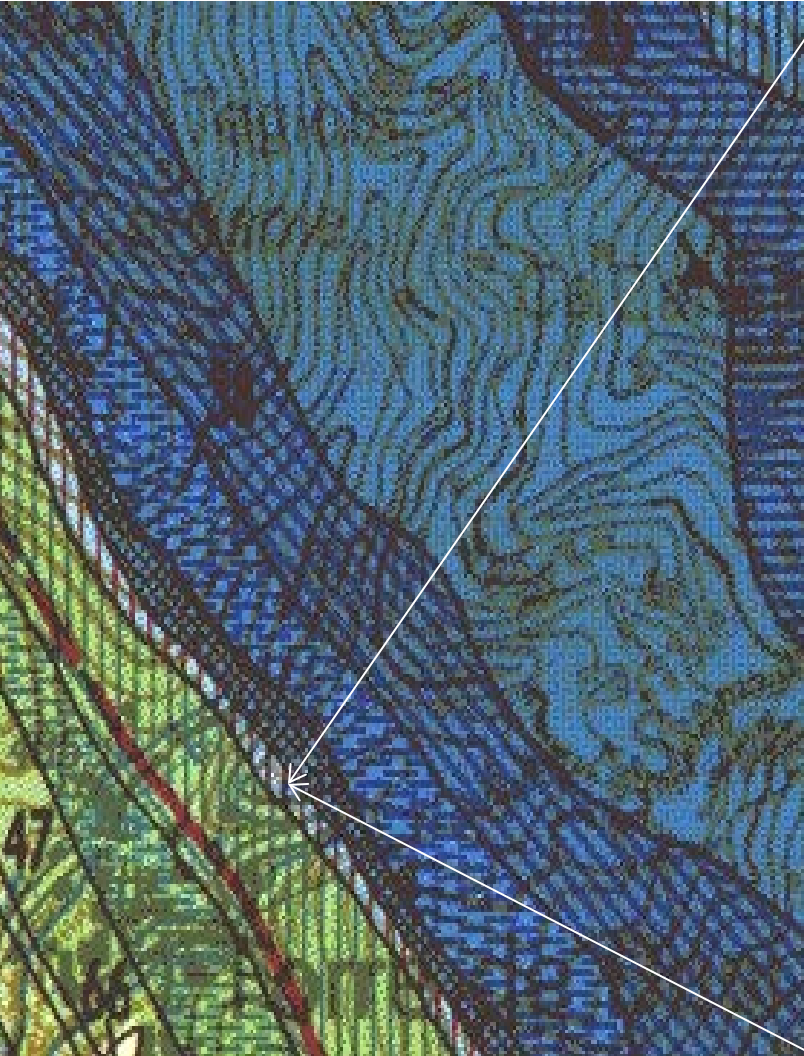
B

Calcari fini ben stratificati con
selce (Domaro, 38)

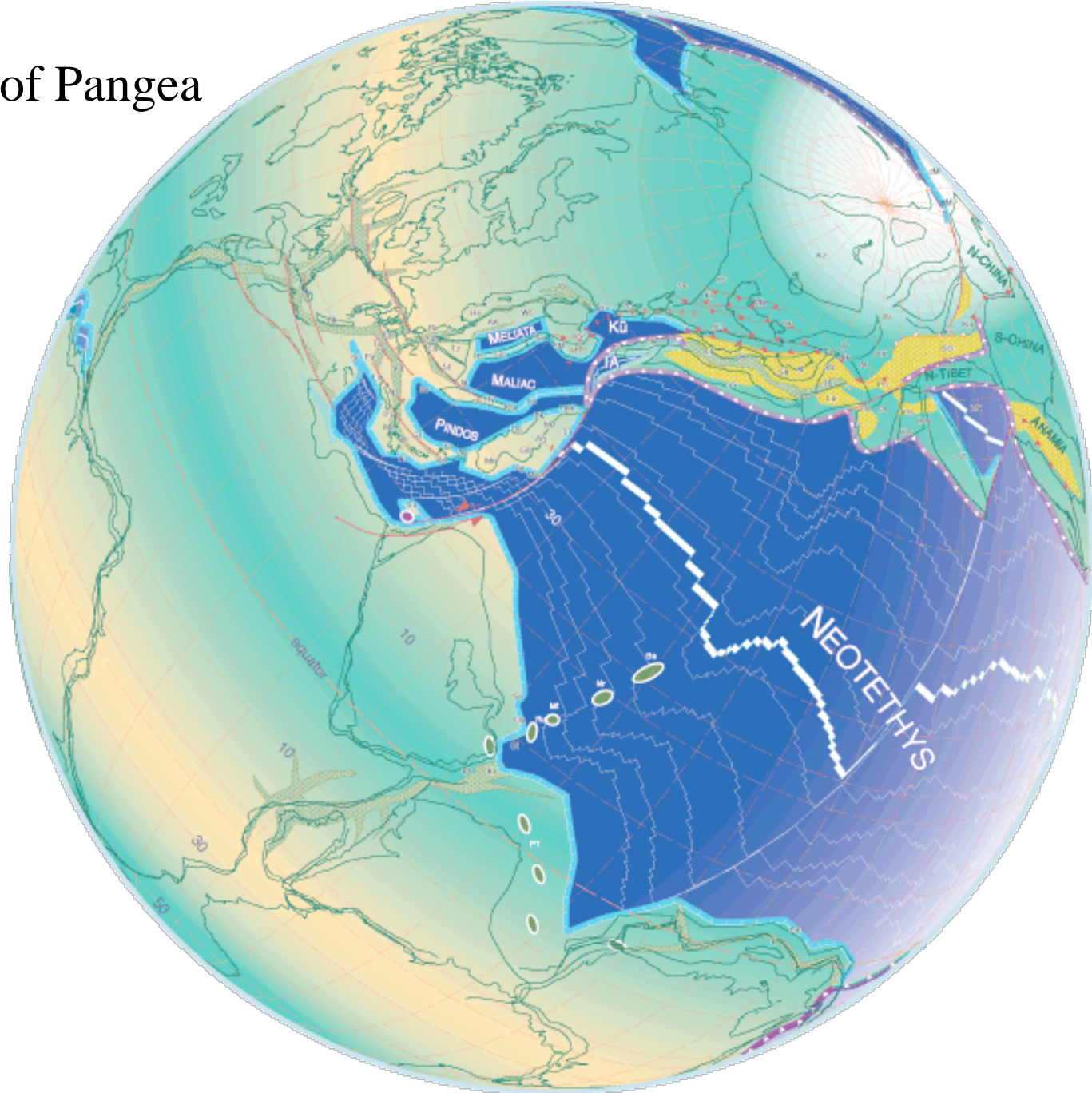
Il Giurassico medio-superiore del M. Albenza

Calcari con selce
rossa (Rosso ad
Aptici (43)

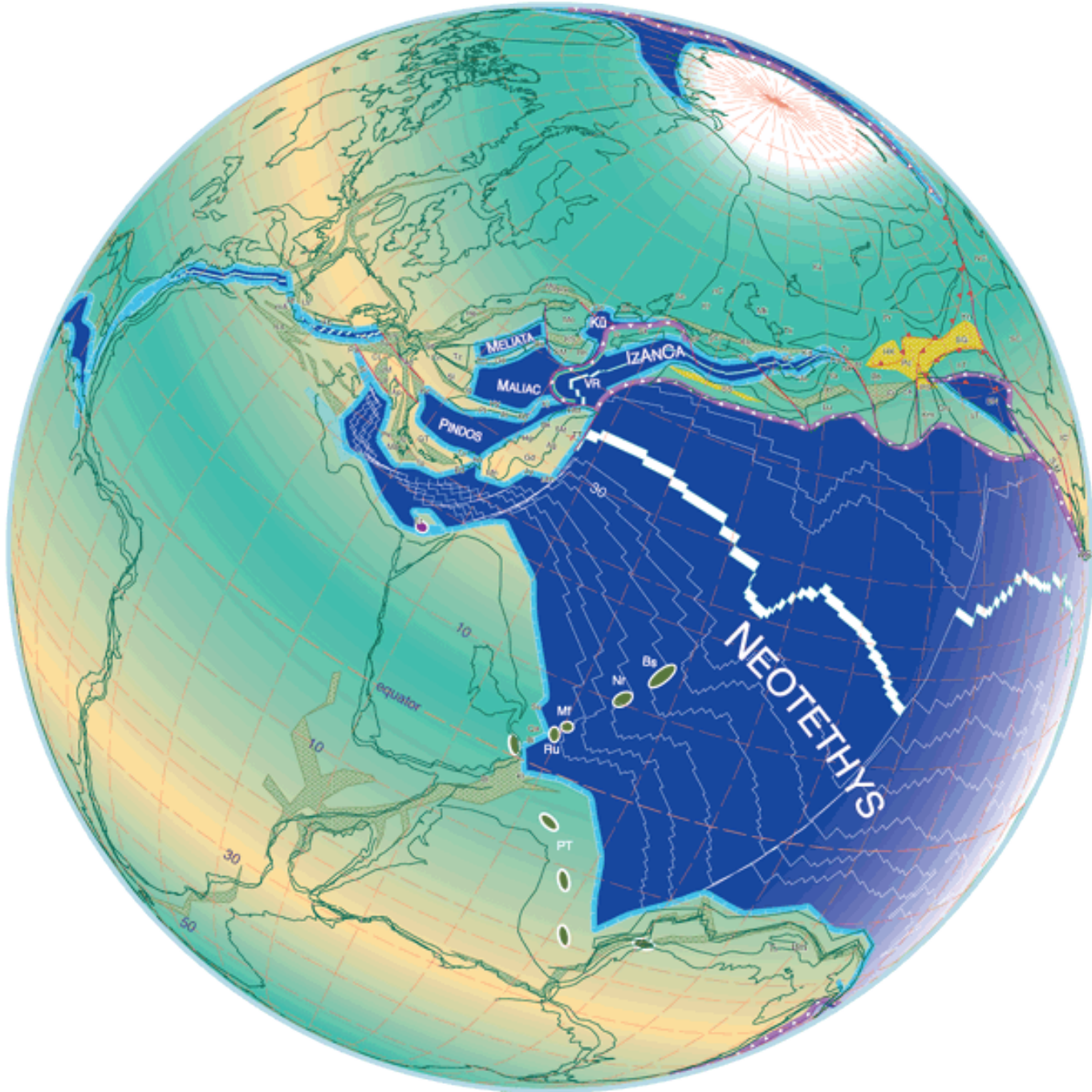
Le Radiolariti (42)



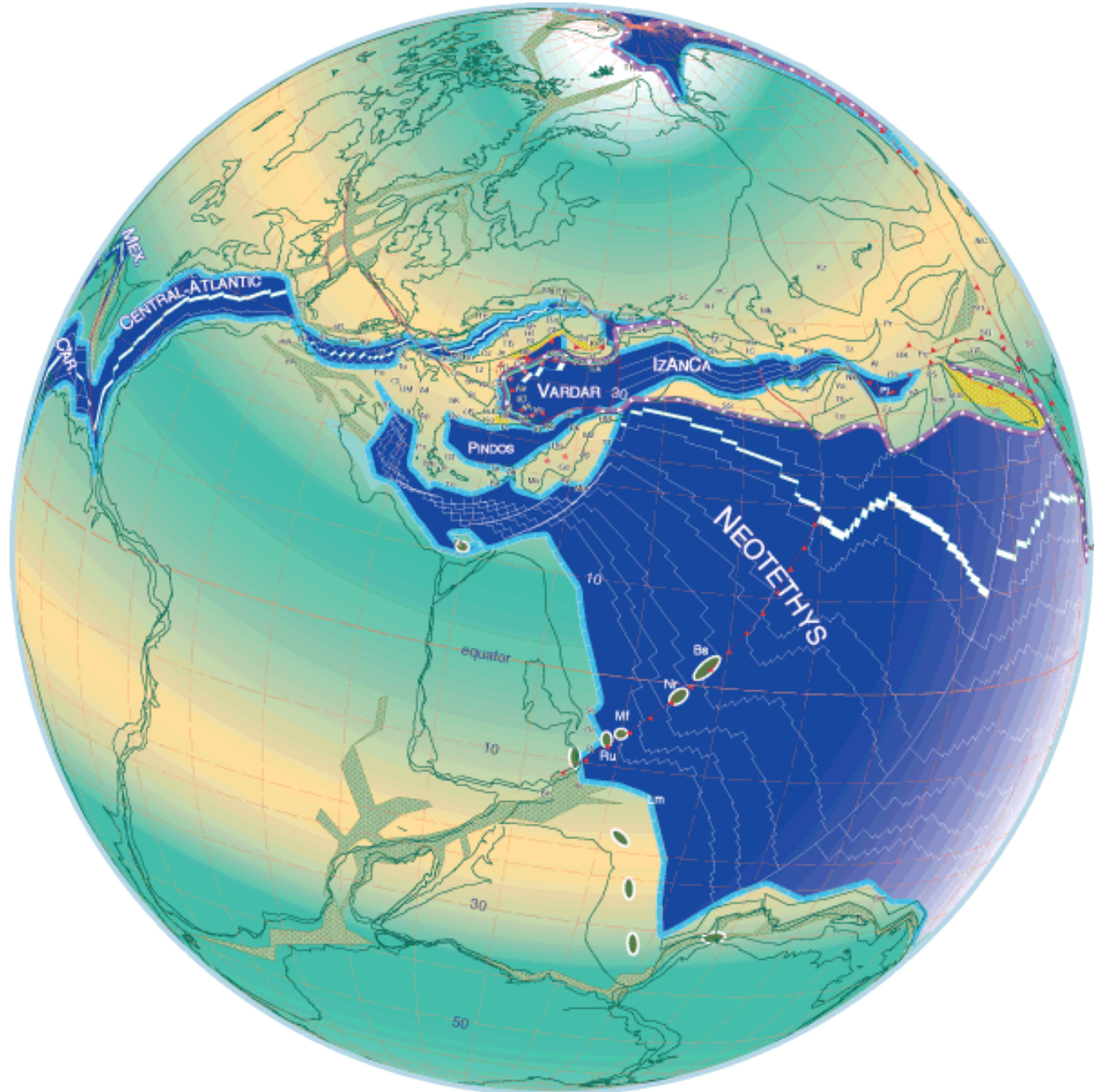
Rifting of Pangea



200 Ma - Hettangian



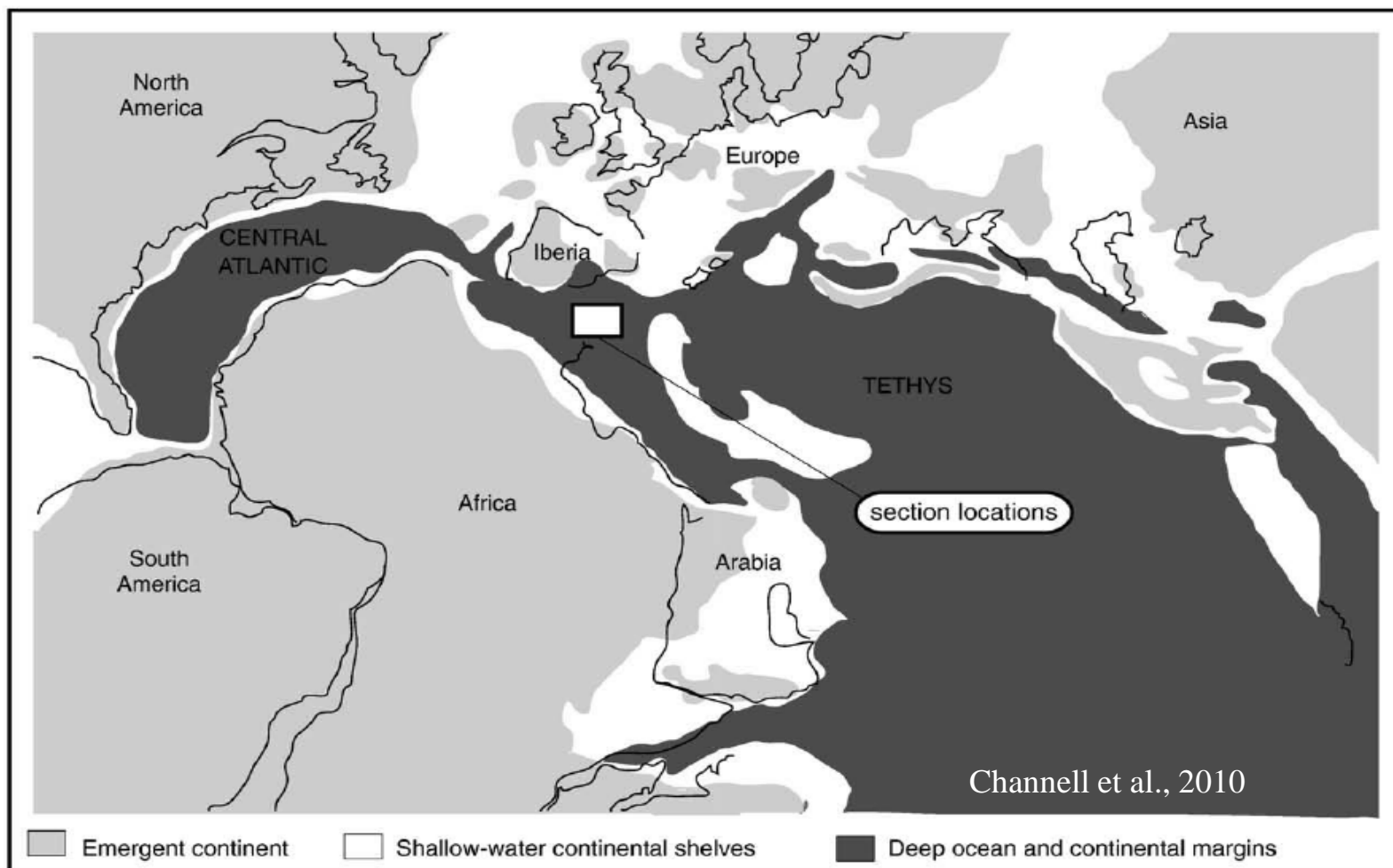
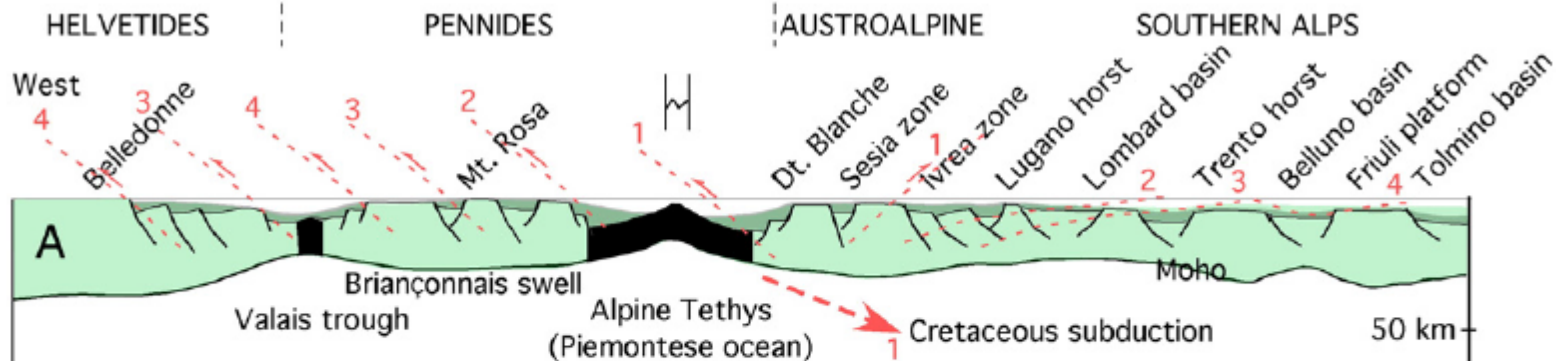
180 Ma - Toarcian-Aalenian



155 Ma - Late Oxfordian (an. M25)

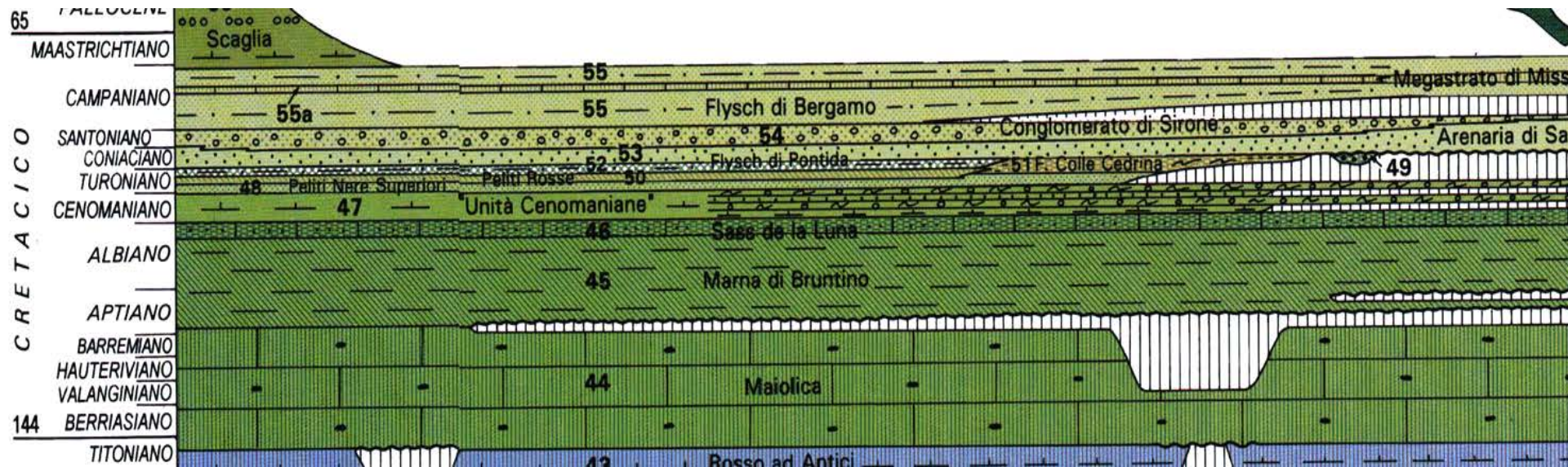
European Plate

Adriatic Plate



IL CRETACICO

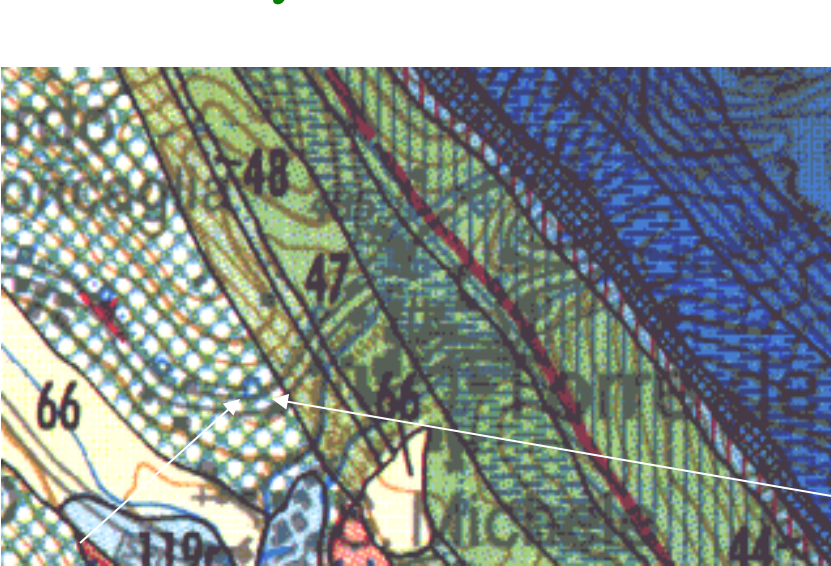
Le rocce di questo periodo affiorano in corrispondenza del bordo più meridionale e collinare delle Prealpi Bergamasche.



Cretacico Inferiore: continuano i depositi carbonatici e marnosi di mare aperto e profondo.

Cretacico Superiore: inizia la sedimentazione terrigena (flysch sudalpini) alimentata dalle prime rughe prodotte dalla deformazione alpina precoce.

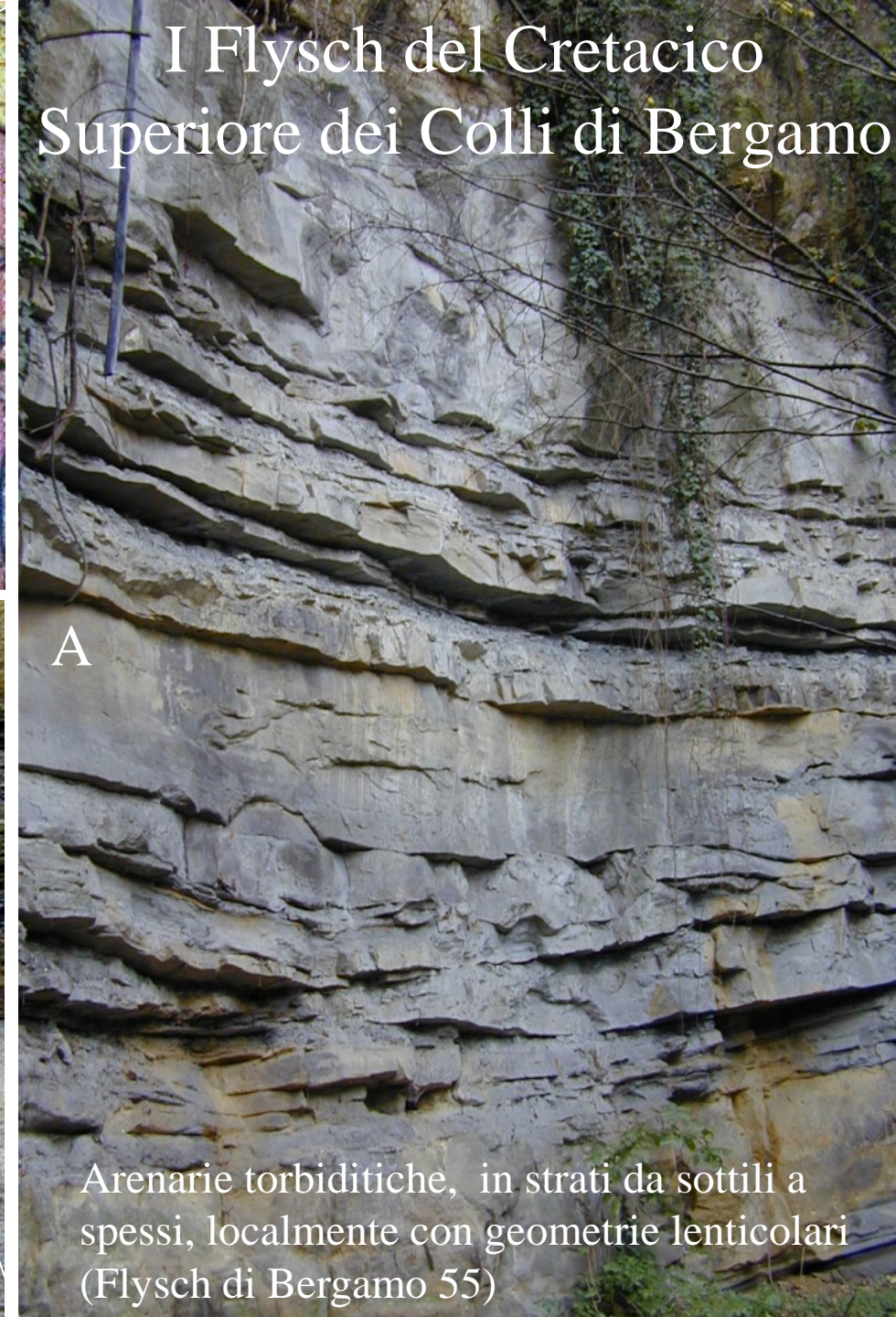
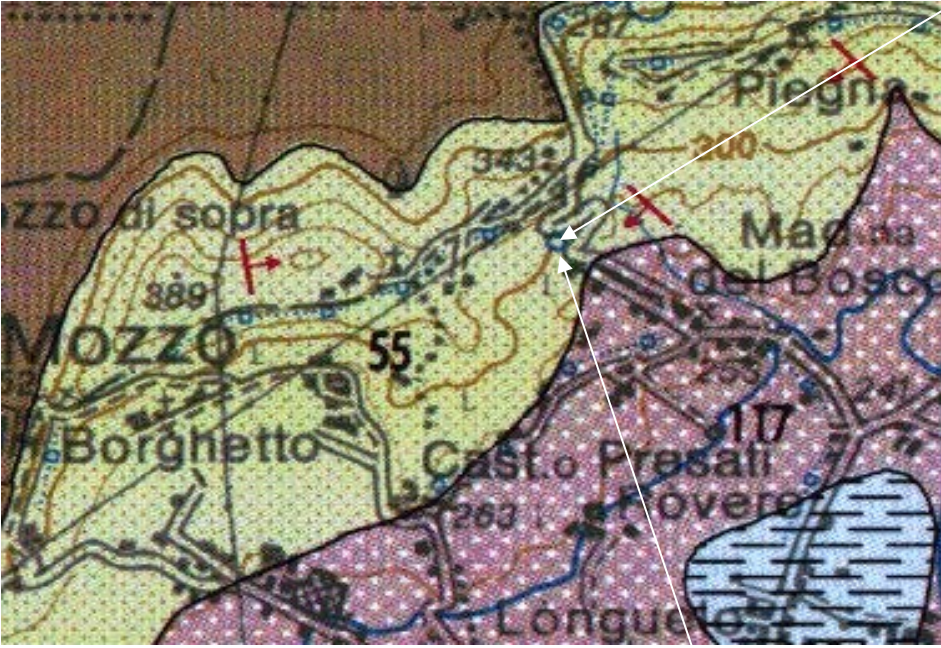
I flysch silicoclastici cretaceutici di Torre de Busi



Arenarie fini e grossolane (torbiditi sottili ed in grossi banchi) alternate con peliti (Flysch di Pontida, 52)

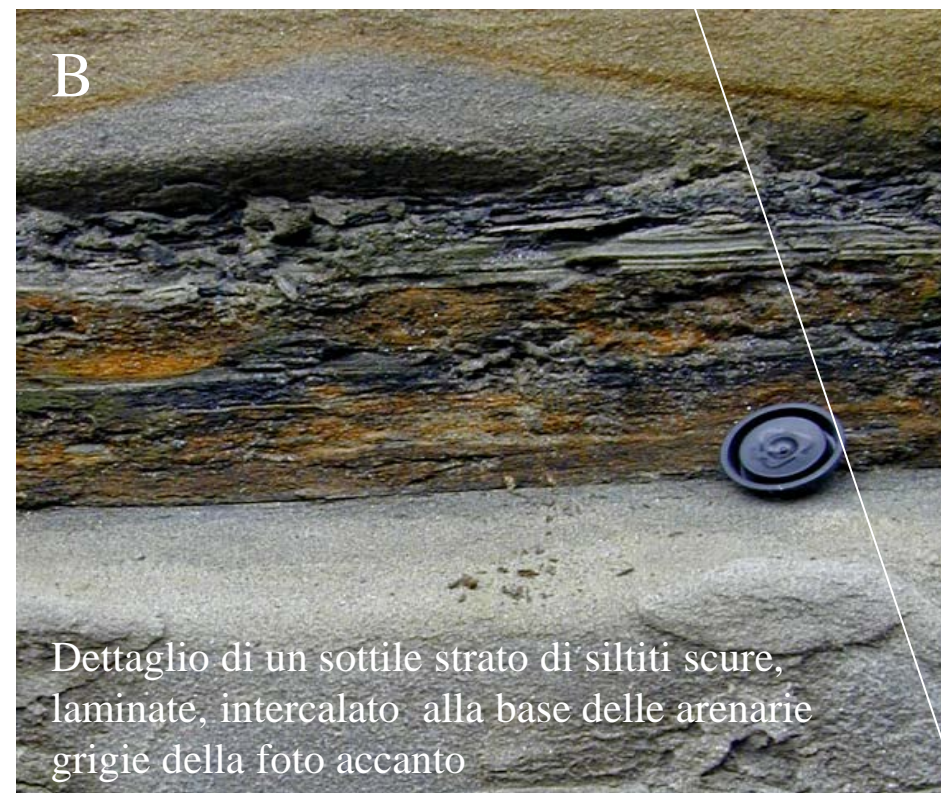
Dettaglio del limite tra un'arenaria torbiditica, ricca in mica, e peliti grigie (F. di Pontida)

I Flysch del Cretacico Superiore dei Colli di Bergamo



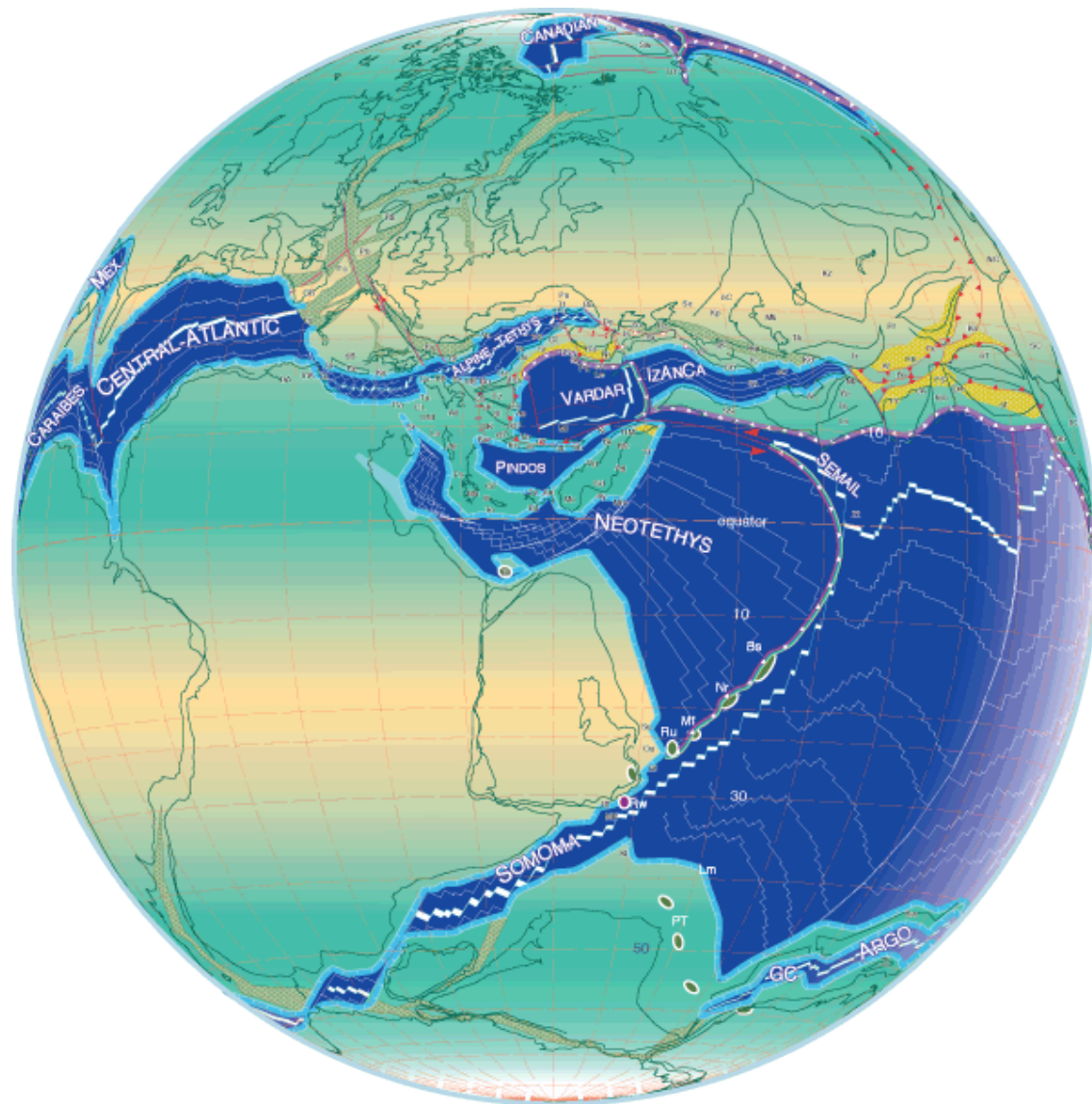
A

Arenarie torbiditiche, in strati da sottili a spessi, localmente con geometrie lenticolari (Flysch di Bergamo 55)

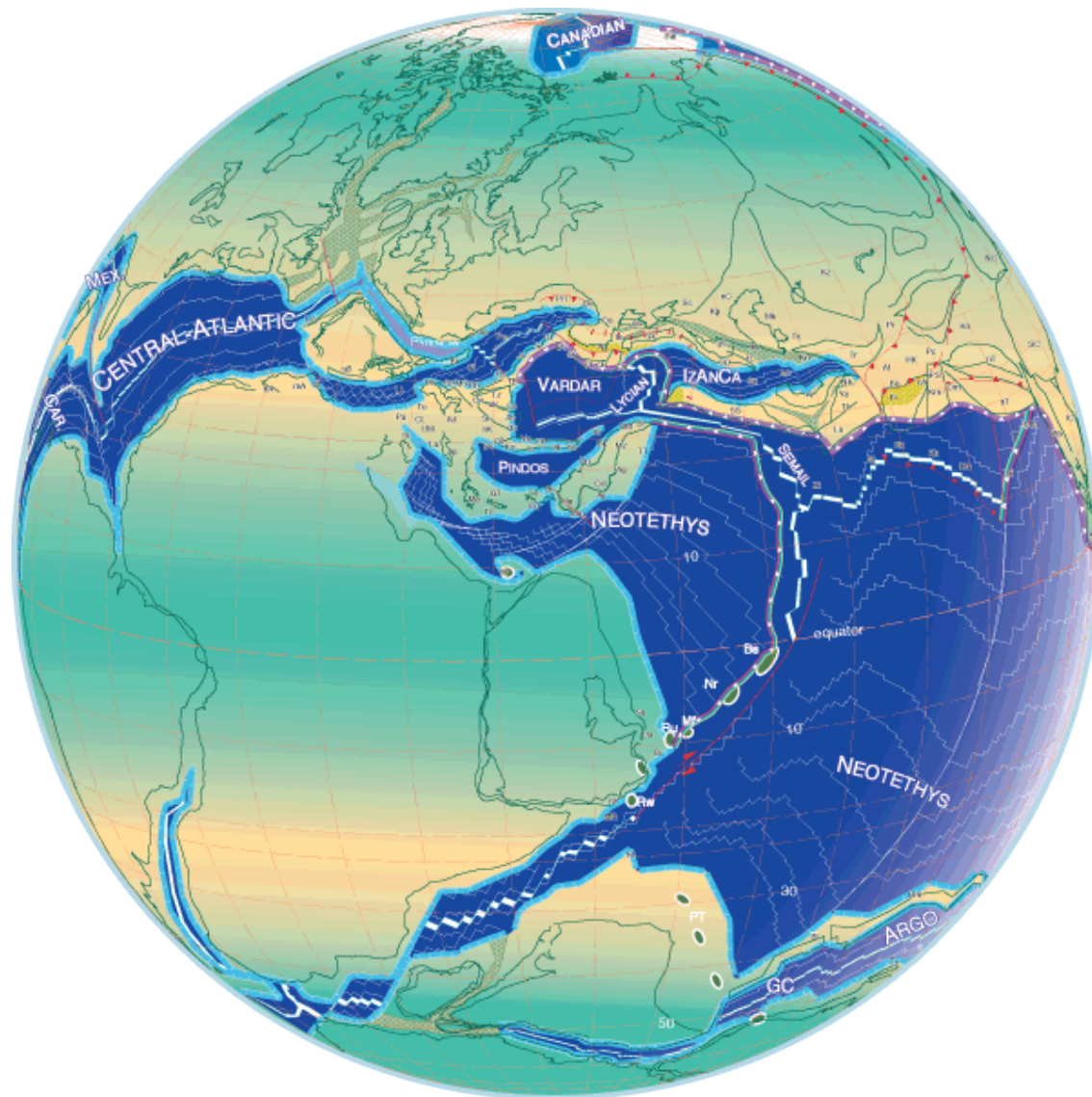


B

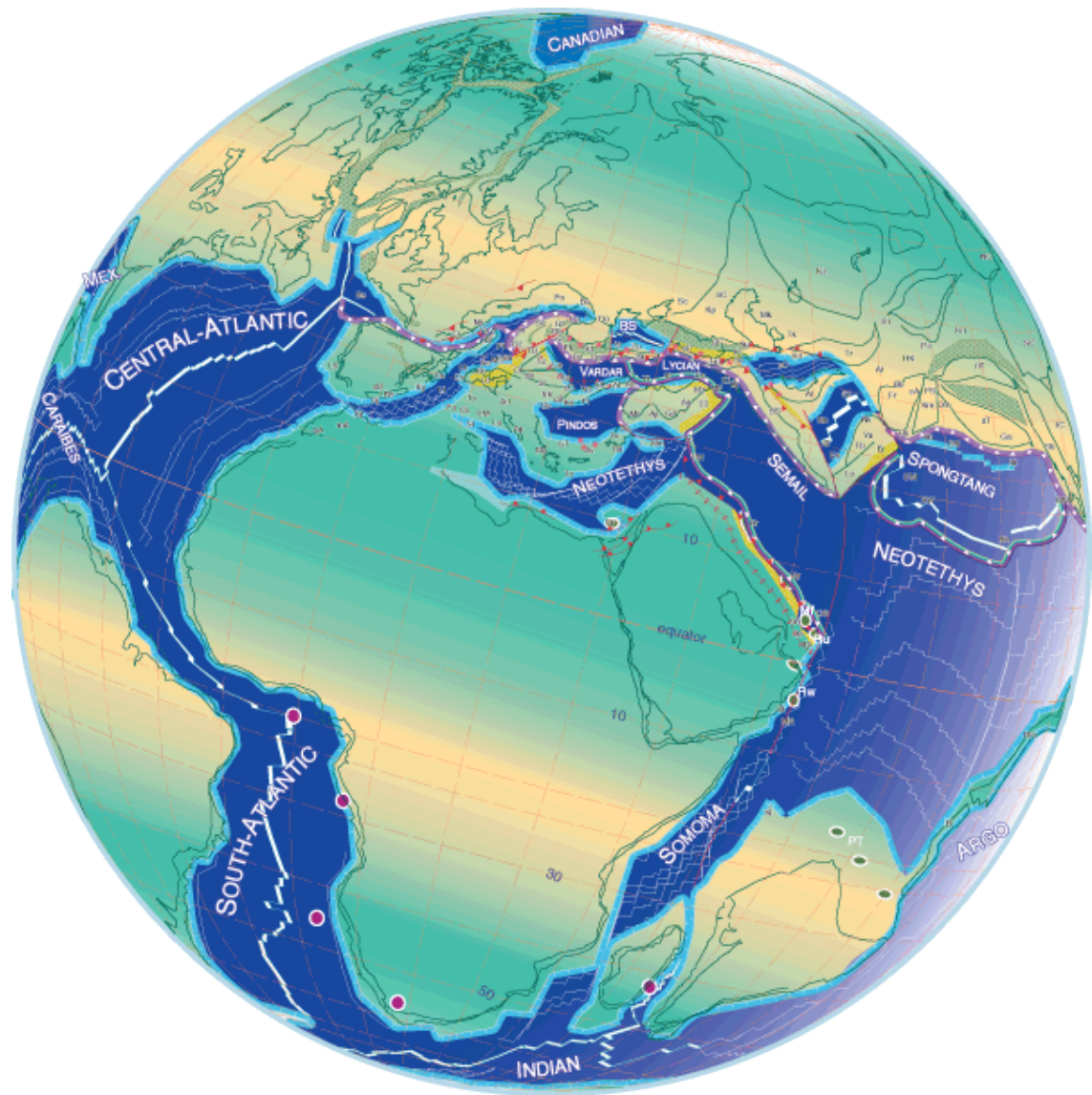
Dettaglio di un sottile strato di siltiti scure, laminato, intercalato alla base delle arenarie grigie della foto accanto



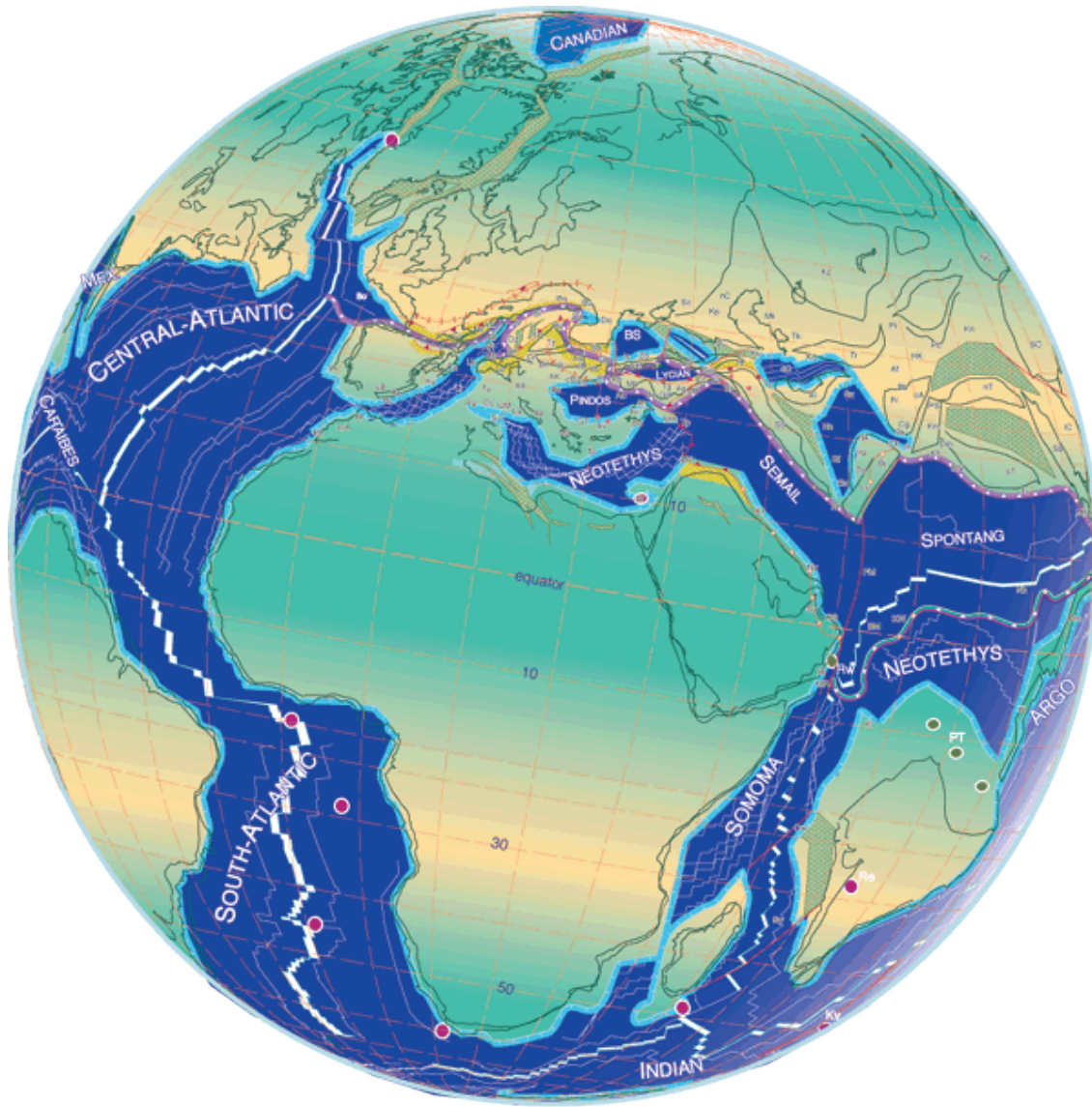
131 Ma - Hauterivian-Valanginian (an. M10)



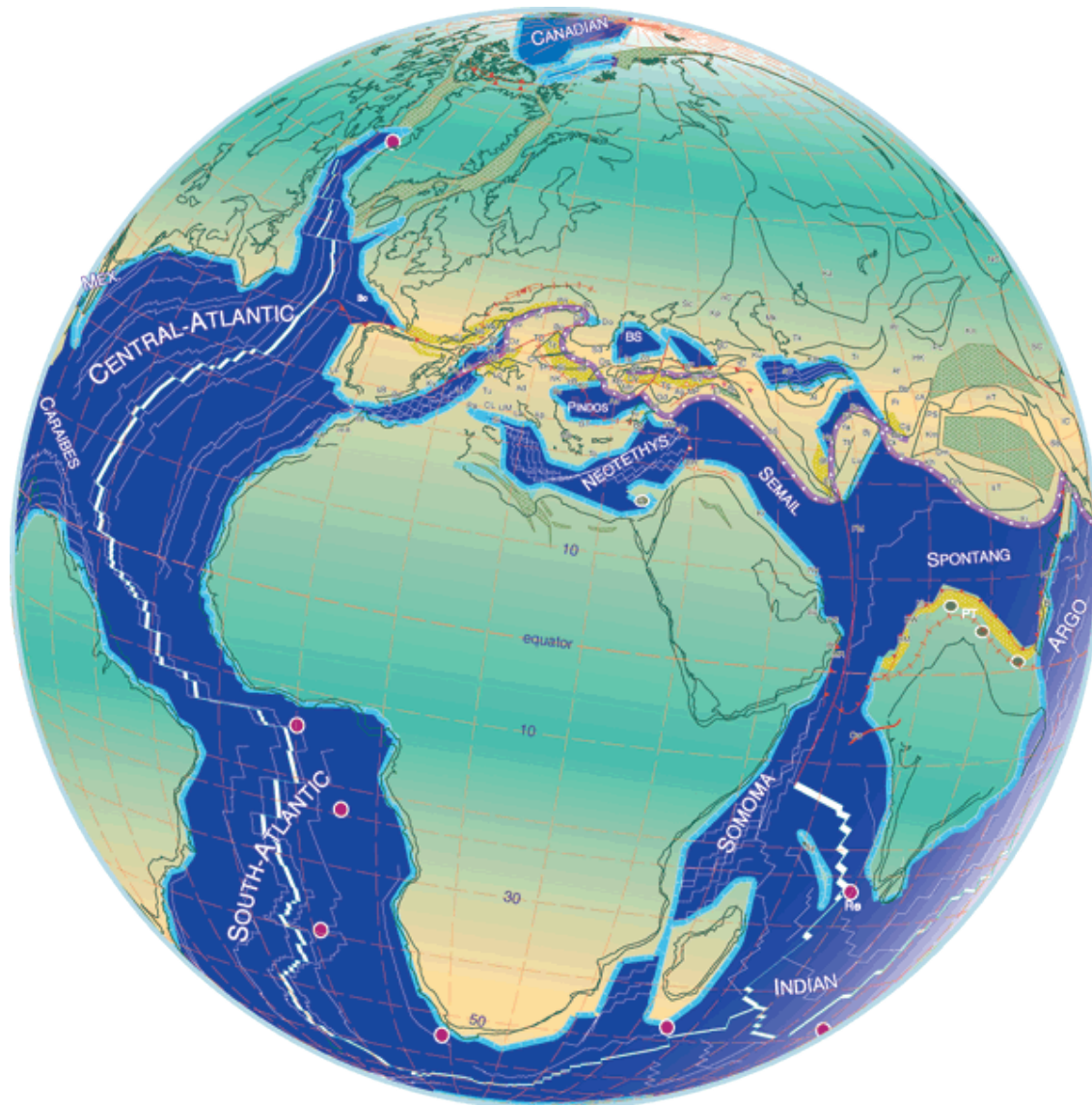
121Ma - Barremian-Aptian (an. M0)



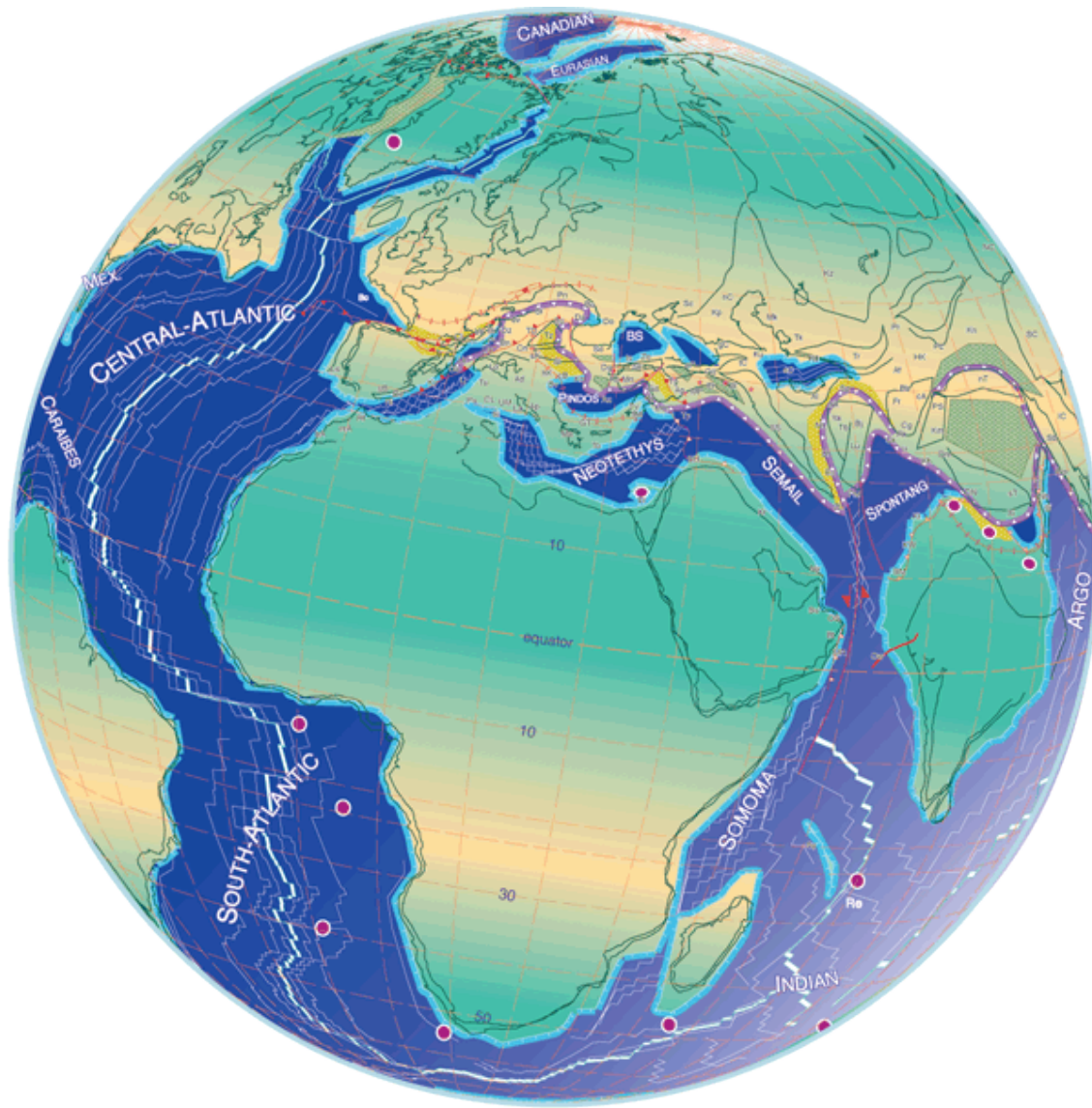
84 Ma - Santonian (an. 34)



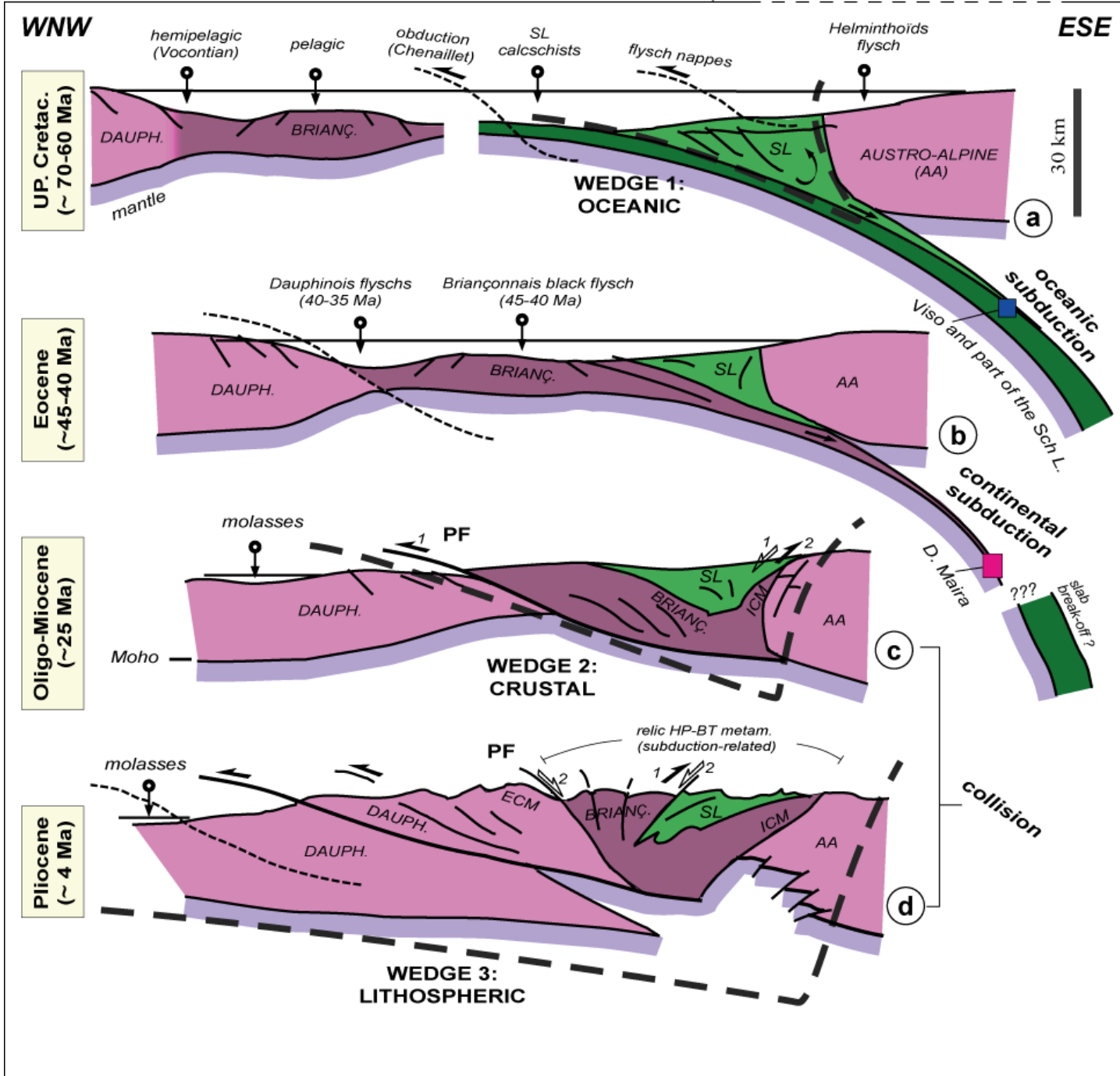
70 Ma - Early Maastrichtian (an. 31)



57 Ma - Thanetian (an. 25)



46 Ma - Lutetian (an. 21)



Agard & Lemoine, Fig. 48

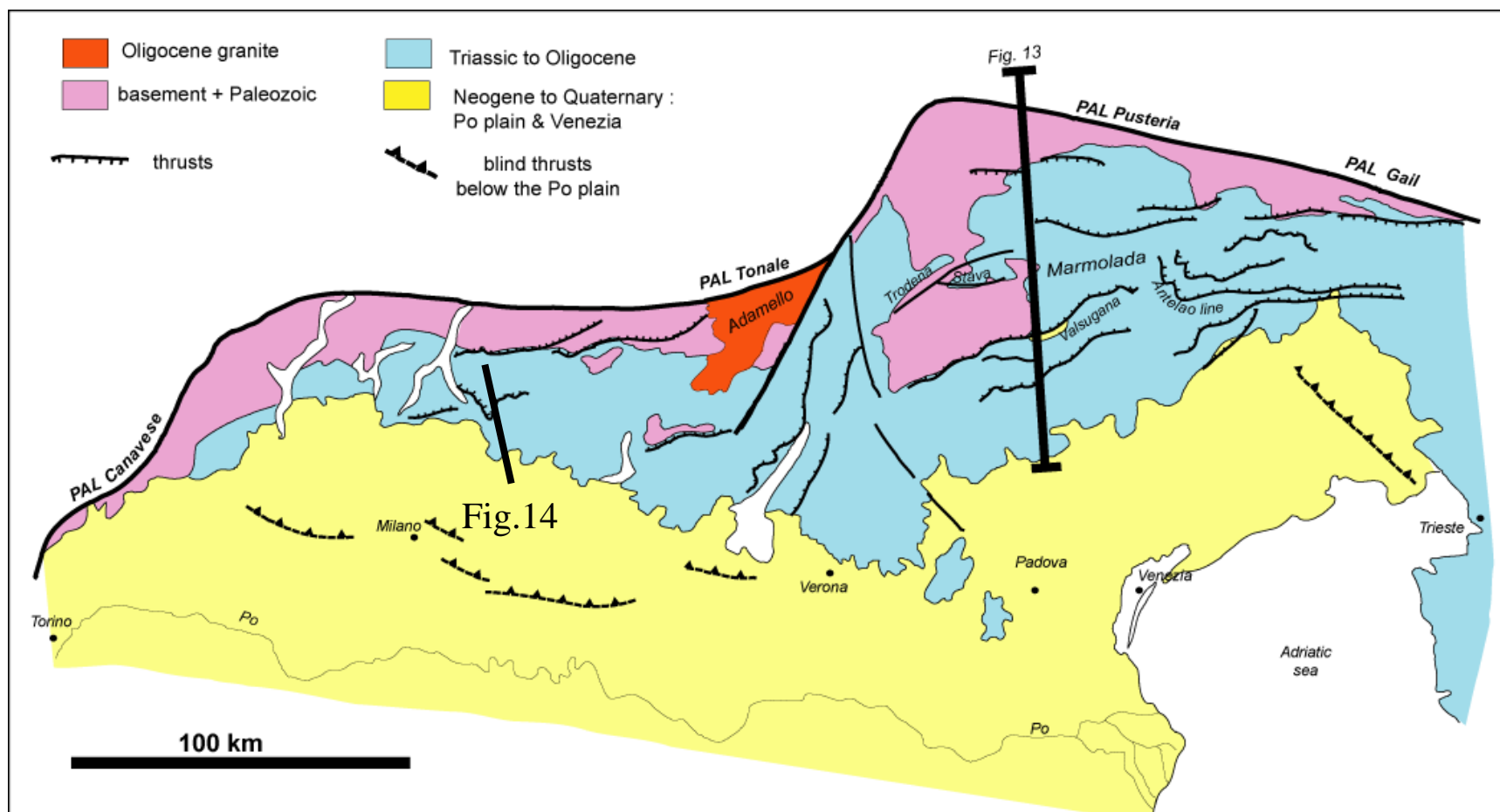
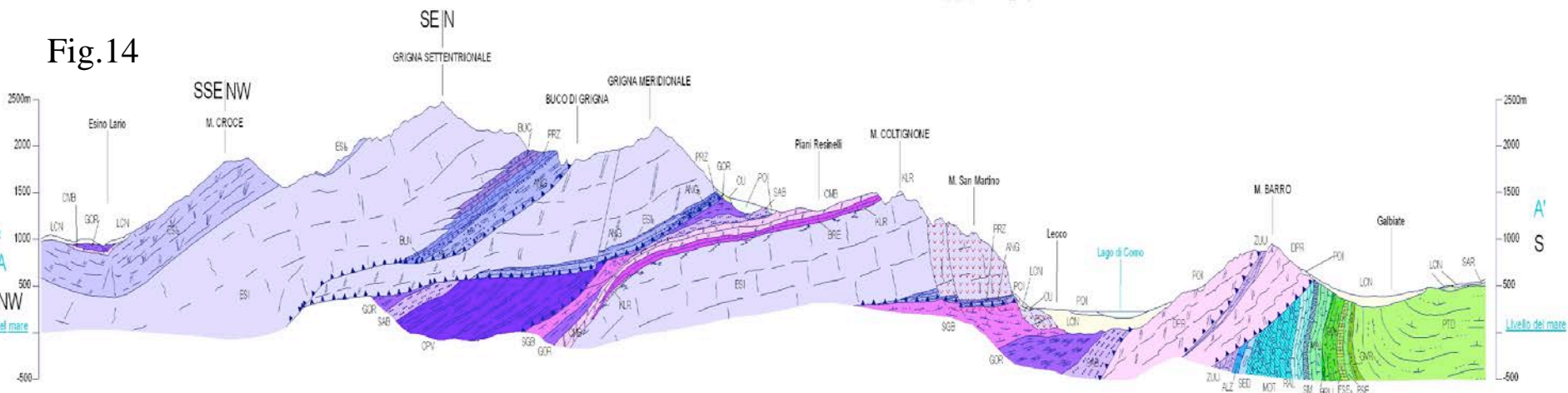
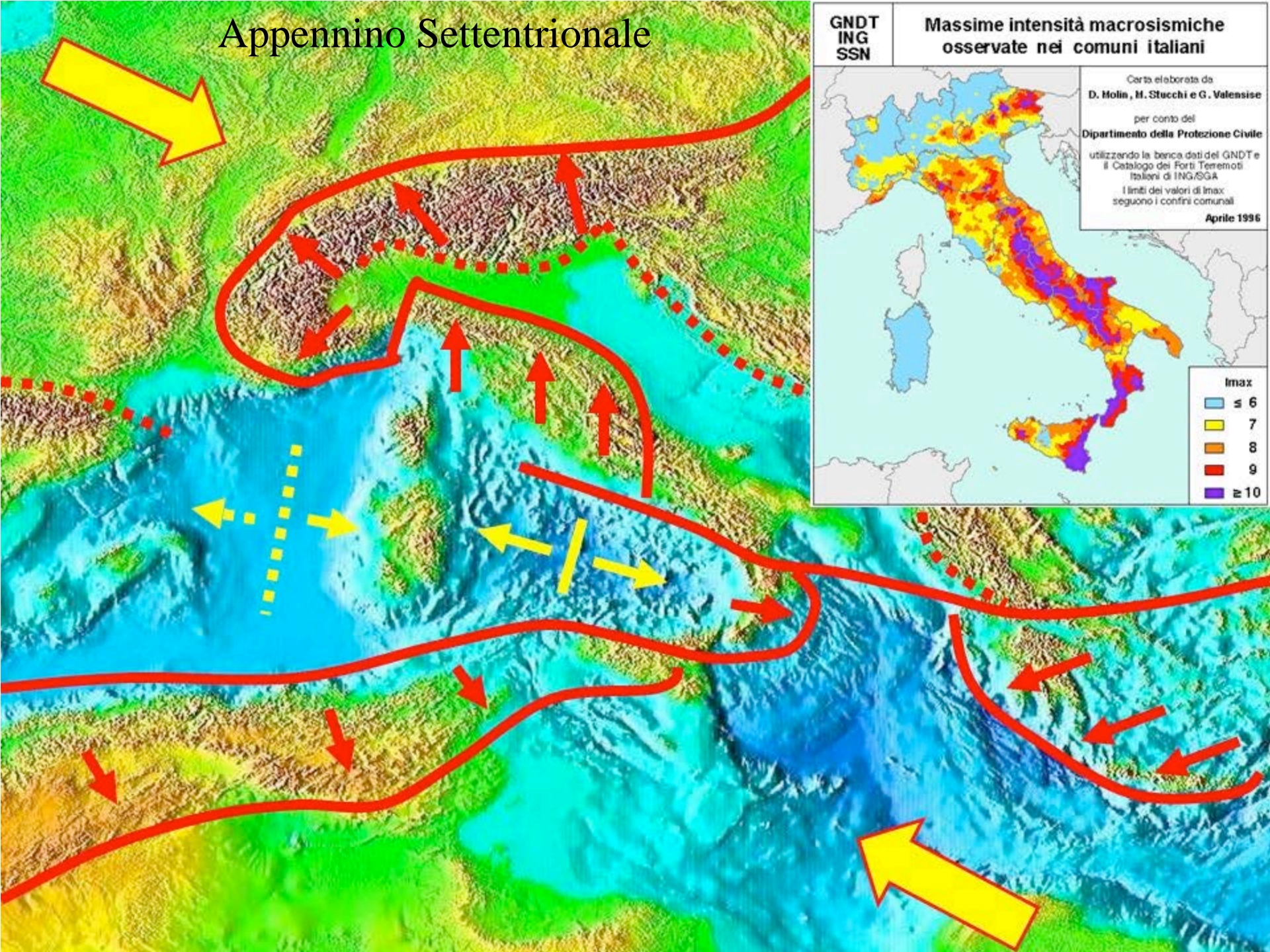


Fig.14



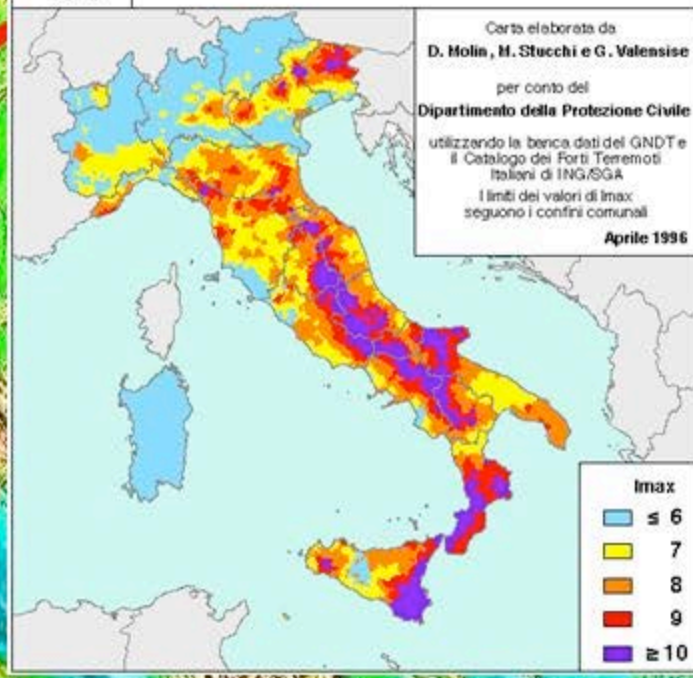
Appennino Settentrionale



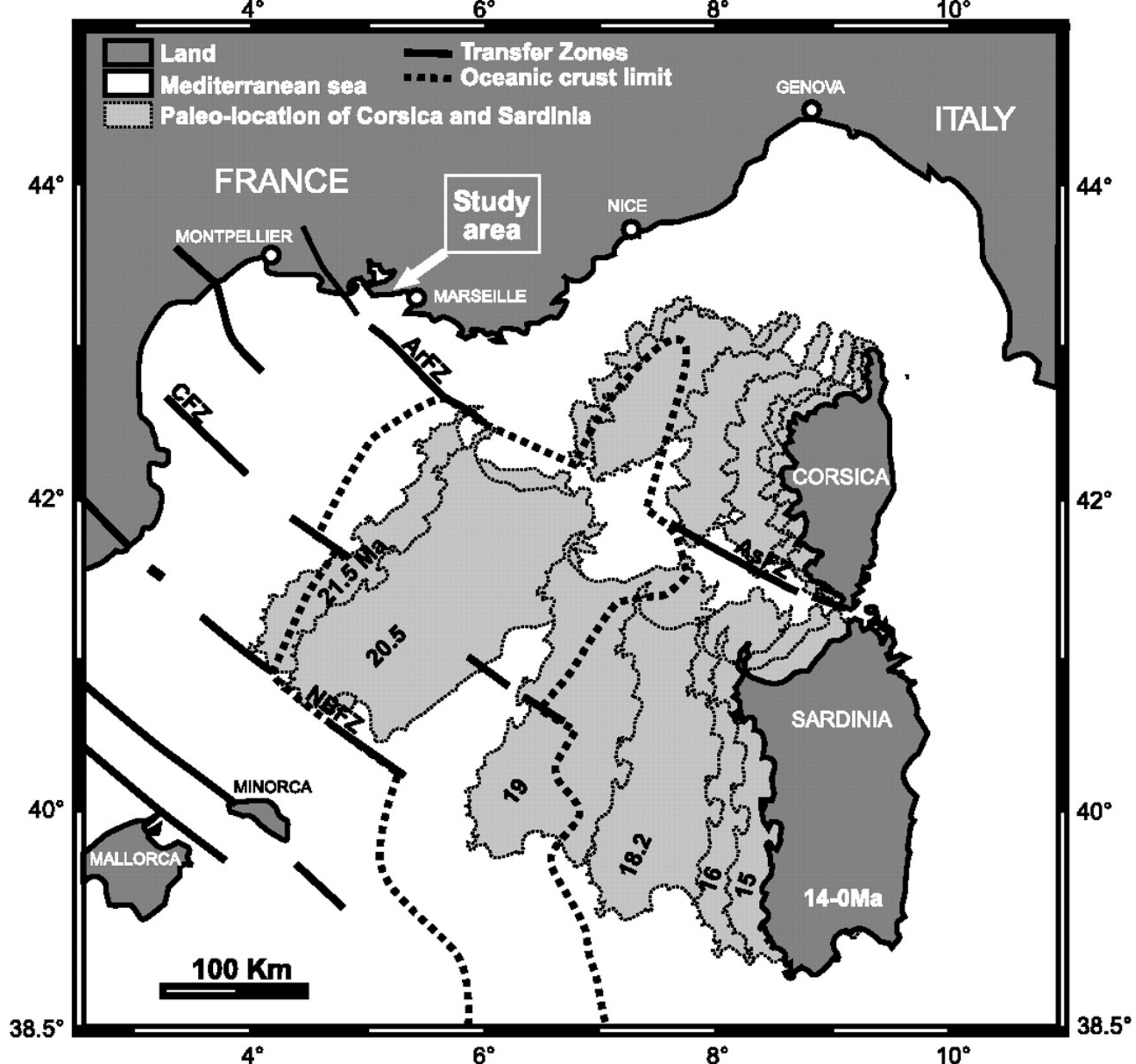
GNDT
ING
SSN

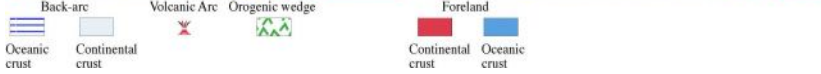
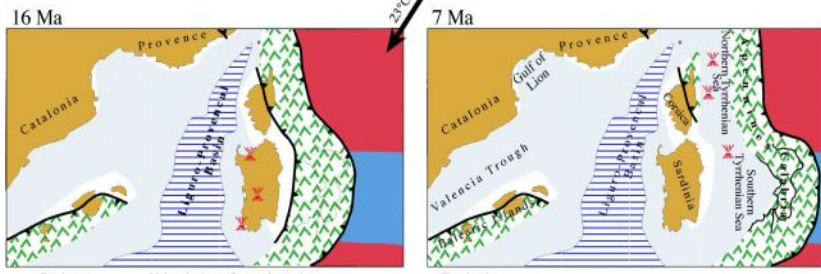
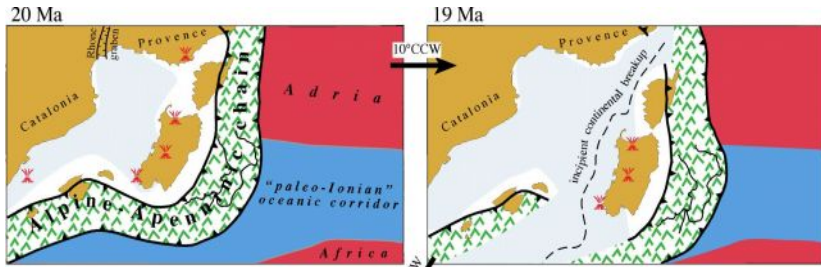
Massime intensità macrosismiche
osservate nei comuni italiani

Carta elaborata da
D. Molin, M. Stucchi e G. Valensise
per conto del
Dipartimento della Protezione Civile
utilizzando le banche dati del GNDT e
il Catalogo dei Forti Terremoti
Italiani di ING/SSN
I limiti dei valori di I_{max}
segono i confini comunali
Aprile 1996

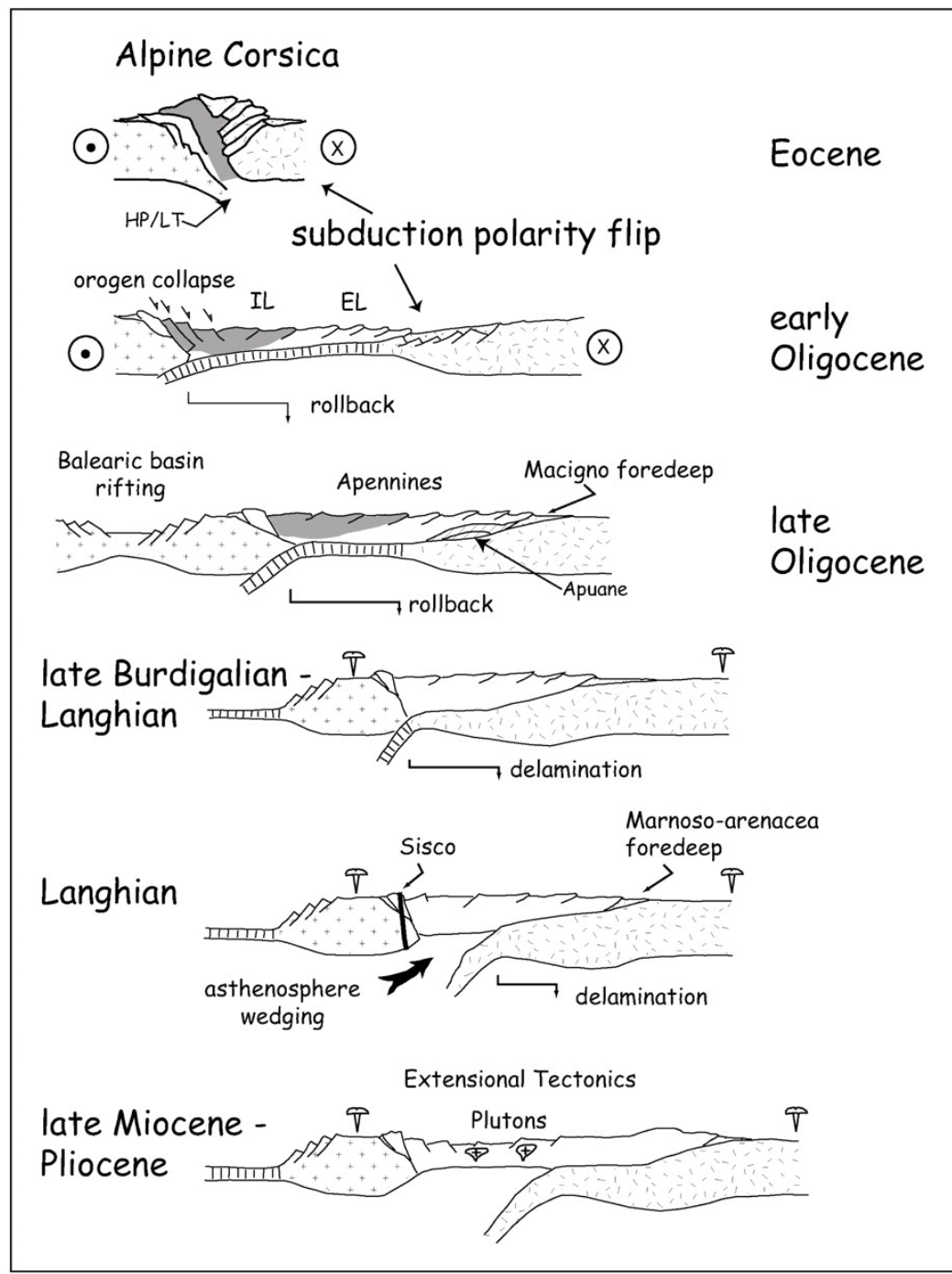


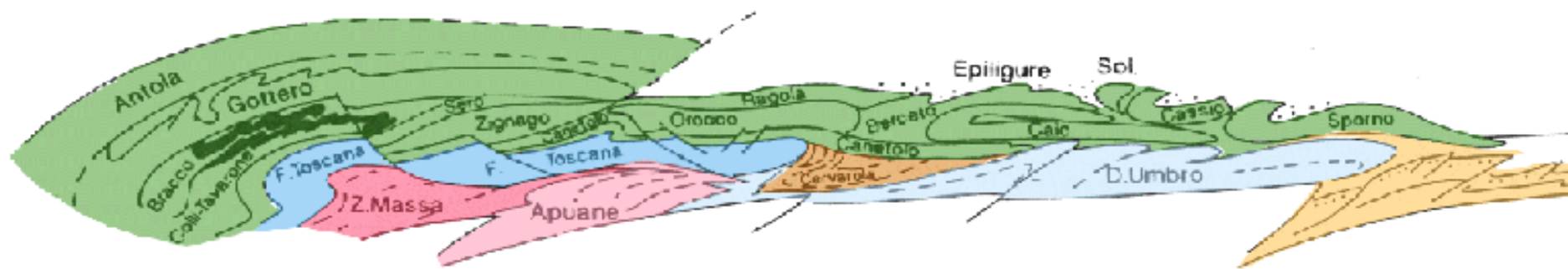
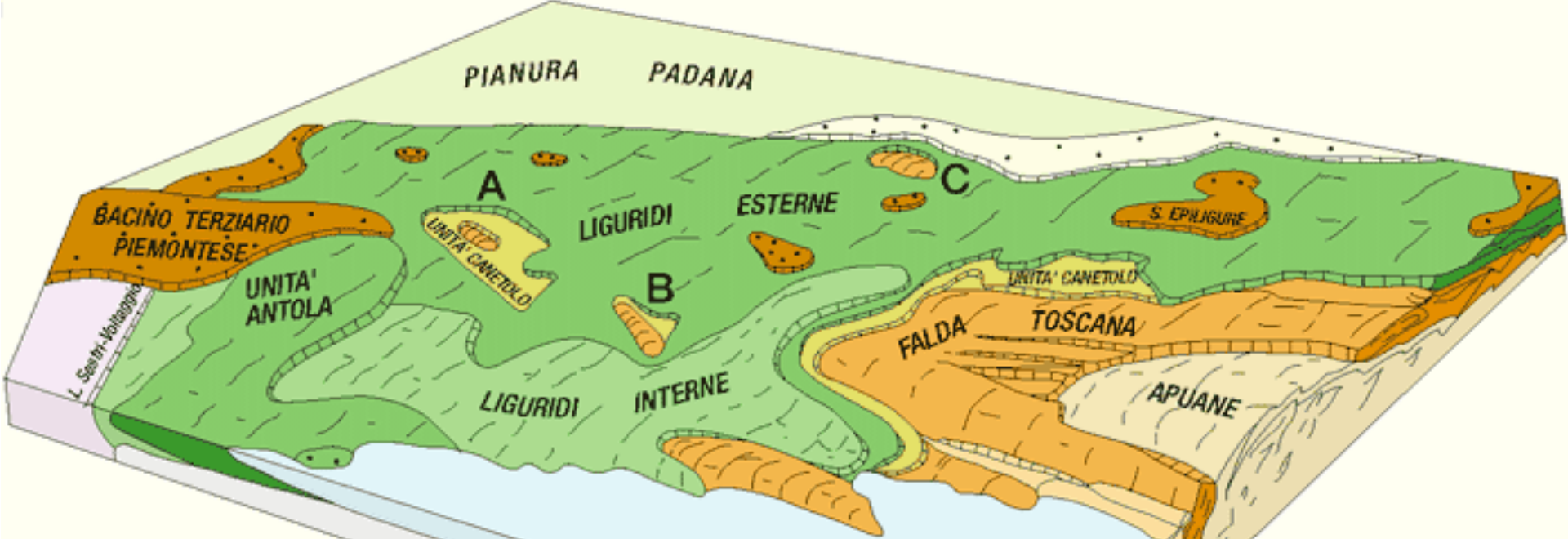
I_{max}
≤ 6
7
8
9
≥ 10





PERIOD	EPOCH	AGE	PICKS (Ma)
NEOGENE	HOLOCENE		0.01
	PLEISTOCENE*	CALABRIAN	1.8
		GELASIAN	2.6
		PIACENZIAN	3.6
	MIOCENE	ZANCLEAN	5.3
		MESSINIAN	7.2
		TORTONIAN	
		SERRAVALLIAN	11.6
		LANGHIAN	13.8
		BURDIGALIAN	16.0
AQUITANIAN		20.4	
OLIGOCENE		23.0	
	CHATTIAN	28.1	
	RUPELIAN	33.9	





- | | | | | | | | |
|--|-----------------|---|---------------|--|------------------|---|------------------------|
|  | UNITA' DI MASSA |  | FALDA TOSCANA |  | CERVAROLA |  | LIGURIDI E SUBLIGURIDI |
|  | APUANE |  | UMBRIA |  | AVANFOSSA PADANA | | |

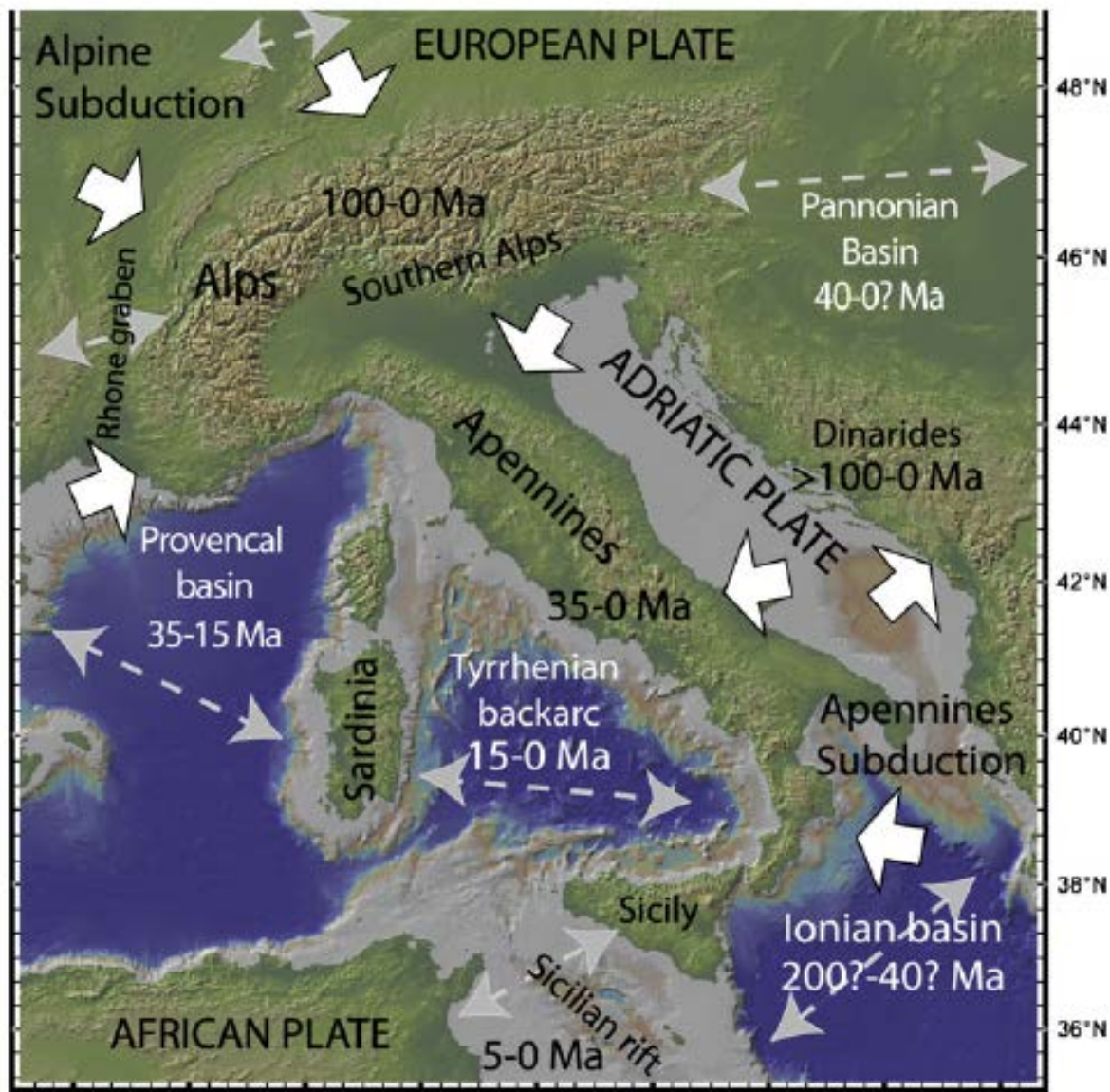
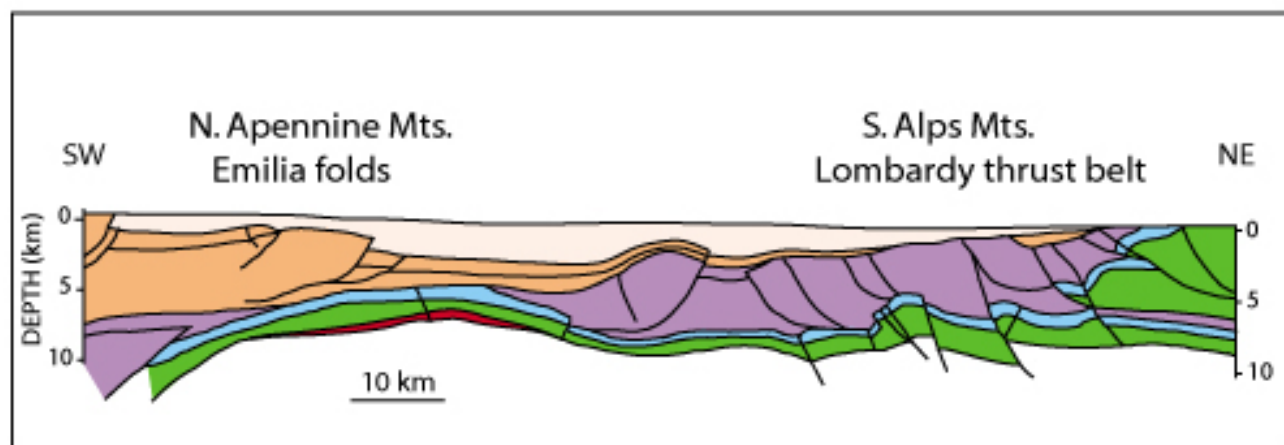


Fig. 1. The Alps and Apennines are the two belts in the hangingwall of two opposite subduction zones. In the Alps the European plate subducted beneath the Adriatic plate, whereas in the Apennines the Adriatic, Ionian, Sicily and African plates subducted "westerly", retreating from the European upper plate. White arrows: subduction directions. Ma: million years life of the tectonic feature. The gray arrows show the main rifting directions.

Figure 3a. Western onshore structural cross section, Po Basin Province, Northern Italy (after Anelli and others, 1996).

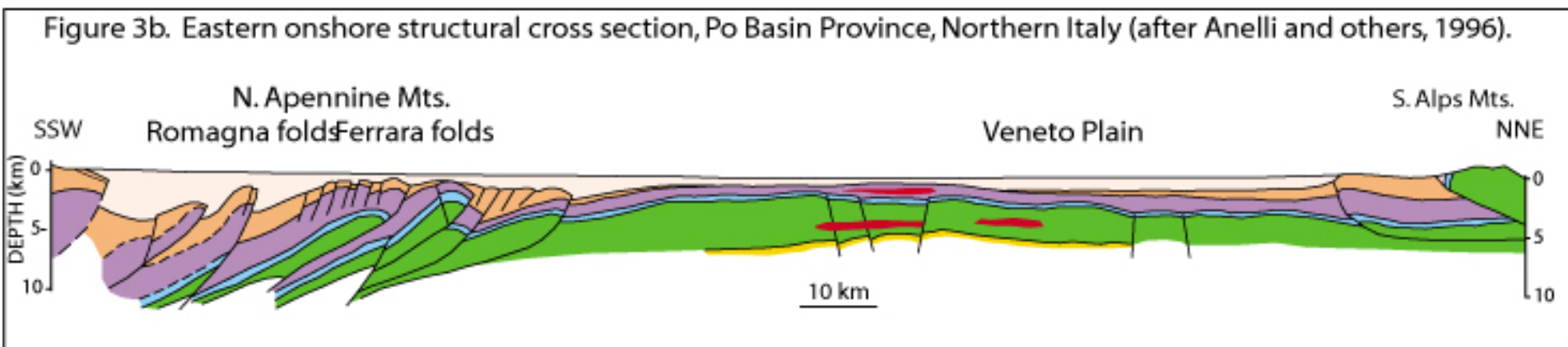


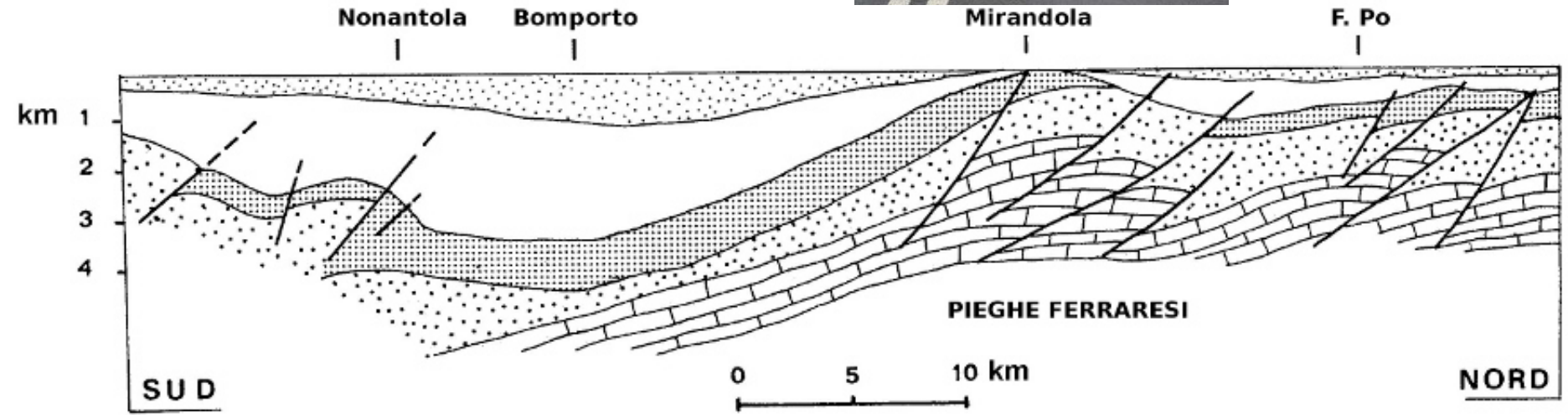
LEGEND (Figures 3a & 3b)

- Middle Pliocene - Quaternary
- Latest Miocene - Early Pliocene
- Paleogene - Late Miocene
- Triassic - Cretaceous deep marine
- Triassic - Cretaceous shallow marine
- Permian - Early Triassic siliciclastics
- Volcanics

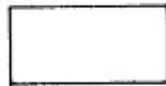
Cross section locations on Figure 1

Figure 3b. Eastern onshore structural cross section, Po Basin Province, Northern Italy (after Anelli and others, 1996).

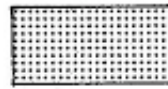




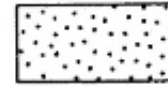
1



2



3

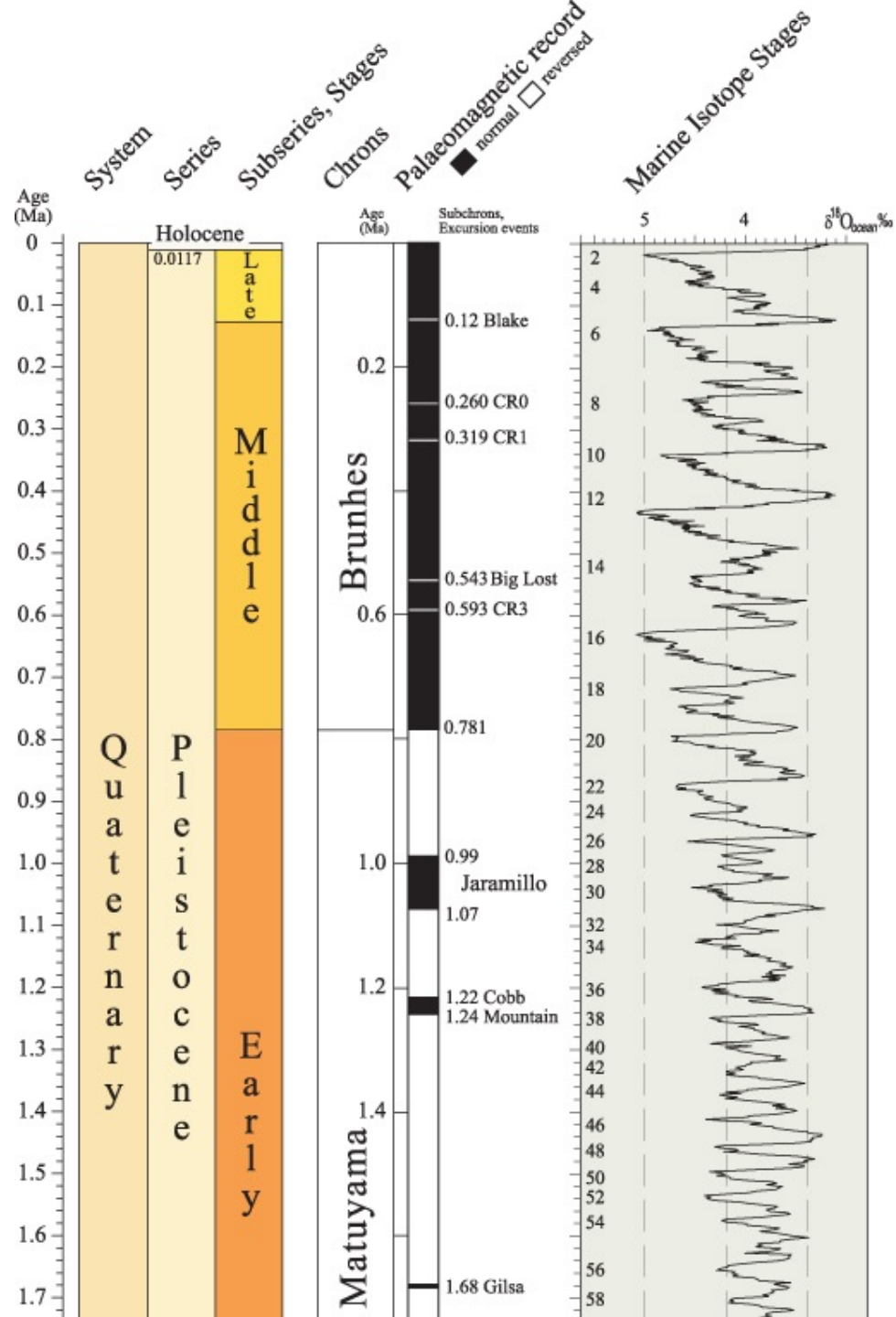


4

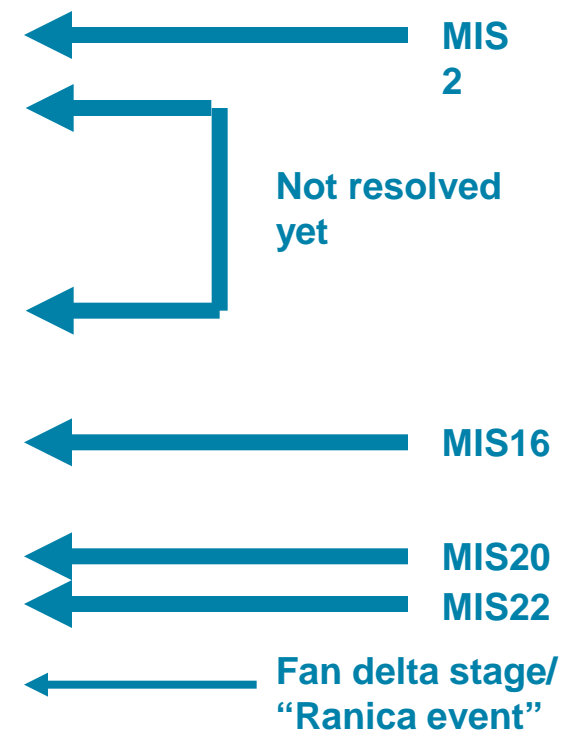


5

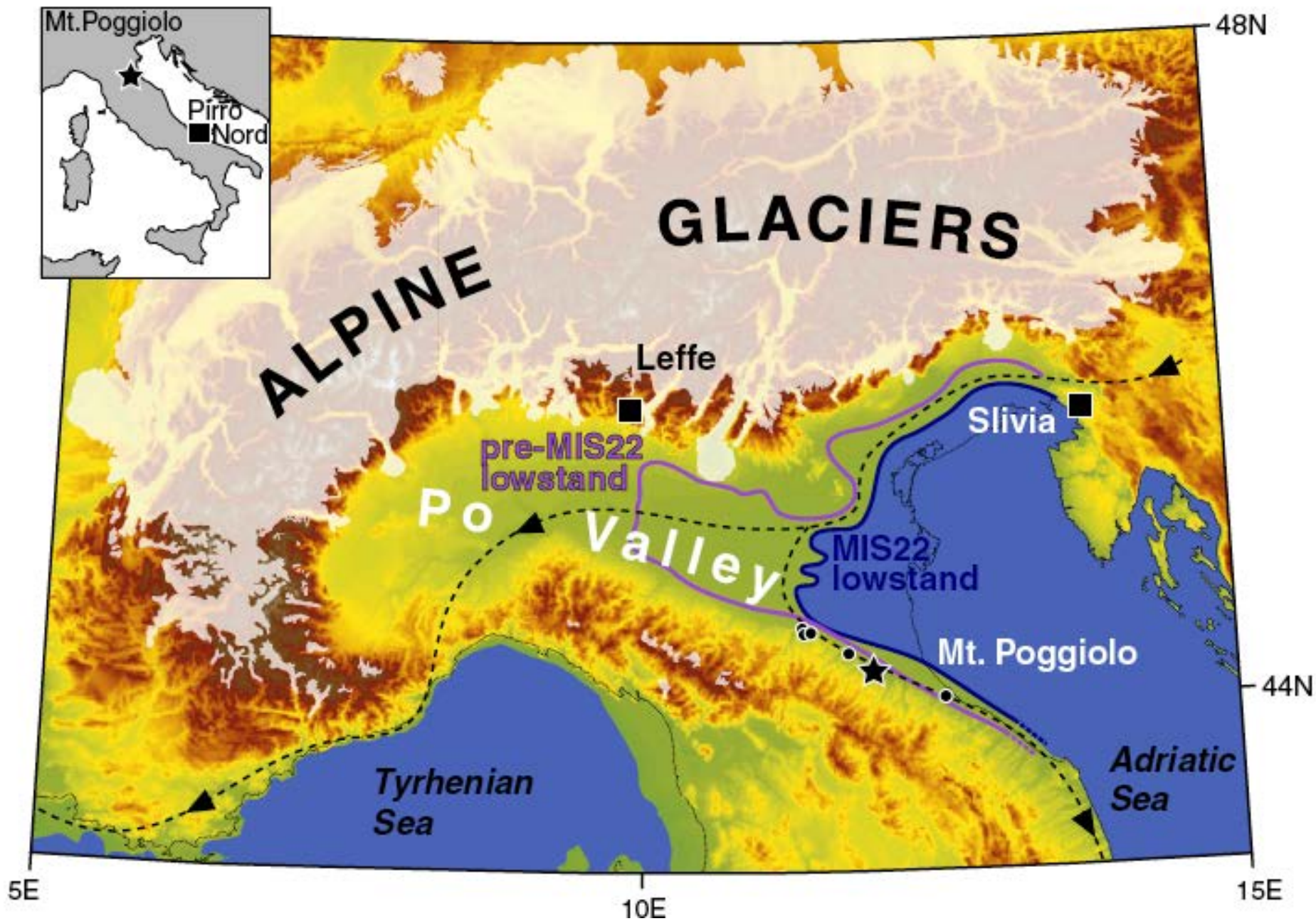
Legenda: 1) depositi alluvionali (Pleistocene-Olocene); 2) sedimenti marini del Pliocene sup.-Pleistocene; 3) sedimenti marini del Pliocene inf.; 4) sedimenti marini del Paleogene-Miocene; 5) formazioni marnoso-calcaree marine del Mesozoico costituenti le "Pieghe ferraresi".



Major stratigraphic events at the Southern Alps



Pleistocene: glaciazioni





PERGAMON

Quaternary Science Reviews 21 (2002) 1719–1727



QSR

Emergence of Venice during the Pleistocene

Dennis V. Kent^{a,b,*}, Domenico Rio^c, Francesco Massari^c, George Kukla^b, Luca Lanci^a

^a *Department of Geological Sciences, Rutgers University, Piscataway, NJ 08854, USA*

^b *Lamont-Doherty Earth Observatory, Palisades, NY 10964, USA*

^c *Dipartimento di Geologia, Università di Padova, Via Giotto 1, 35137 Padova, Italy*

Received 1 May 2001; accepted 29 September 2001

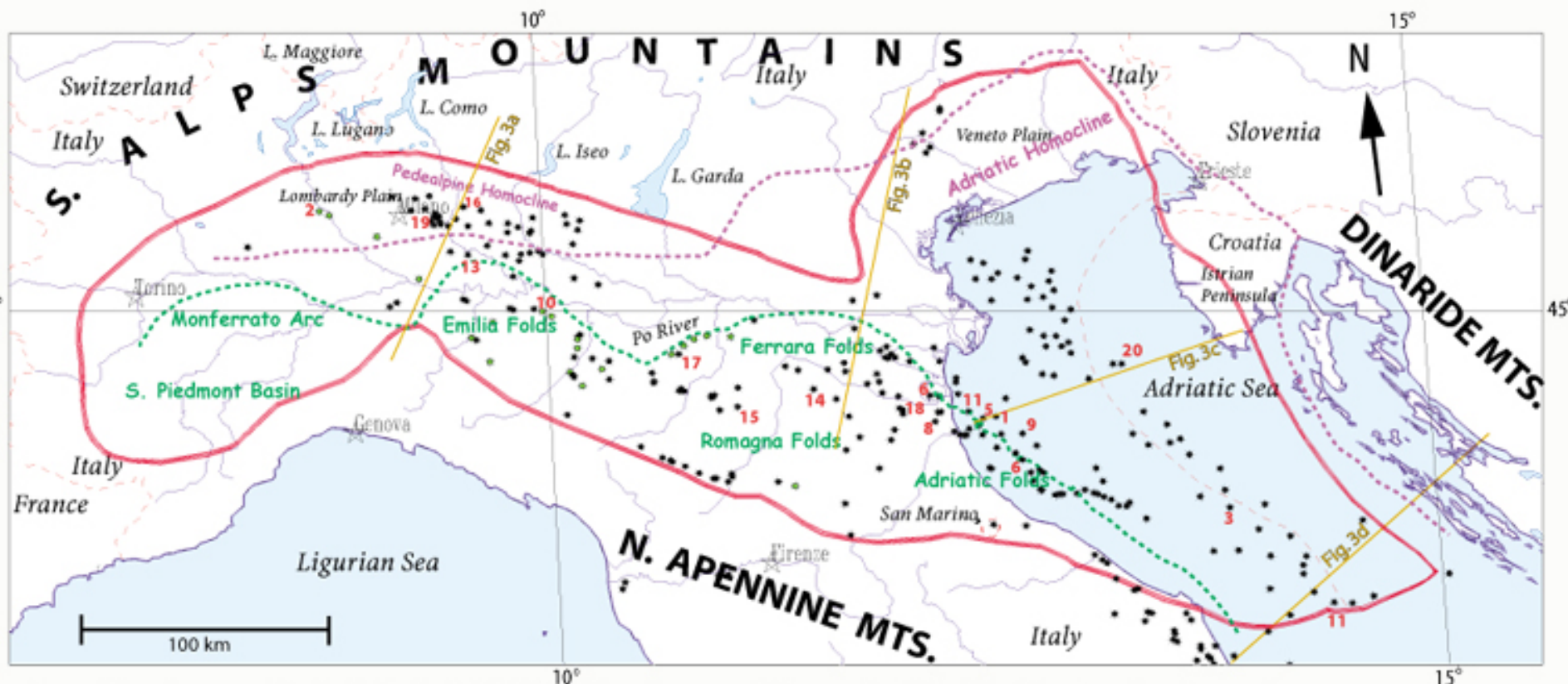


Figure 1. Location map of Po Basin Province (#4060), its fields and geographic features. Italy-Croatia offshore boundary is approximate.

EXPLANATION

- Rivers
- Shoreline
- Po Province boundary
- Country Boundary

- Field Centerpoints (• oil production in province)
(1-20 Top 20 fields by reserves, #6 and #11 have 2 fields each)
- Approximate extent of S. Alps (south-verging) thrusting (Anelli and others, 1996)
- Approximate extent of N. Apennine north-verging (Pieri, 1992)

Projection: Robinson. Central meridian: 0



GeoMol



Assessing subsurface potentials of the Alpine Foreland Basins
for sustainable planning and use of natural resources



grazie