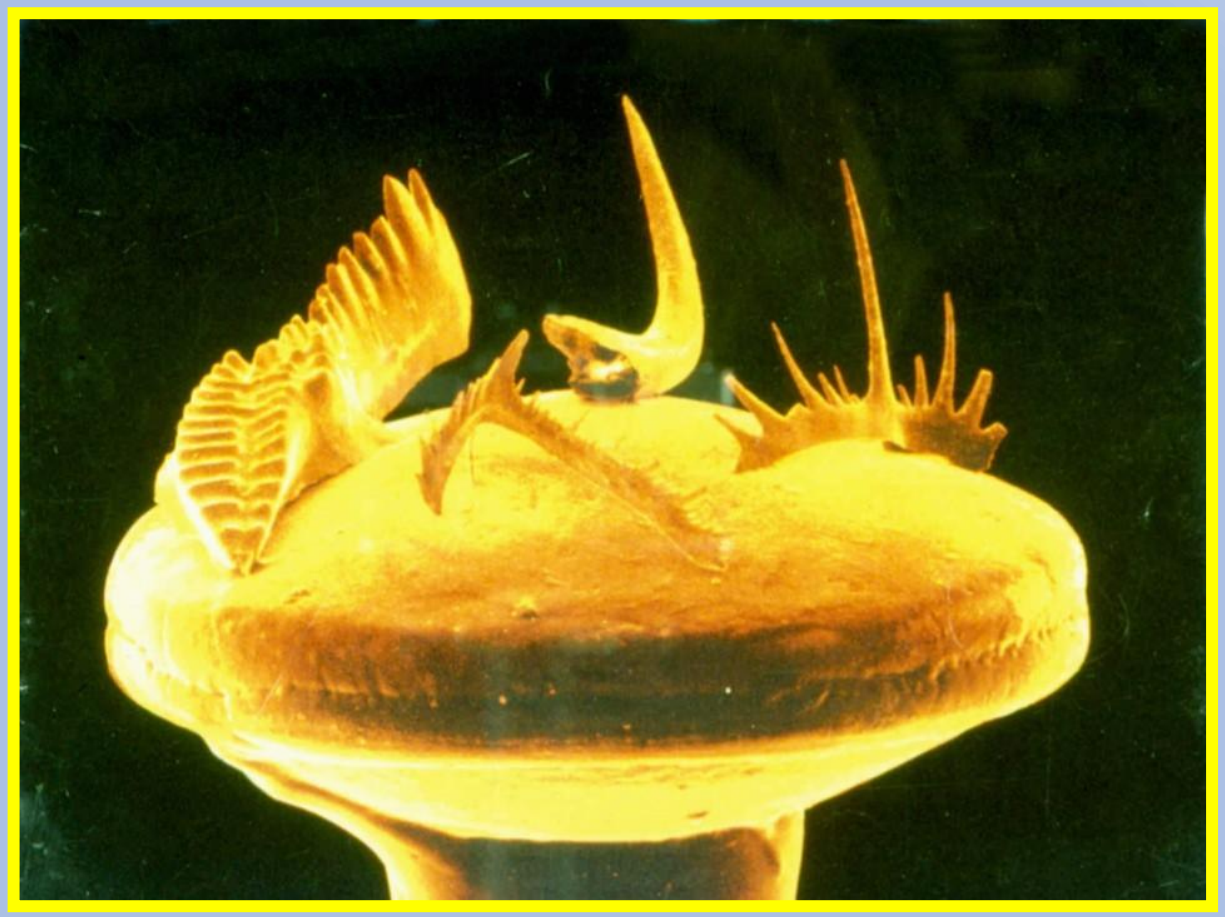
Università di Trieste
Corso di Laurea Magistrale in Geoscienze
Curriculum Esplorazione Geologica
A.A. 2025/26

FOSSILI UTILI IN BIOSTRATIGRAFIA

Conodonti

Conodonti

I Conodonti sono denti microscopici di organismi estinti.
Sono fatti di apatite e hanno dimensioni comprese tra 30 e 1500 µm (la maggior parte misura 150-300 µm).



Distribuzione stratigrafica

Cambriano sup. - Triassico

Composizione mineralogica

Apatite

Struttura del dente

Cartilagine basale

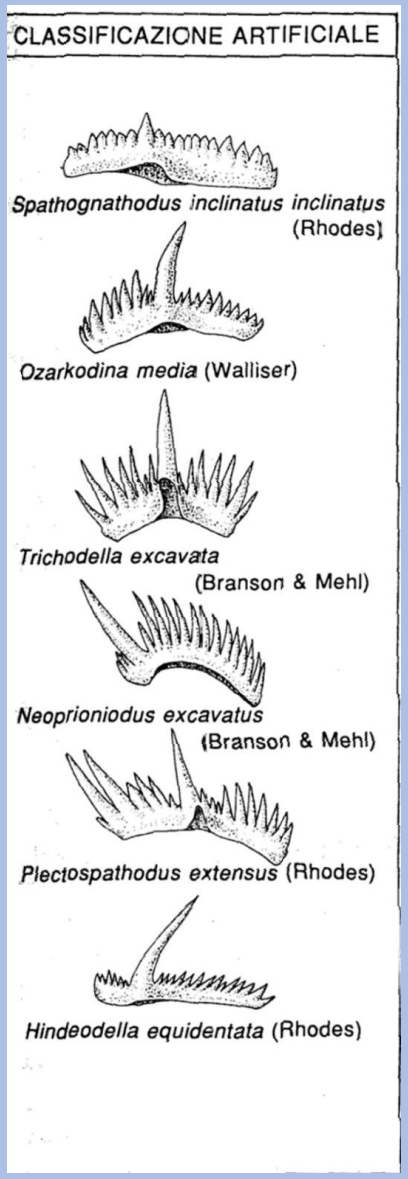
Smalto

Dentina

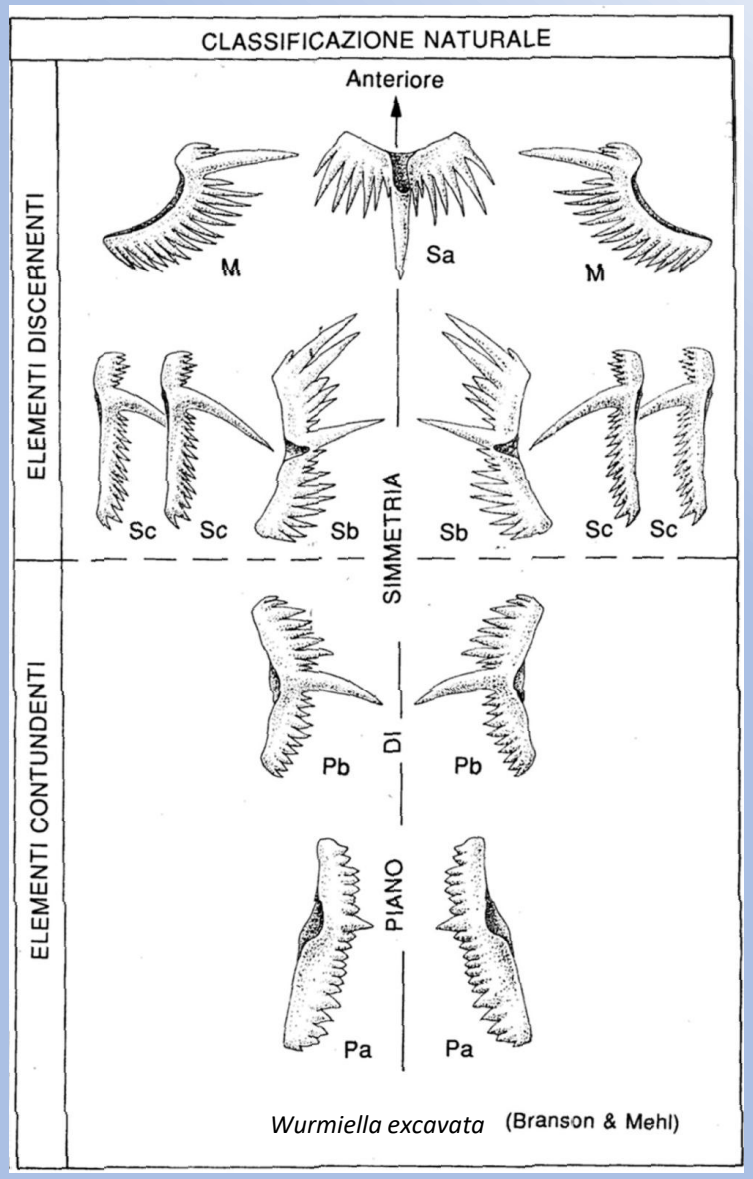


Conodonti

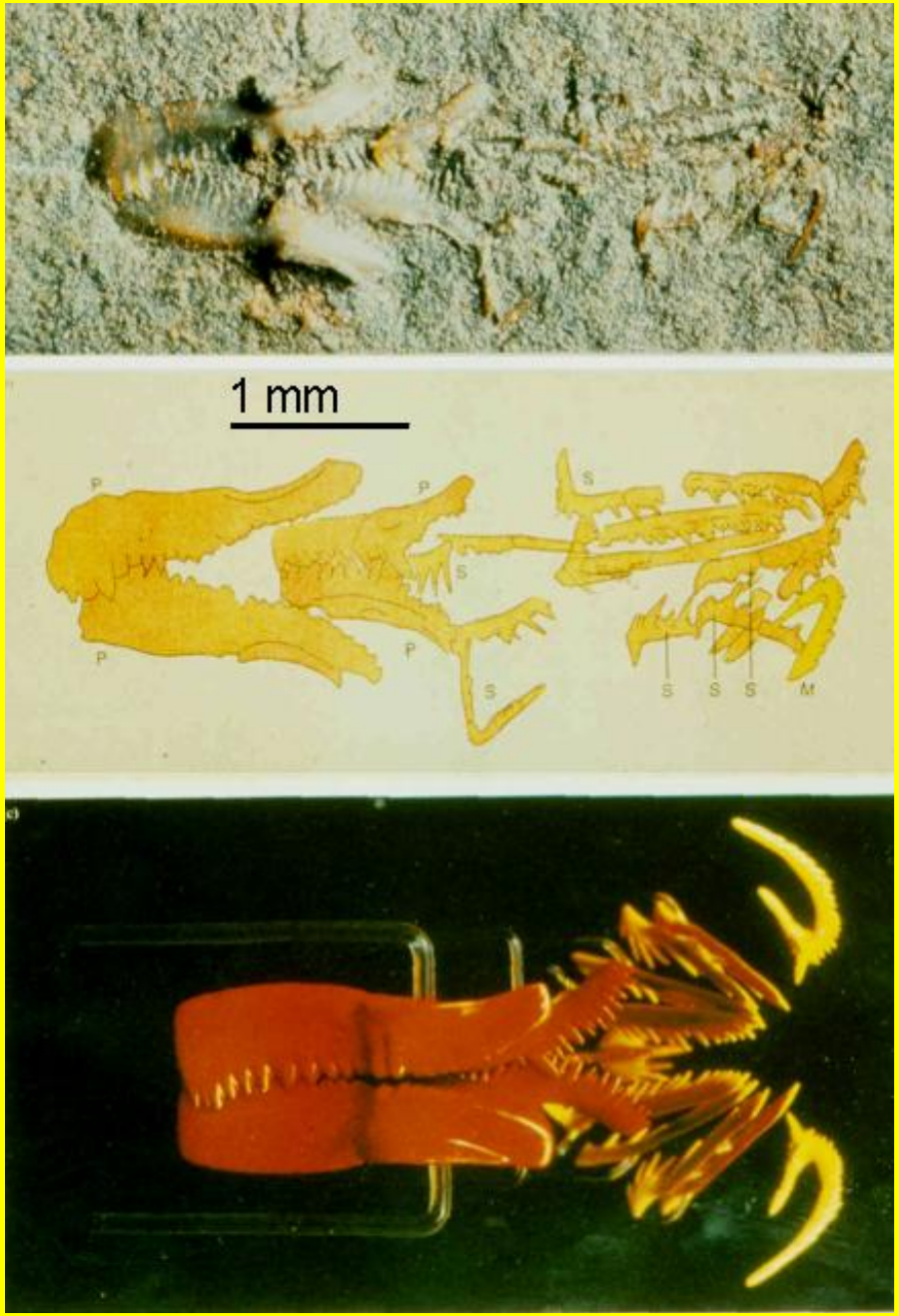
MORFOELEMENTI

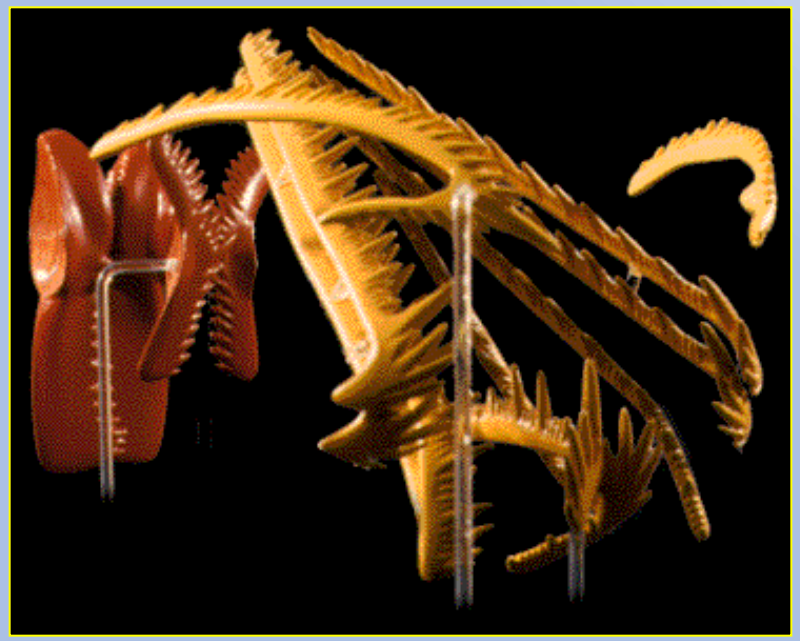


APPARATO



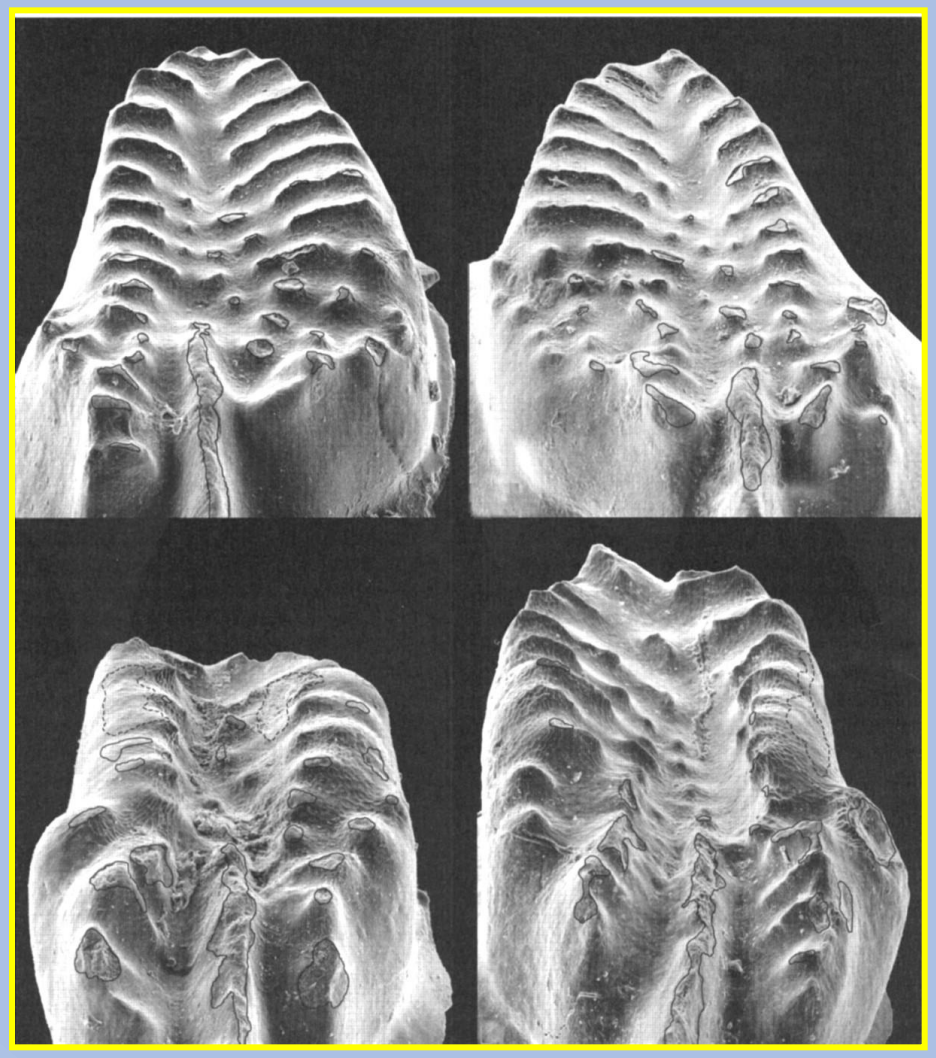
Conodonti





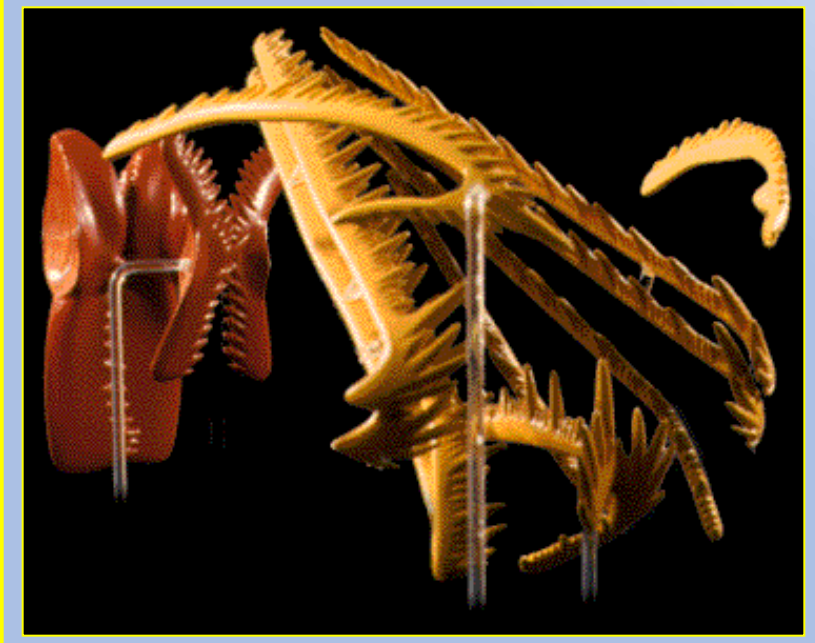
Idiognathodus sp.

Carbonifero sup. - USA



Purnell et al. (1998)

Segni di usura sulla superficie di elementi P1 (sinistri e destri).



Idiognathodus sp.

Carbonifero sup. - USA

Conodonti

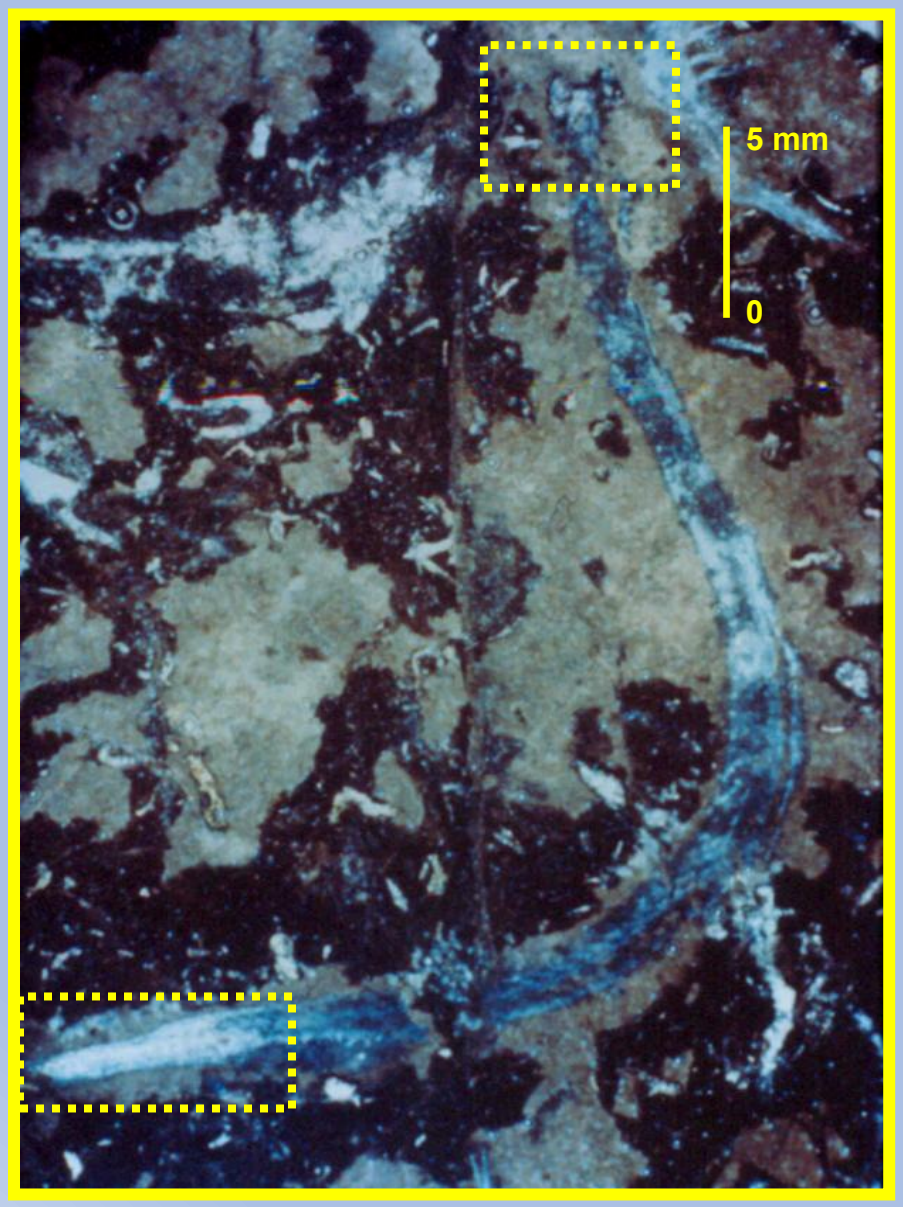
COELENTERATA	Bischoff (1973)
TENTACULATA	Lindström (1973), Conway Morris (1976)
ARTHROPODA	Harley (1861), Barrande *et al*. (1867)
MOLLUSCA	Owen (1861), Owen (1967), Morse (1975), Stimpson (1875), James (1894), Woodward (1898), Loomis (1936), Pilsbury (1937), Tiller & Cuif (1986)
ANELLIDA	Owen (1861), Owen (1967), Ulrich (1878), Zittel & Rohon (1886), Woodward (1898), Scott (1934), Dubois (1934), Rhodes (1952)
ASCHELMINTHES	Denham (1944), Missarzhevsky (1973), Hofker (1974)
CHETOGNATHA	Rietschel (1973), Szaniawski (1982)
GNATHOSTOMULIDA	Durden (1969), Ochielli & Cailleux (1969), Rodgers (1969)
PLANTS	Fahlbusch (1964), Nease (1969)
CHORDATA	Pander (1856), Newberry (1875), Agassiz (1875), Hinde (1879), Rolle (1882), Clarke (1885), Bryant (1921), MacFarlane (1923), Ulrich & Bassler (1926), Holmes (1928), Kirk (1929), Stauffer & Plummer (1932), Schmidt (1934), Branson & Mehl (1936), Delmanet (1939), Beckmann (1949), Schmidt (1950), Gross (1954), Rhodes (1954), Rhodes & Wingard (1957), Schmidt (1964), Halstaed (1968), Scott (1969), Melton & Scott (1973), Aldridge *et al.* (1986), Nowlan & Carlisle (1987), Kreisa *et al.* (1990), Aldridge *et al.* (1993), …
PHYLUM INDIPENDENTE	Clark (1981), Briggs *et al.* (1983), Gould (1983), Clark (1987), Sweet (1988)

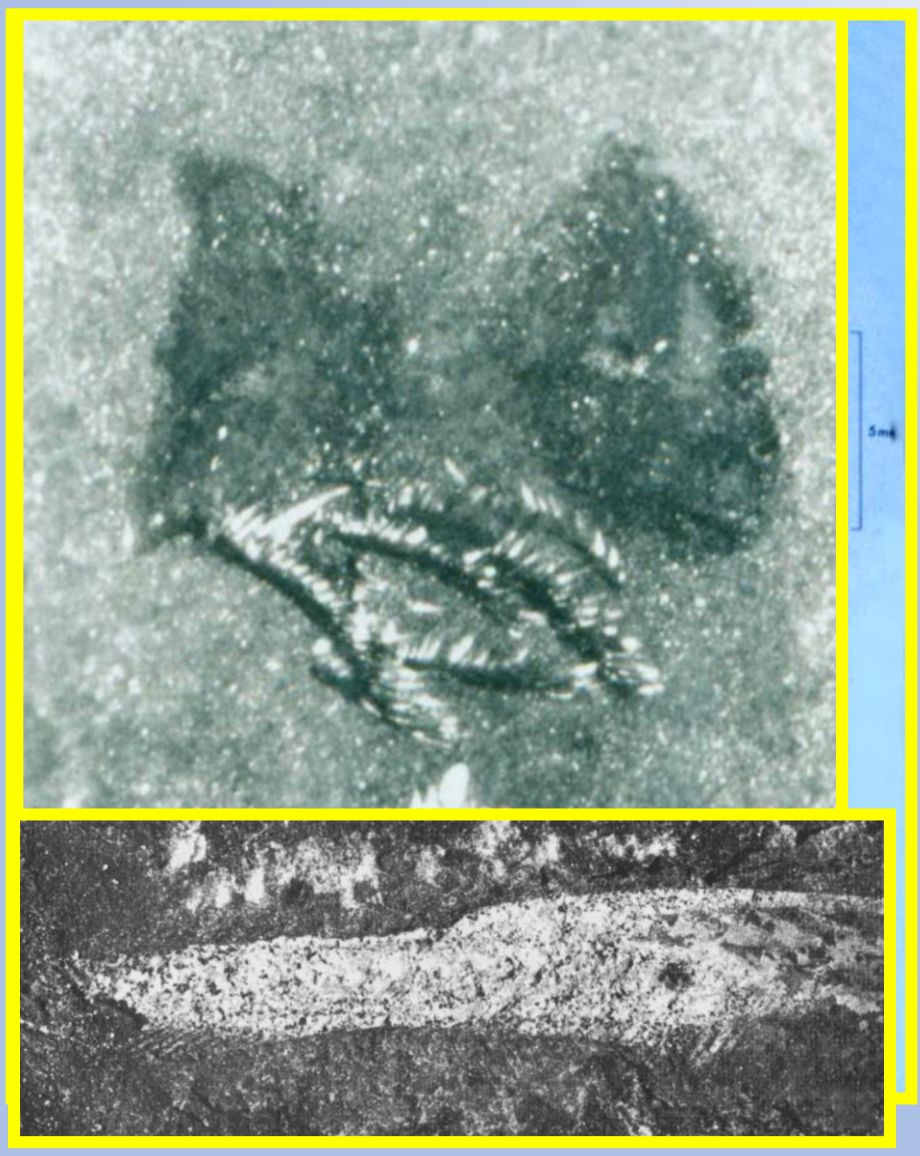
Conodonti

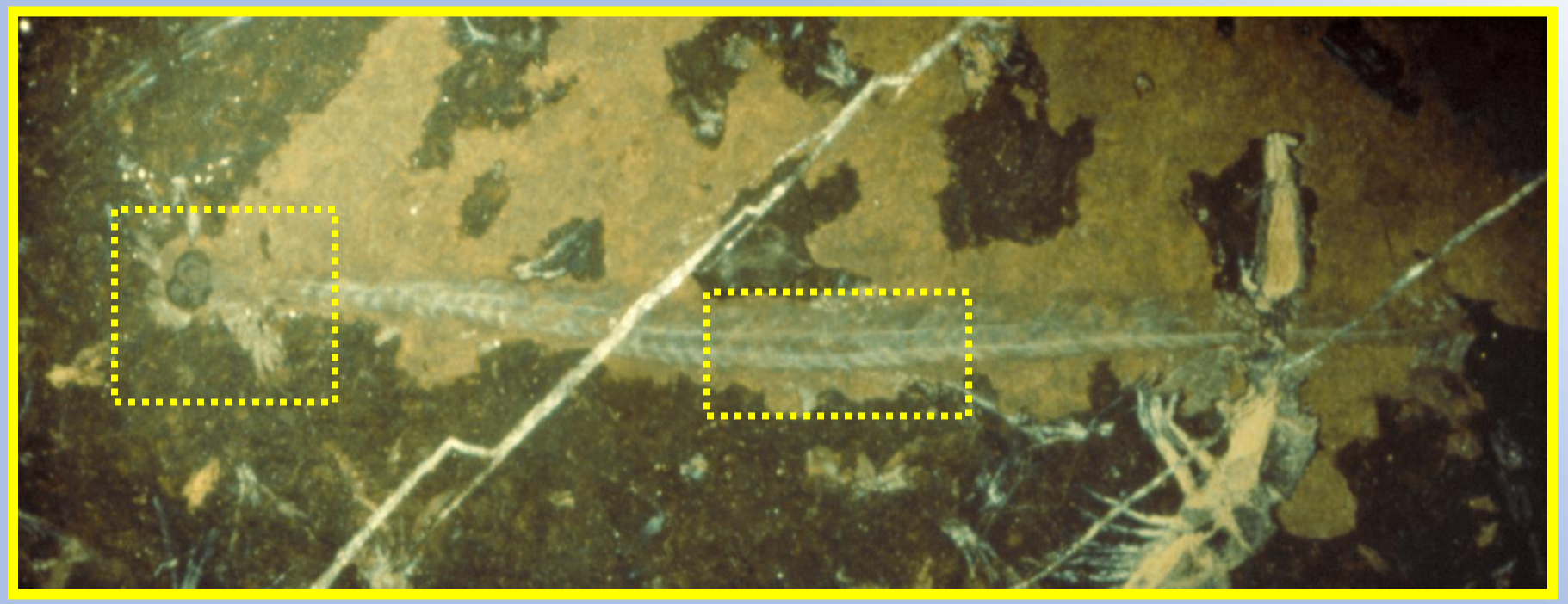


Clydagnathus windsorensis

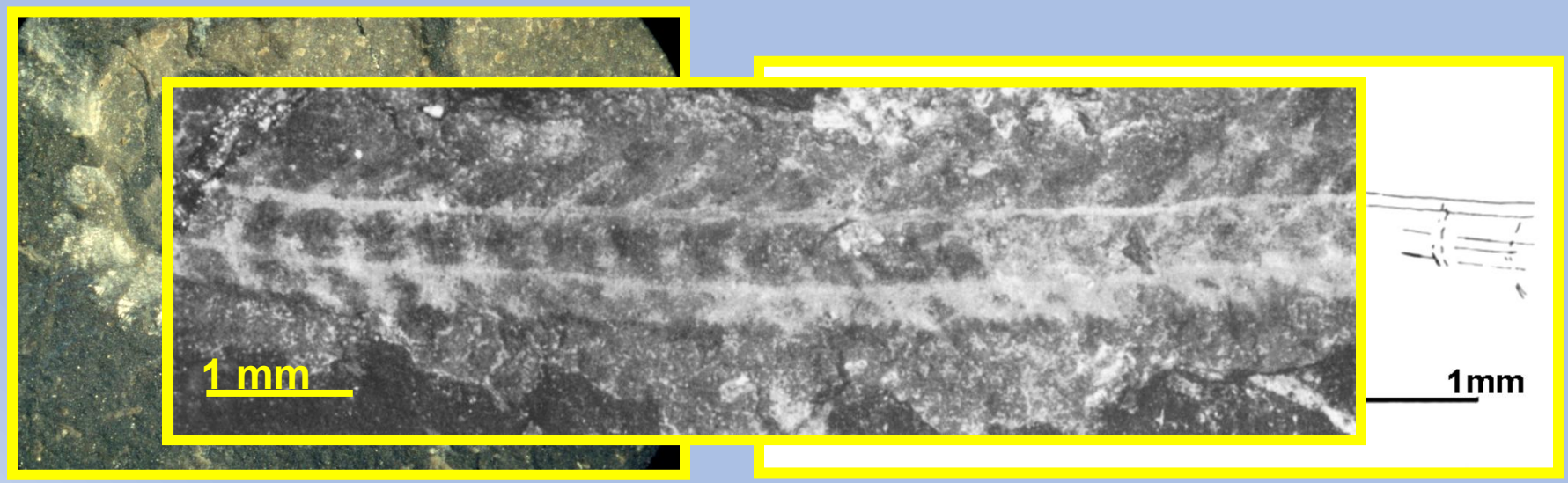
(esemplare 1) Carbonifero inf. - Scozia





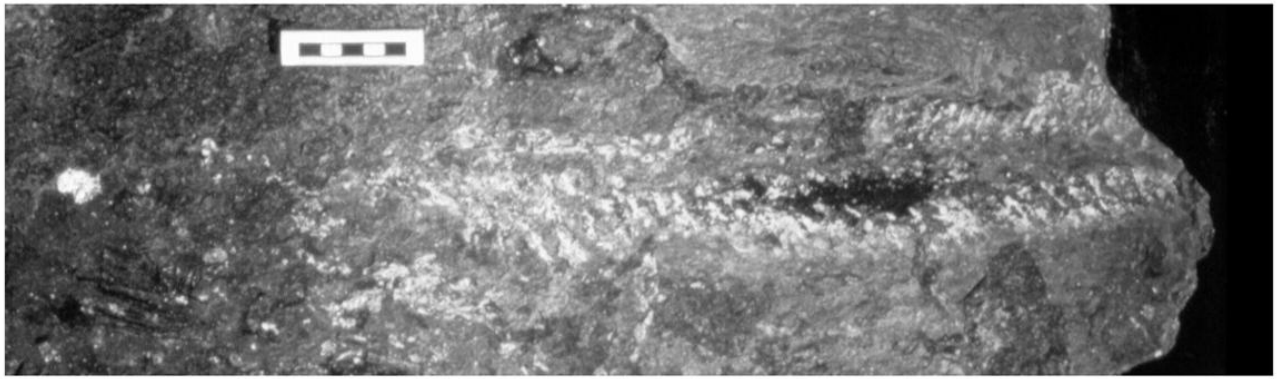


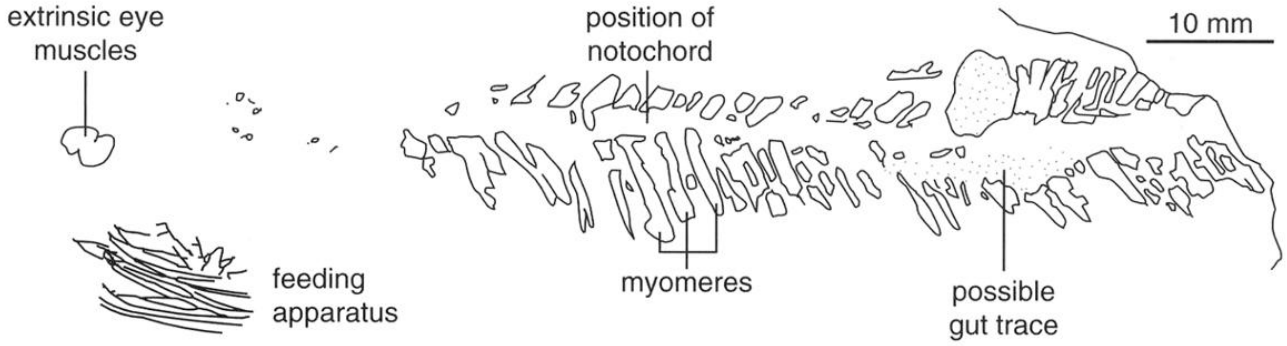
Clydagnathus windsorensis - (esemplare 5), Carbonifero inf. - Scozia

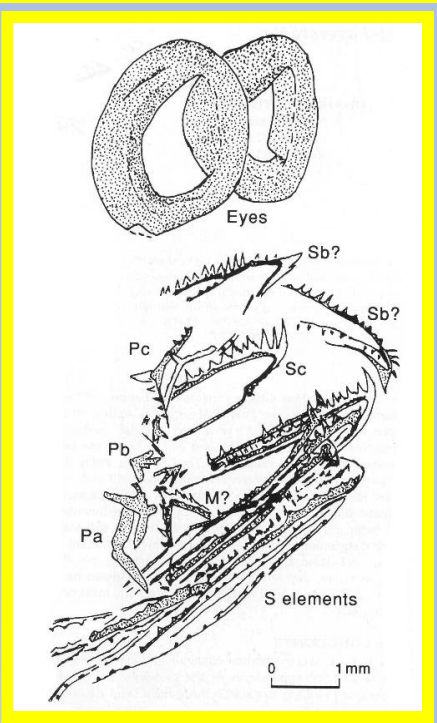


Conodonti









Promissum pulchrum

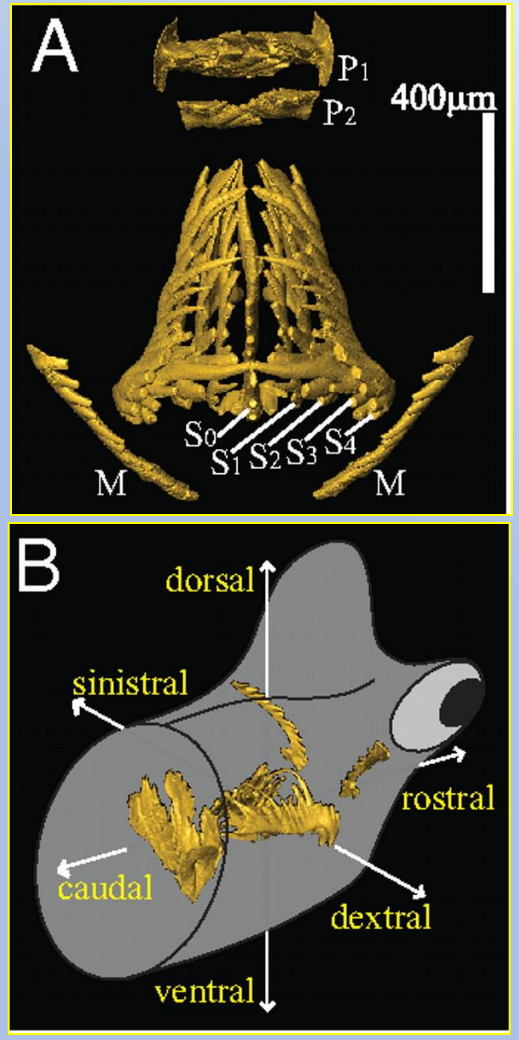
Ordoviciano Sup.

Sud Africa



Conodonti




A
P1
P2
400µm
S0
S1
S2
S3
S4
M
M
B
dorsal
sinistral
rostral
caudal
dextral
ventral

Caratteristiche dei conodonti sono:

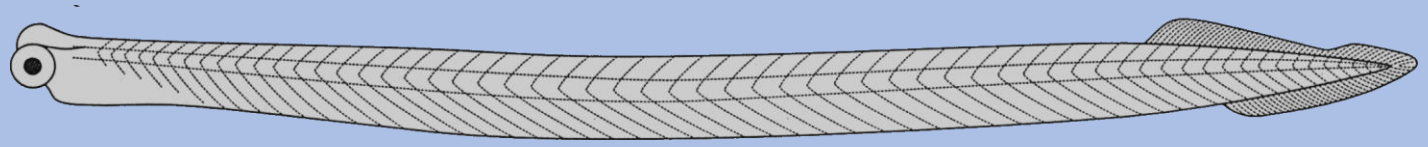
la notocorda

la muscolatura divisa in miomeri a forma di V

la coda con una pinna;

la simmetria bilaterale del corpo

la composizione e istiologia delle parti dure mineralizzate



CORDATI

Il *phylum* Chordata comprende tre *subphyla*:

1. Urochordata (Tunicata)
2. Cephalochordata
3. Craniata (Vertebrata)

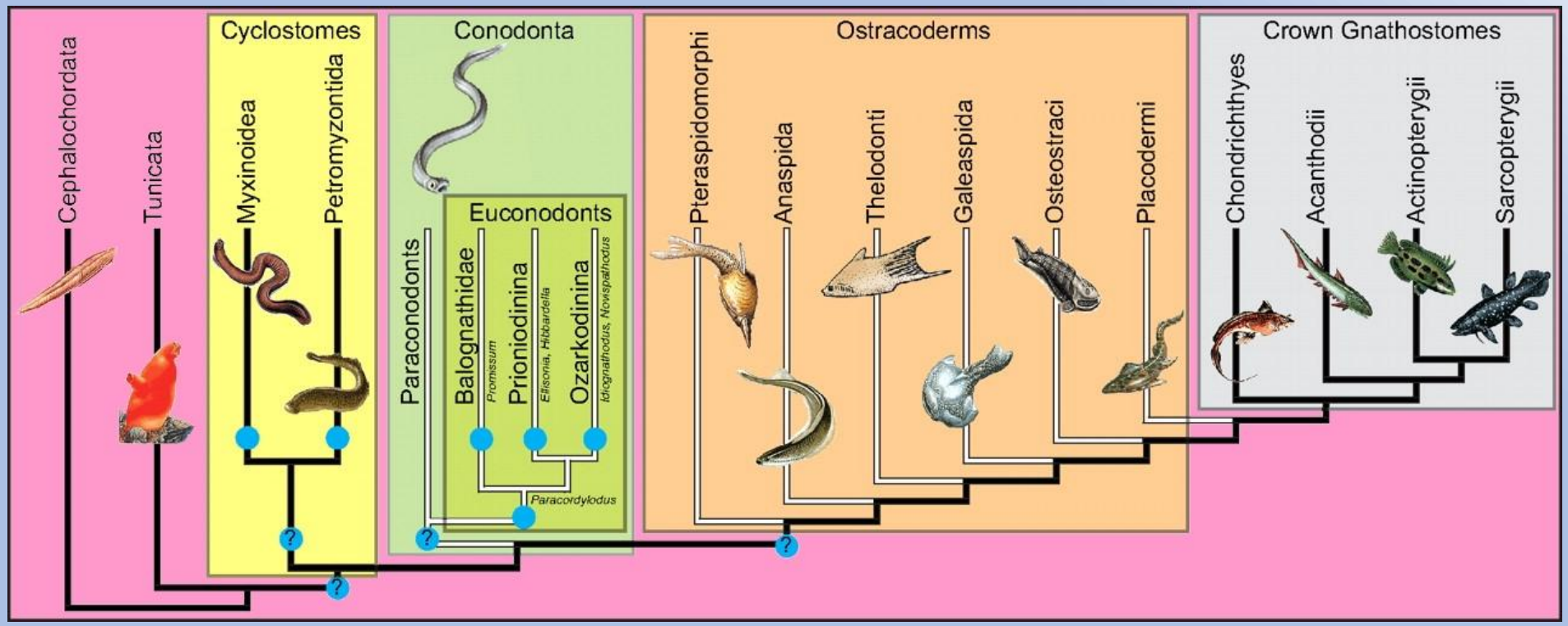
I Vertebrati si dividono in:

1. Agnati
2. Gnatostomi

Secondo la presenza o meno di mandibole e mascelle

I CONODONTI sono AGNATI

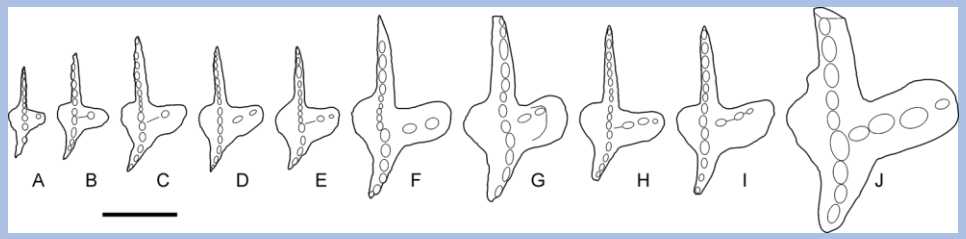
Filogenesi



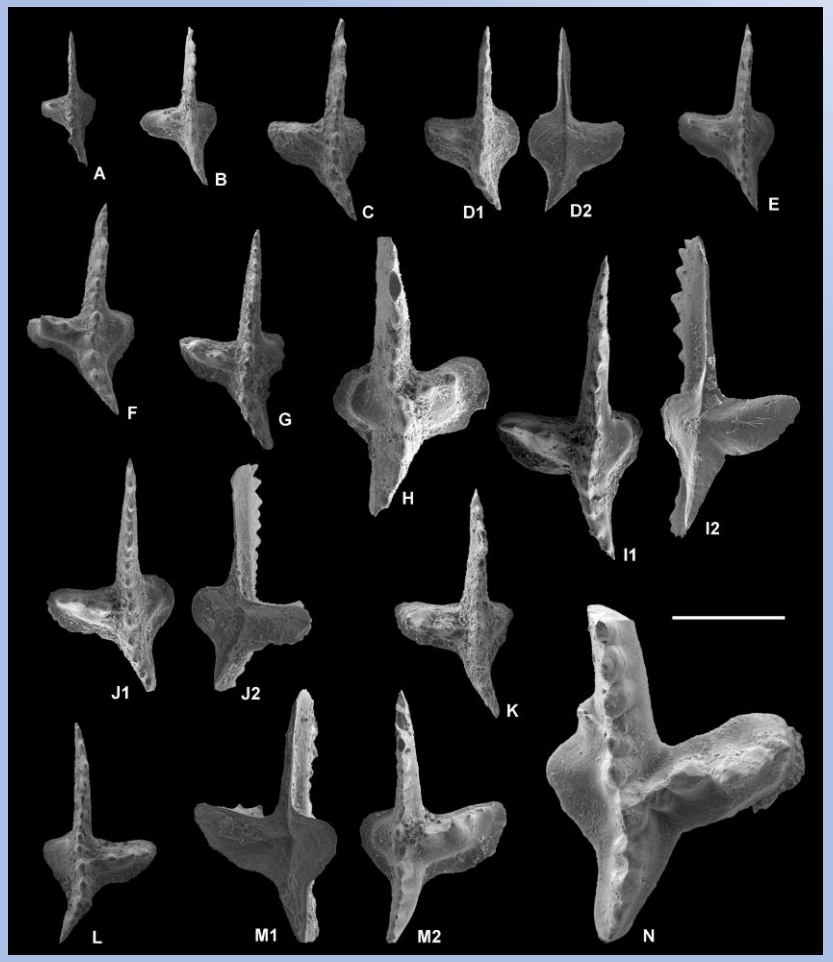
Goudemand et al. (2013)

Ontogenesi

I denti dei conodonti si accrescevano per tutta la vita dell'animale.



Corriga & Corradini (2017)

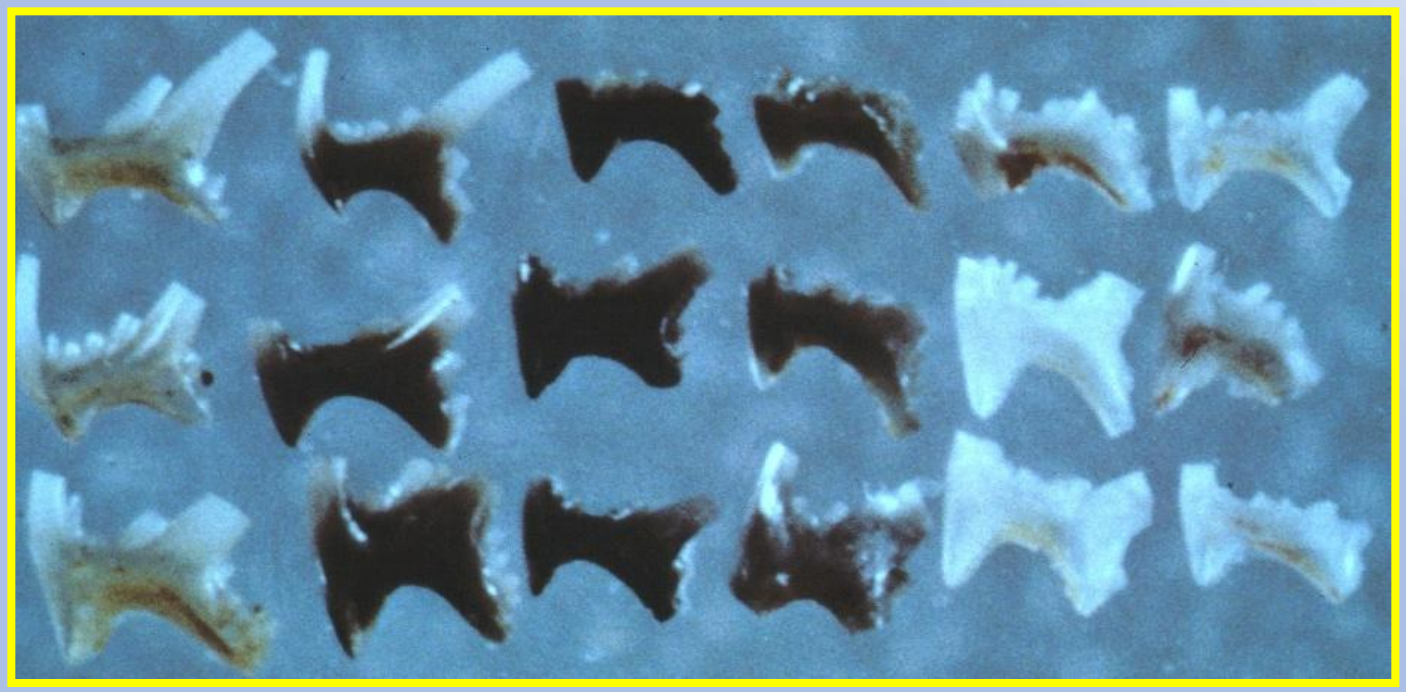


Colore



Zhang et al. (2016)

Colore



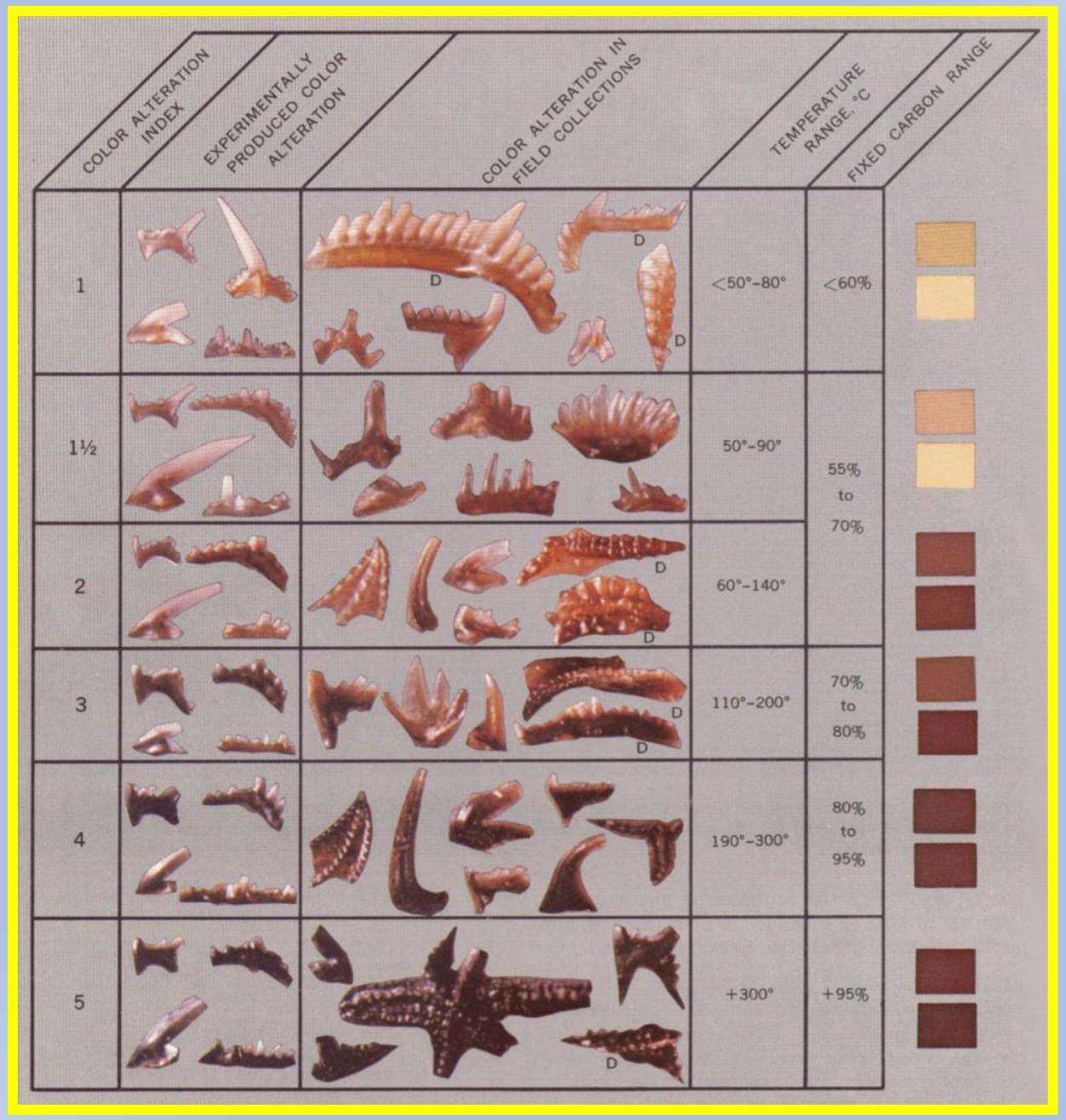
Epstein et al. (1984)

Temperatura

L'alterazione di colore dipende dal TEMPO e dalla TEMPERATURA.

L'alterazione di colore è PROGRESSIVA, CUMULATIVA e IRREVERSIBILE.

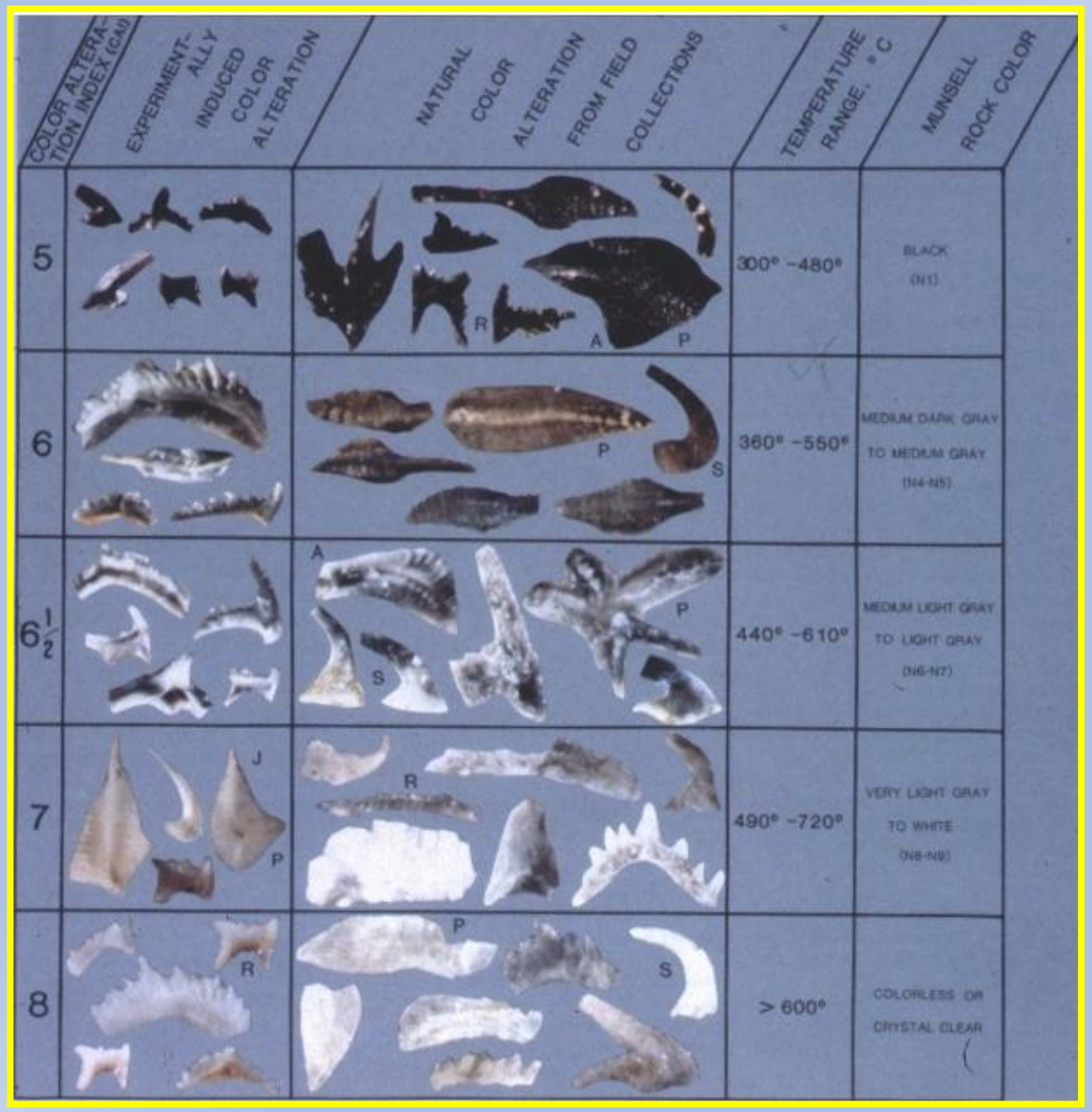
La pressione non accelera né ritarda il processo di alterazione di colore.



C.A.I

(Color Alteration Index)

Epstein et al. (1984)



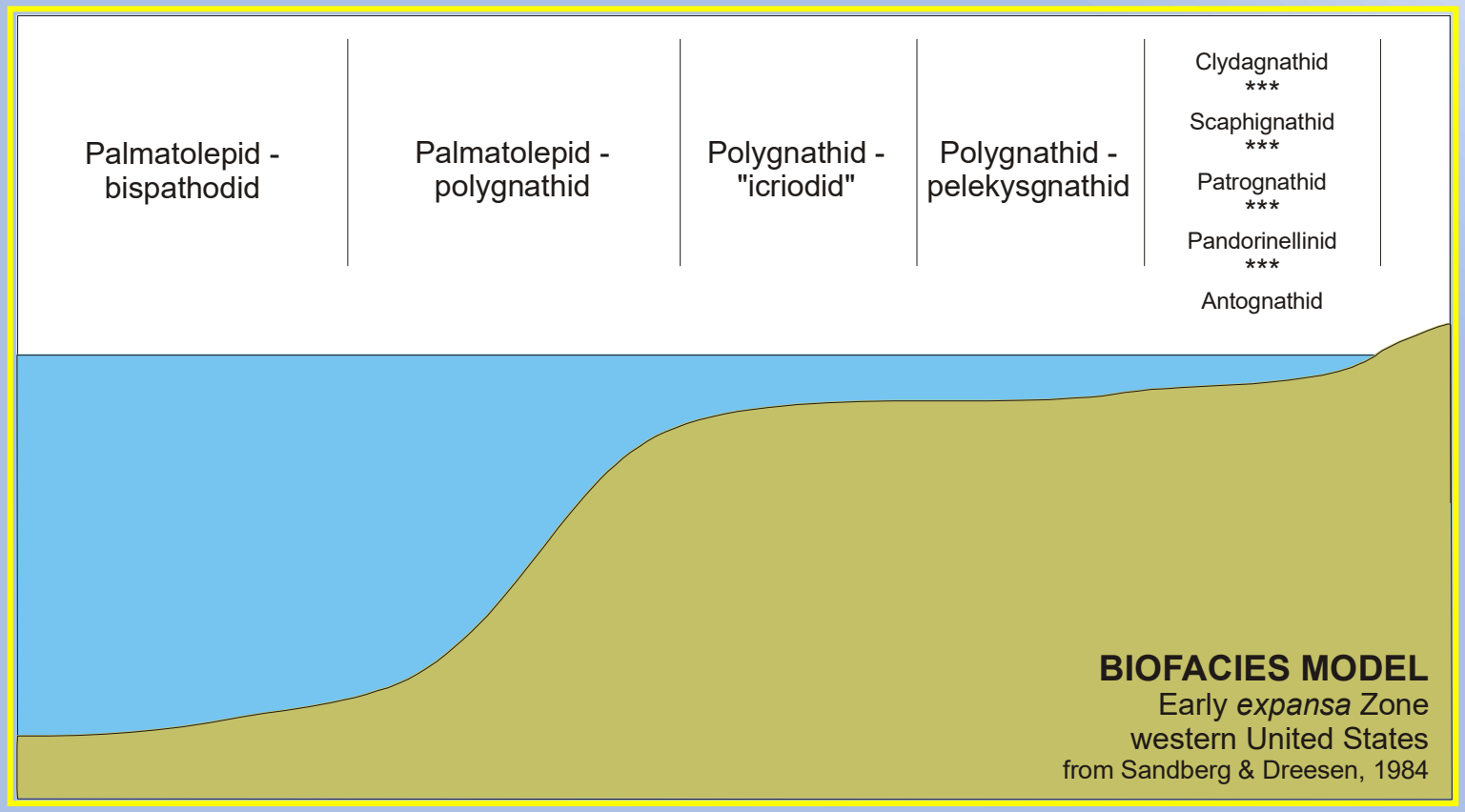
C.A.I

(Color Alteration Index)

APPLICAZIONI

- STRATIGRAFIA
- PALEOECOLOGIA e PALEOCLIMA
- GEOLOGIA REGIONALE
- RICERCHE PETROLIFERE

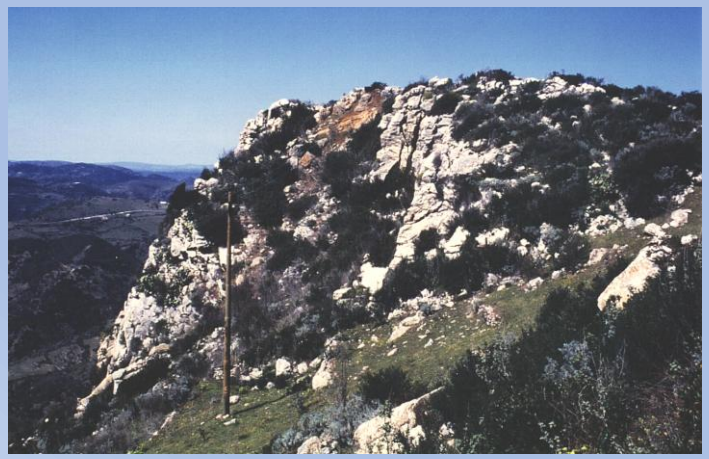
Ricostruzioni paleoambientali

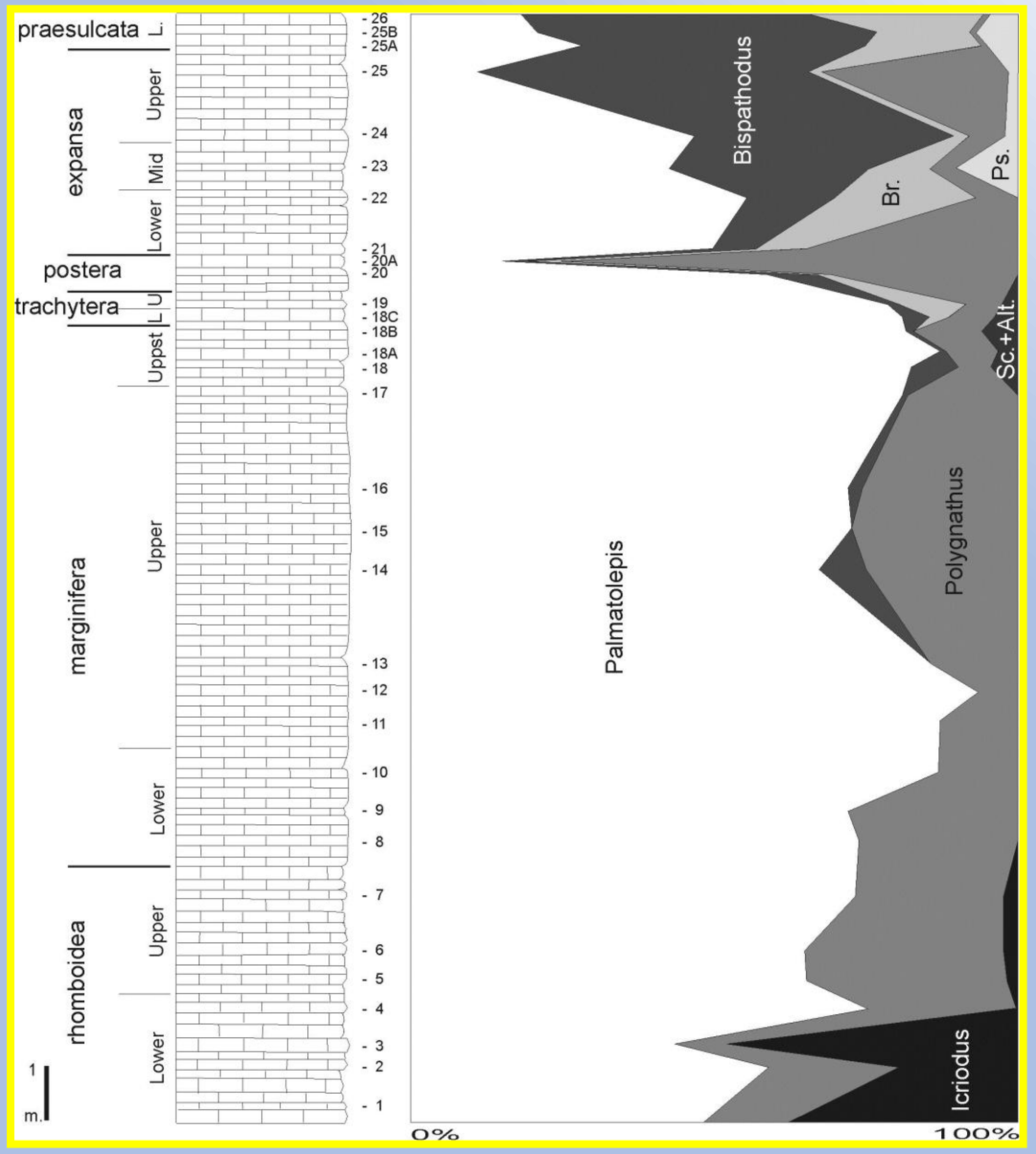


Ricostruzioni paleoambientali

Sezione Corona Mizziu I

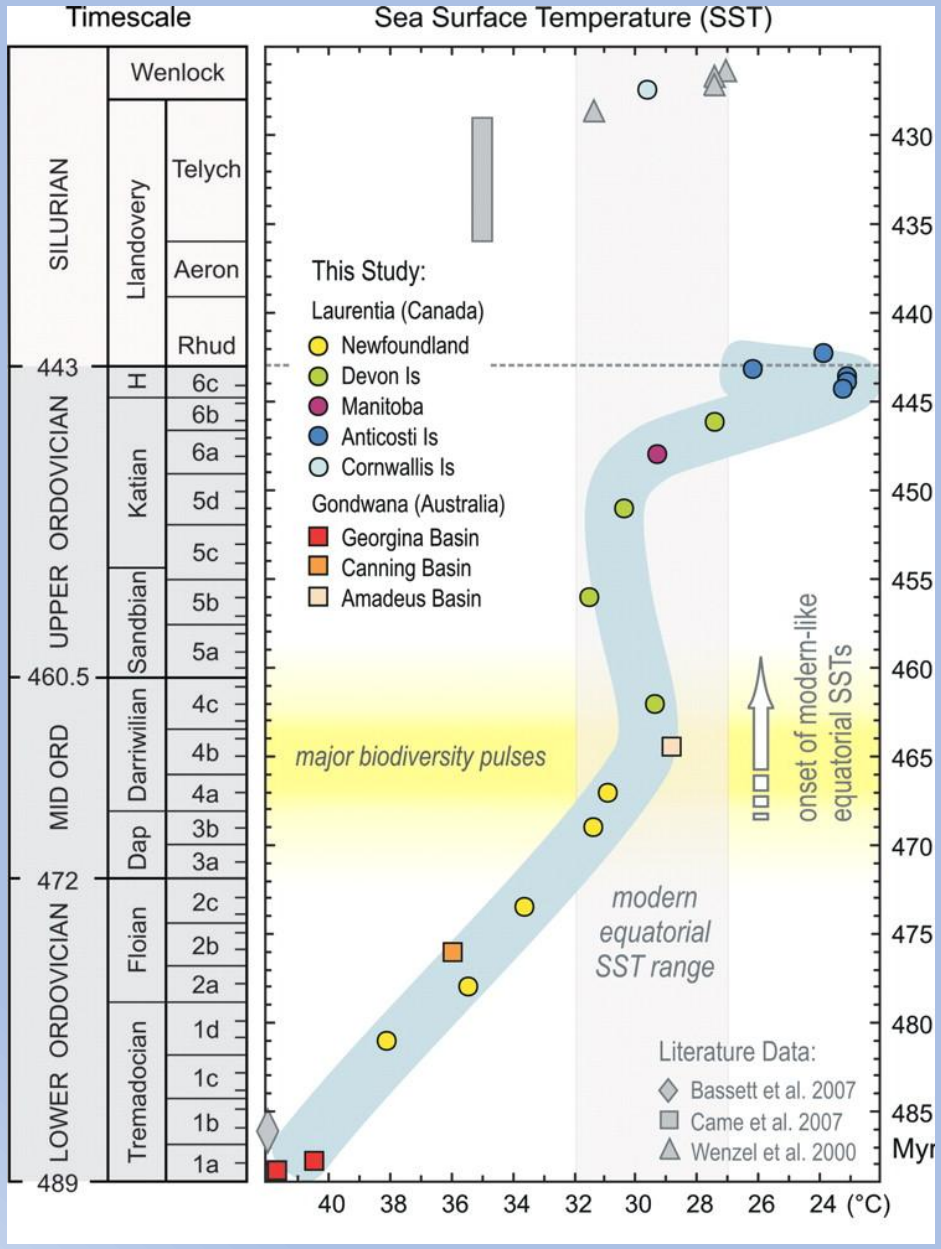
Devoniano Sup. – Sardegna





Corradini, 2003

Ricostruzioni paleoclimatiche



Curva delle temperature del mare durante l'Ordoviciano basata su $\delta^{18}O$ misurato nei conodonti

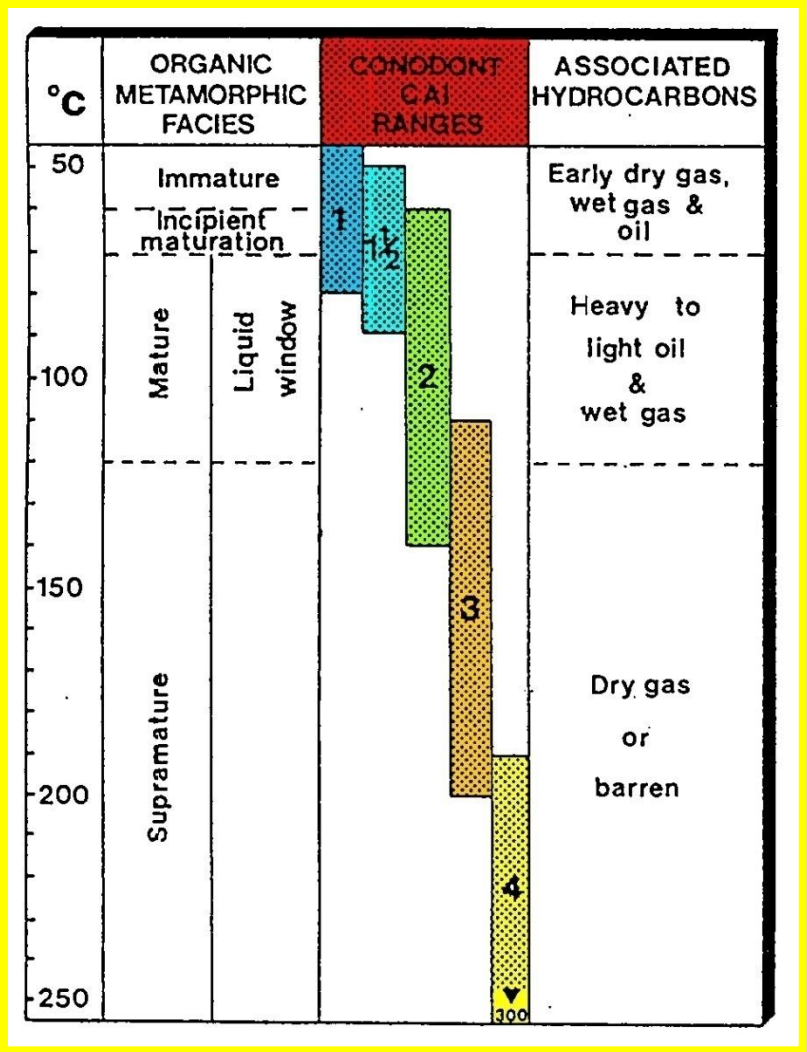
Trotter et al., 2008

Applicazioni del C.A.I

Conoscere la storia termica di un bacino sedimentario, fornendo informazioni sulle aree e sugli intervalli stratigrafici che potrebbero contenere idrocarburi.

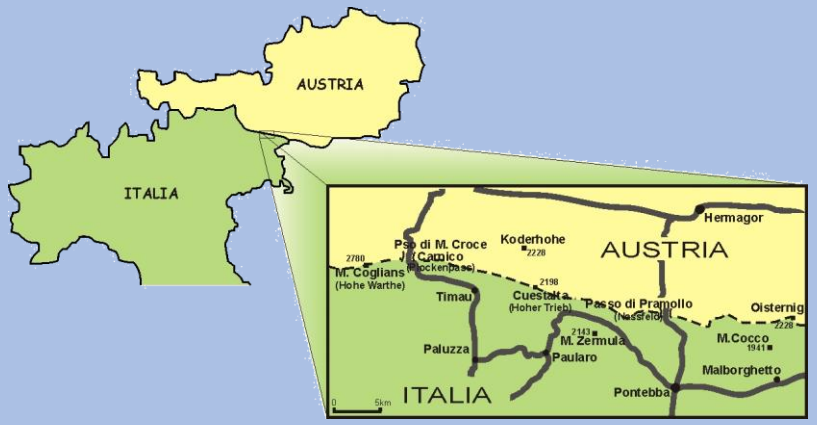
Identificare intrusioni localizzate, e quindi contribuire all'individuazione di depositi minerari.

Identificare effetti tettonici locali, che hanno provocato flussi di calore (grandi sovrascorrimenti o rifting).

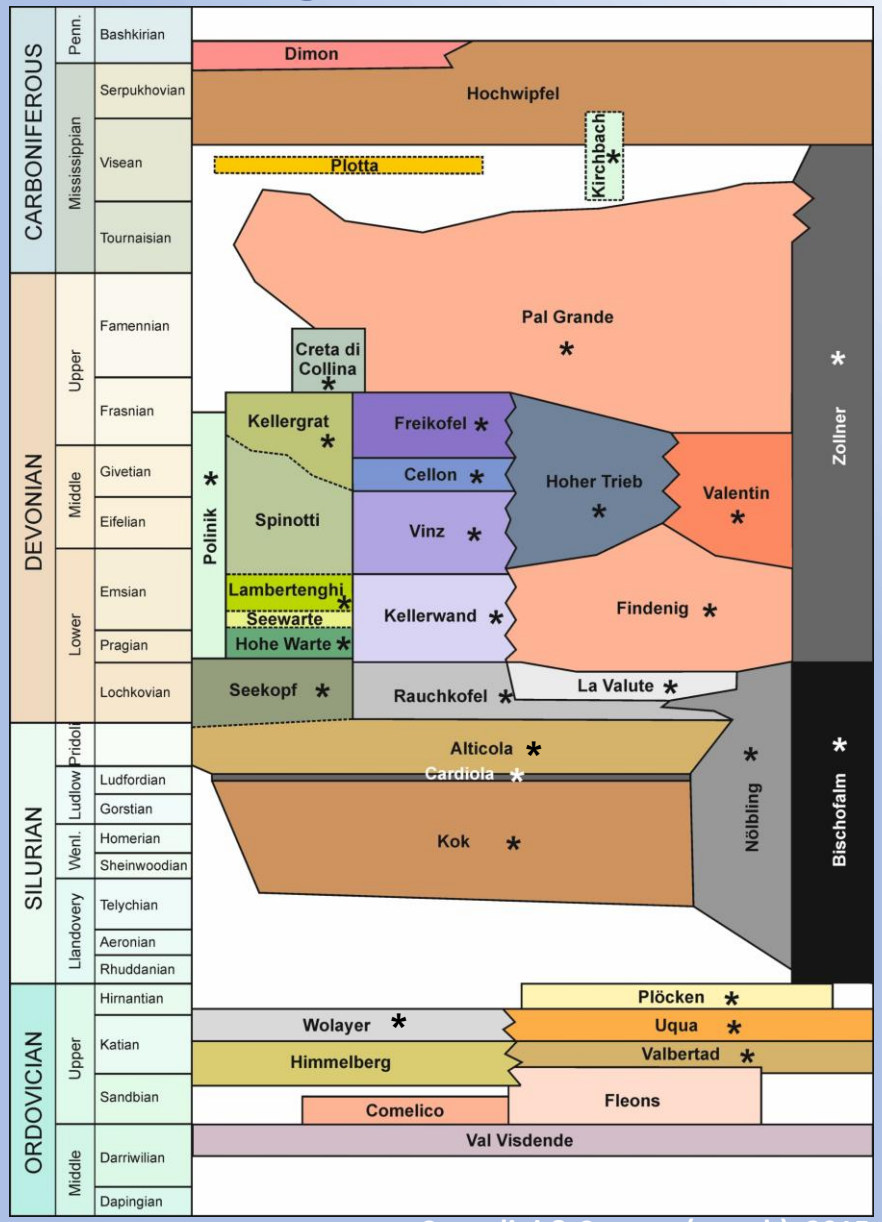


Contributo alla Litostratigrafia

SEQUENZA PRE-VARISICA DELLE ALPI CARNICHE







Corradini & Suttner (coord.), 2015

Biostratigrafia

DEVONIANO SUPERIORE

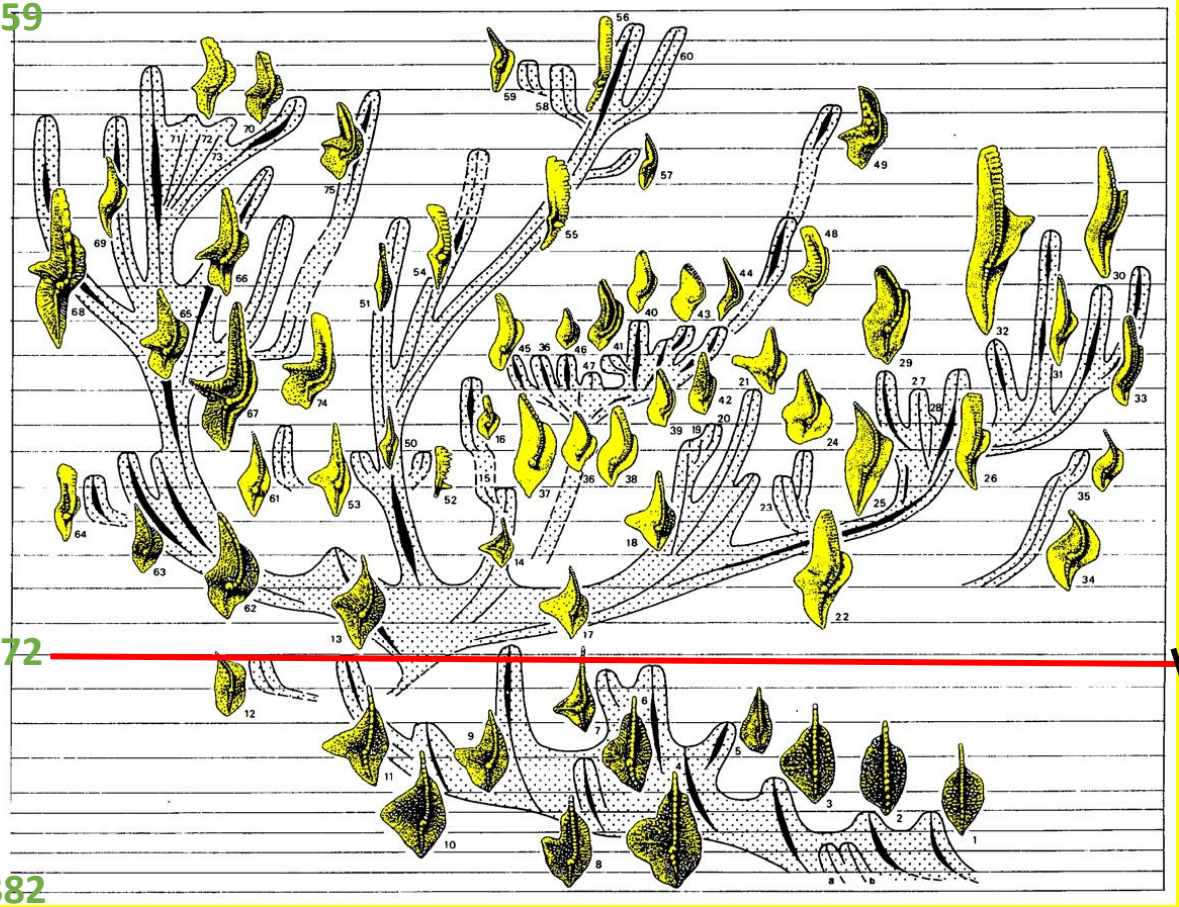
359

FAMENNIANO

372

FRASNIANO

382



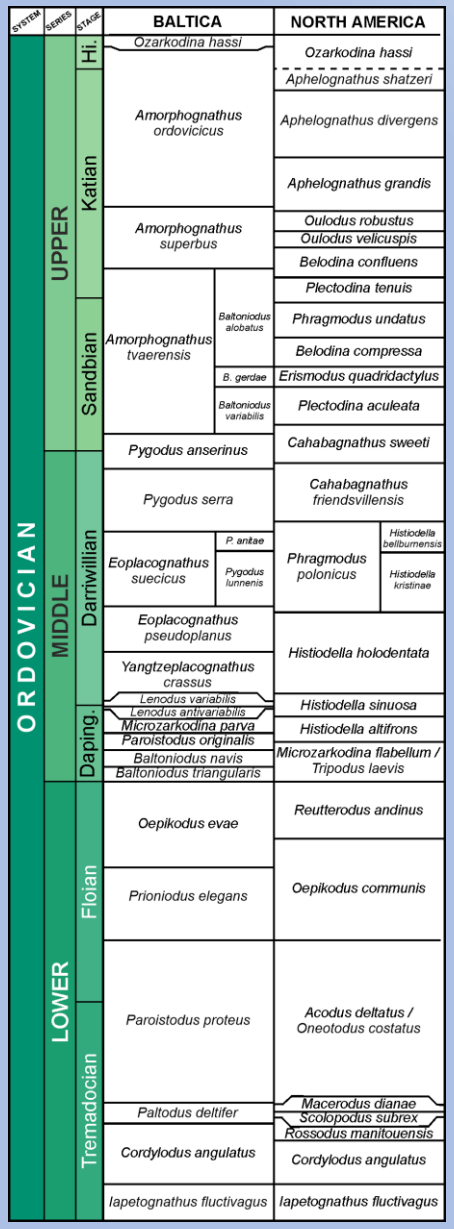
Genere *Palmatolepis*

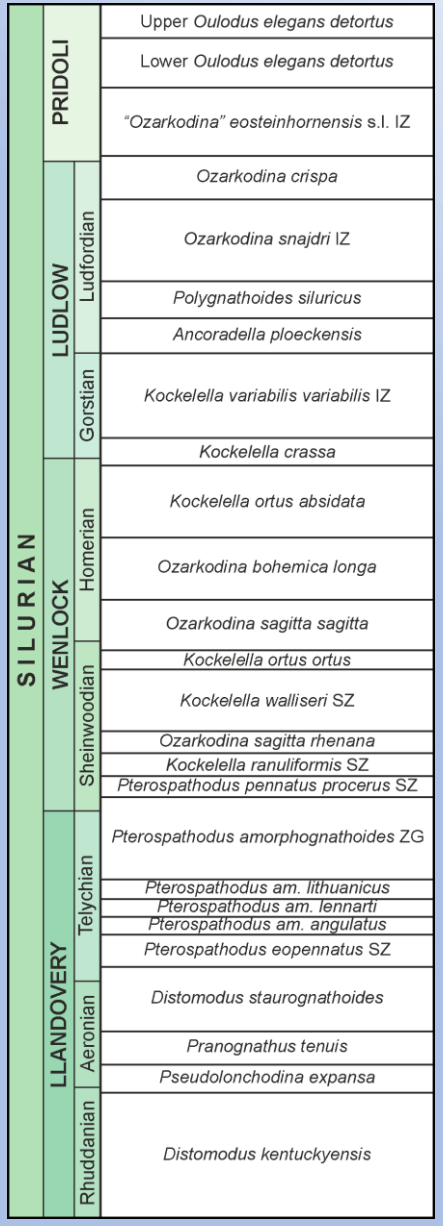
FAMENNIAN CONODONT ZONATION
Protognathodus kockeli
Bispathodus ultimus
Bispathodus costatus
Bispathodus ac. aculeatus
Palmatolepis gr. expansa
Palmatolepis gr. manca
Polygnathus styriacus
Pseudopolygnathus granulosus
Palmatolepis r. trachytera
Scaphignathus v. velifer
Palmatolepis m. utahensis
Palmatolepis m. marginifera
Palmatolepis gr. gracilis
Palmatolepis rhomboidea
Palmatolepis gl. pectinata
Palmatolepis gl. prima
Palmatolepis termini
Palmatolepis crepida
Palmatolepis m. minuta
Palmatolepis del. platys
Palmatolepis triangularis
Palmatolepis subperlobata

Spalletta et al. (2017)

Biostratigrafia

Esistono schemi di biozonazione dettagliati e largamente usati per le rocce carbonatiche dal Cambriano superiore al Triassico.





Newsletters on Stratigraphy, Vol. 59/1–2 (2026), 77–116
Published online July 01, 2024; published in print February 2026

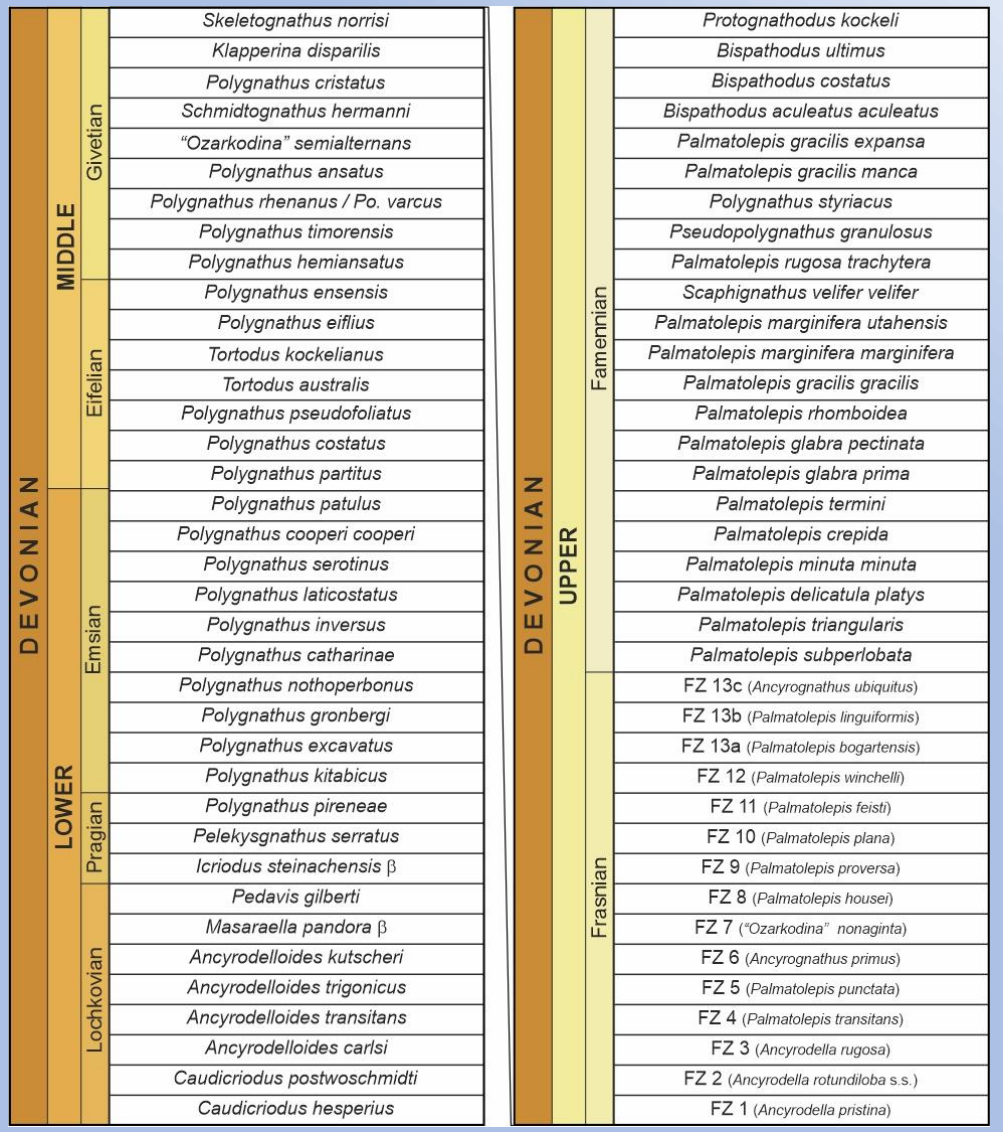
Open Access Article
CC BY NC

Conodonts in Biostratigraphy. A 300-million-years long journey through geologic time

Carlo Corradini[1]*, Charles Henderson[2], James E. Barrick[3] and Annalisa Ferretti[4]

Biostratigrafia

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Biostratigrafia

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SYSTEM	SUBSYSTEM	SERIES	STAGE	European deepwater zonation	Standard Russian zonation	South China zonation	North American Midcontinent zonation
CARBONIFEROUS	MISSISSIPPIAN	UPPER	Serpukhovian	*Dec. bernesgae*	*Gn. bilineatus bollandensis*	*Gn. postbilineatus*	U. *Rh. muricatus*
				Gn. postbilineatus		*Gn. bollandensis*	L. *Rh. muricatus*
				Gn. truyolsi			
				Lochriea ziegleri	*Lochriea cruciformis*	*Lochriea ziegleri*	*C. naviculus*
		MIDDLE	Visean	*L. nodosa*	*L.nodosa*	*L.nodosa*	U. *Gn. bilineatus*
				Gn. bilineatus	*Gn. bilineatus bilineatus*	*Gn. bilineatus*	L. *Gn. bilineatus*
				Gn. romulus			
				Gnathodus praebilineatus	*Gn. texanus*	*Lochriea commutata*	*"H." scitula/ "Ap." scalensus*
							Gn.texanus
						Pseudognathodus homopunctatus	*Gn.bulbosus*
				Gn. texanus			*E. burlingtonensis*
		LOWER	Tournaisian	*Sc. anchoralis/ Do. latus*	*Sc. anchoralis*	*Sc. anchoralis/ Gn. pseudosemiglaber*	*B. lanei*
							Do. latus
				Upper *Gn. typicus*	*Doll. bouckaerti*	*Gn. typicus/ Pr. cordiformis*	*Ps. multistriatus*
				Lower *Gn. typicus*	*Gn. typicus*	*Gn. typicus/ Gn. cuneiformis*	*Ne. carinus*
				S. isosticha - Upper S. crenulata	*S. isosticha*	*Gn. punctatus*	*Gn. punctatus*
						S. isosticha	*Gn. delicatus*
				S. crenulata	*S. quadruplicata*	*S. crenulata*	*S. crenulata*
				S. quadruplicata		*S.sandbergi*	*S. sandbergi*
				S. sandbergi			
				S. mehli	*S. belkai*	*S.jii*	*S. cooperi*
				S. duplicata	*S. duplicata*	*S. duplicata*	*S. duplicata*
				S. bransoni	*S. sulcata*	*S. bransoni*	*S. bransoni*
				Pr. kockeli		*S. sulcata*	*Pr. kockeli*

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Biostratigrafia

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SYSTEM	SUBSYSTEM	SERIES	STAGE	Standard Russian zonation	Donets Basin zonation	South China zonation	North American Midcontinent zonation
CARBONIFEROUS	PENNSYLVANIAN	UPPER	Gzhelian	*S. wabaunsensis*	UNZONED	*S. wabaunsensis*	*S. binodosus*
							S.farmeri
						S. tenuialveus	*S. flexuosus*
				S. bellus			*S. bellus*
				S. virgilicus		*S. virgilicus*	*S. virgilicus*
				S. vitali		*S. vitali*	*S. vitali*
				H. simulator	*H. luganicus*	*I. nashuiensis*	*H. simulator*
						H. simulator	
			Kasimovian	*S. firmus*	*S. firmus/ I. kalitvensis*	*I. naraoensis*	*S. zethus*
						H. eudoraensis	*H. eudoraensis*
				I. toretzianus	*I. toretzianus*	*I. magnificus*	*S. gracilis*
				S. cancellosus	*I. sagittalis/ I. neverovensis*	*I. turbatus*	*I. cancellosus*
				I. sagittalis			*I. confragus*
							I. turbatus
							I. eccentricus
				Sw. maklinae	*Sw. subexcelsa*	*Sw. maklinae*	*I. sulciferus*
				Sw. subexcelsa		*Sw. subexcelsa*	*Sw. nodocarinatus*
							Sw. neoshoensis
		MIDDLE	Moscovian	*N. roundy*	*Sw. gurkovaensis*	*I. podolskensis*	*I. delicatus*
				N. inaequalis			*I. acutus*
				I. podolskensis/ N. medexultimus	*Sw. dissectus*		*I. rectus/ I. iowaensis*
				Sw. cocinna/ I. robustus	*I. izwaricus*	*Mg. clarki/ Mg. dombassica*	*I. amplificus/ I. obliquus*
				N. medadultimus/ N. bothrops	*"S." transitivus/ N. atokaensis*		*N. bothrops*
				S. transitivus			*N. colombiensis*
				De. donetzianus/ Id. postsulcatus	*De. donetzianus*	*D. ellesmerensis*	*N. atokaensis*
		LOWER	Bashkirian	*De. marginodosus*	*De. marginodosus*	*"S." expansus* M2	
					Id. tuberculatus/ Id. fossatus		*N. nataliae*
					"S." expansus		
				I. sinuosus	*I. sinuosus*	*"S." expansus* M1	*I. klapperi*
							I. sinuosus
				N. askynensis	*Id. sinuatus/ Id. sulcatus sulcatus*	*I. primulus*	*N. bassleri*
				Id. sinuatus		*N. symmetricus*	*N. symmetricus*
						Id. sinuatus	*Id. sinuatus*
				De. noduliferus	*De. noduliferus*	*De. noduliferus*	*De. noduliferus*

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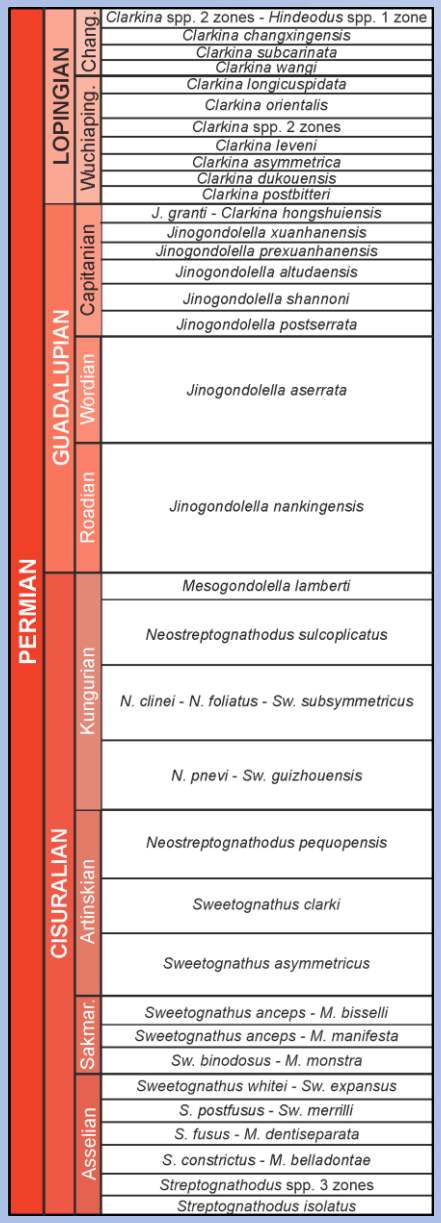
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Conodonts in Biostratigraphy. A 300-million-years long journey through geologic time

Carlo Corradini[1]*, Charles Henderson[2], James E. Barrick[3] and Annalisa Ferretti[4]

Biostratigrafia

Esistono schemi di biozonazione dettagliati e largamente usati per le rocce carbonatiche dal Cambriano superiore al Triassico.



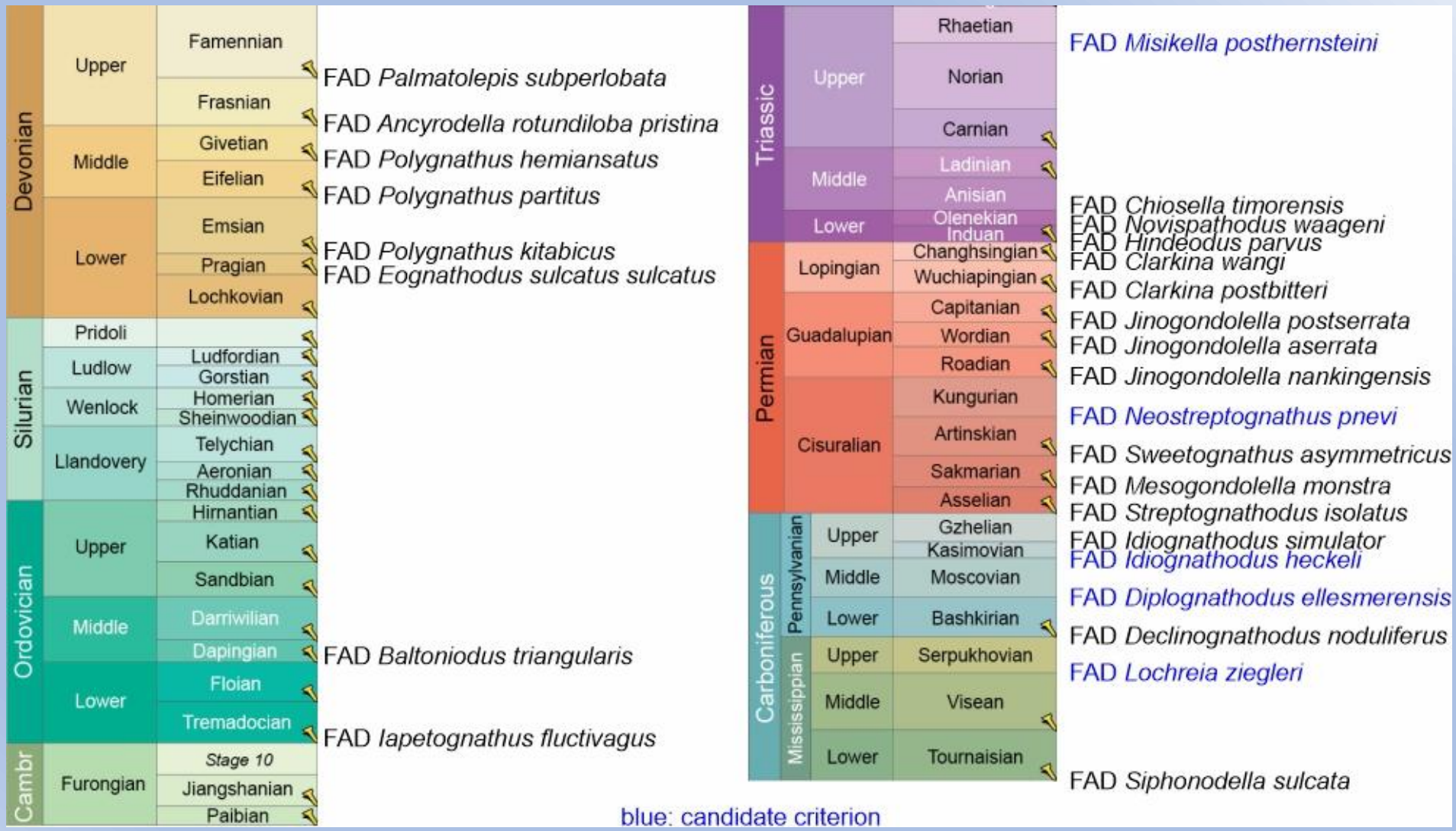
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Conodonts in Biostratigraphy. A 300-million-years long journey through geologic time

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Cronostratigrafia



Corradini et al., 2026, mod.

Cronostratigrafia

GSSPs of the Devonian Stages, with location and primary correlation criteria

Stage	GSSP Location	Latitude, Longitude	Boundary Level	Correlation Events	Reference
* **Famennian**	Coumiac Quarry, near Cessenon, Montagne Noire, France	43°27'40.6"N 3°02'25"E*	base of Bed 32a	Conodont, FAD of *Palmatolepis subperlobata,* Conodont, LAD of *Palmatolepis bogartensis*	Episodes **16**/4, 1993
* **Frasnian**	Col du Puech de la Suque, Montagne Noire, France	43°30'11.4"N 3°05'12.6"E*	base of Bed 42a at Col du Puech de la Suque section E	Conodont, FAD of *Ancyrodella rotundiloba pristina*	Episodes **10**/2, 1987
* **Givetian**	Jebel Mech Irdane, Morocco	31°14'14.7"N 4°21'14.8"W*	base of Bed 123	Conodont, FAD of *Polygnathus hemiansatus*	Episodes **18**/3, 1995
* **Eifelian**	Wetteldorf, Eifel Hills, Germany	50°08'58.6"N 6°28'17.6"E*	21.25 m above the base of the exposed section, base of unit WP30	Conodont, FAD of *Polygnathus partitus*	Episodes **8**/2, 1985
* **Emsian**	Zinzil'ban Gorge, Uzbekistan	39°12'N 67°18'20"E	base of Bed 9/5 in the Zinzil'ban Gorge in the Kitab State Geological Reserve	Conodont, FAD of *Eocostapolygnathus kitabicus* New Emsian base under discussion, potentially FAD of *Eolinguipolygnathus excavatus* M114	Episodes **20**/4, 1997
* **Pragian**	Velká Chuchle, Prague, Czech Republic	50°00'53"N 14°22'21.5"E*	base of Bed 12 in Velká Chuchle Quarry	Conodont, just above FAD of *Eognathodus irregularis*	Episodes **12**/2, 1989
Lochkovian	Klonk, near Prague, Czech Republic	48.855°N 13.792°E**	within Bed 20	Graptolite, FAD of *Uncinatograptus uniformis*	IUGS Series A, **5**, 1977

* according to Google Earth, ** derived from map

Cronostratigrafia

GSSPs of the Carboniferous Stages, with location and primary correlation criteria

Stage	GSSP Location	Latitude, Longitude	Boundary Level	Correlation Events	Reference
* *Gzhelian*	*Candidates are in southern Urals or Nashui (South China)*			*Conodont, FAD of* Idiognathodus simulator *(candidate)*	
* *Kasimovian*	*Candidates are in Usolka, Russia, Nashui (South China)*			*Conodont, FAD of* Idiognathodus heckeli	
* *Moscovian*	*Candidates are in southern Urals or Nashui (South China)*			*Conodont, FAD* Diplognathodus ellesmerensis *(candidate)*	
* **Bashkirian**	Arrow Canyon, Nevada, USA	36°44'00" N, 114°46'40" W**	82.9 m above the top of the Battleship Formation in the lower Bird Spring Formation	Conodont, FAD of *Declinognathodus noduliferus*	Episodes **22**/4, 1999
* *Serpukhovian*	*Candidates are Verkhnyaya Kardailovka (Urals) or Nashui (South China)*			*Conodont, FAD of* Lochriea ziegleri *(candidate)*	
Visean	Pengchong, South China	24°26'8.88"N, 109°27'19.49"E	base of bed 83 in the Pengchong Section	Foraminifer, FAD of *Eoparastaffella simplex*	Episodes **26**/2, 2003
* **Tournaisian** (GSSP under reevaluation)	La Serre, France	43°33'19.9"N 3°21'26.3"E*	base of Bed 89 in Trench E' at La Serre, (but FAD now known to be at base of Bed 85)	Conodont, FAD of *Siphonodella sulcata* s.l.	Episodes **14**/4, 1991; Kölner Forum Geol. Paläont., **15**, 2006

* according to Google Earth, ** derived from map

Cronostratigrafia

GSSPs of the Permian Stages, with location and primary correlation criteria

	Stage	GSSP Location	Latitude, Longitude	Boundary Level	Correlation Events	Reference
*	**Changhsingian**	Meishan, Zhejiang Province, South China	31°4'55"N 119°42'22.9"E	base of Bed 4a-2, 88 cm above the base of Changxing Limestone at the Meishan D Section	Conodont, FAD of *Clarkina wangi*	Episodes **29**/3, 2006
*	**Wuchiapingian**	Penglaitan, Guangxi Province, South China	23°41'43"N 109°19'16"E	base of Bed 6k in the Penglaitan Section	Conodont, FAD of *Clarkina postbitteri postbitteri*	Episodes **29**/4, 2006
*	**Capitanian**	Nipple Hill, SE Guadalupe Mountains, Texas, U.S.A	31°54'32.8"N 104°47'21.1"W	4.5 m above the base of the outcrop section of the Pinery Limestone Mbr of the Bell Canyon Formation	Conodont, FAD of *Jinogondolella postserrata*	
*	**Wordian**	Guadalupe Pass, Texas, U.S.A	31°51'56.9"N 104°49'58.1"W	17.6 m above the base of the Getaway Ledge outcrop section of the Getaway Limestone Mbr of the Cherry Canyon Formation	Conodont, FAD of *Jinogondolella aserrata*	
*	**Roadian**	Stratotype Canyon, Texas, U.S.A	31°52'36.1"N 104°52'36.5"W	42.7 m above the base of the Cutoff Formation	Conodont, FAD of *Jinogondolella nankingensis*	
*	*Kungurian*	*candidate Mechetlino Quarry section, Russia*	55°21'42"N 57°59'57"E	Bed 19	*FAD of conodont* Neostreptognathodus pnevi	
*	*Artinskian*	*candidate Dal'ny Tulkas section, Russia*	53°53'18.5"N 56°30'58.15"E	2.7 m above the base of Bed 4	*FAD of conodont* Sweetognathus asymmetrica	
*	**Sakmarian**	Usolka section, Russia	53°55'28.86"N 56°31'43.38"E	55.4 m above the base of the Usolka section in Bed 26/3	Conodont, FAD of *Mesogondolella monstra*	Episodes accepted 2020
*	**Asselian**	Aidaralash Creek, Kazakhstan	50°14'45"N 57°53'29"E*	27m above the base of Bed 19	Conodont, FAD of *Streptognathodus isolatus*	Episodes **21**/1, 1998

* according to Google Earth

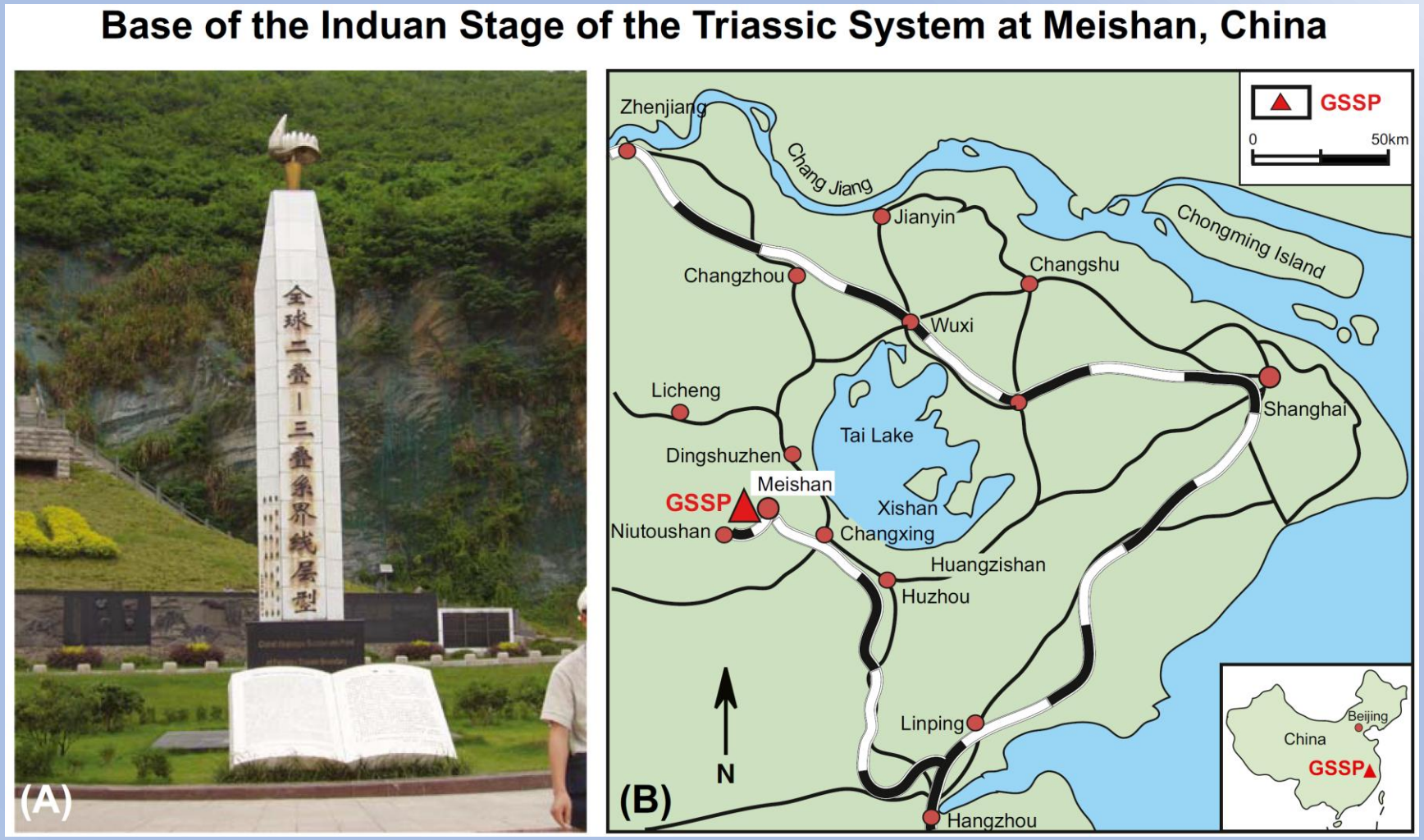
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GSSPs of the Triassic Stages, with location and primary correlation criteria

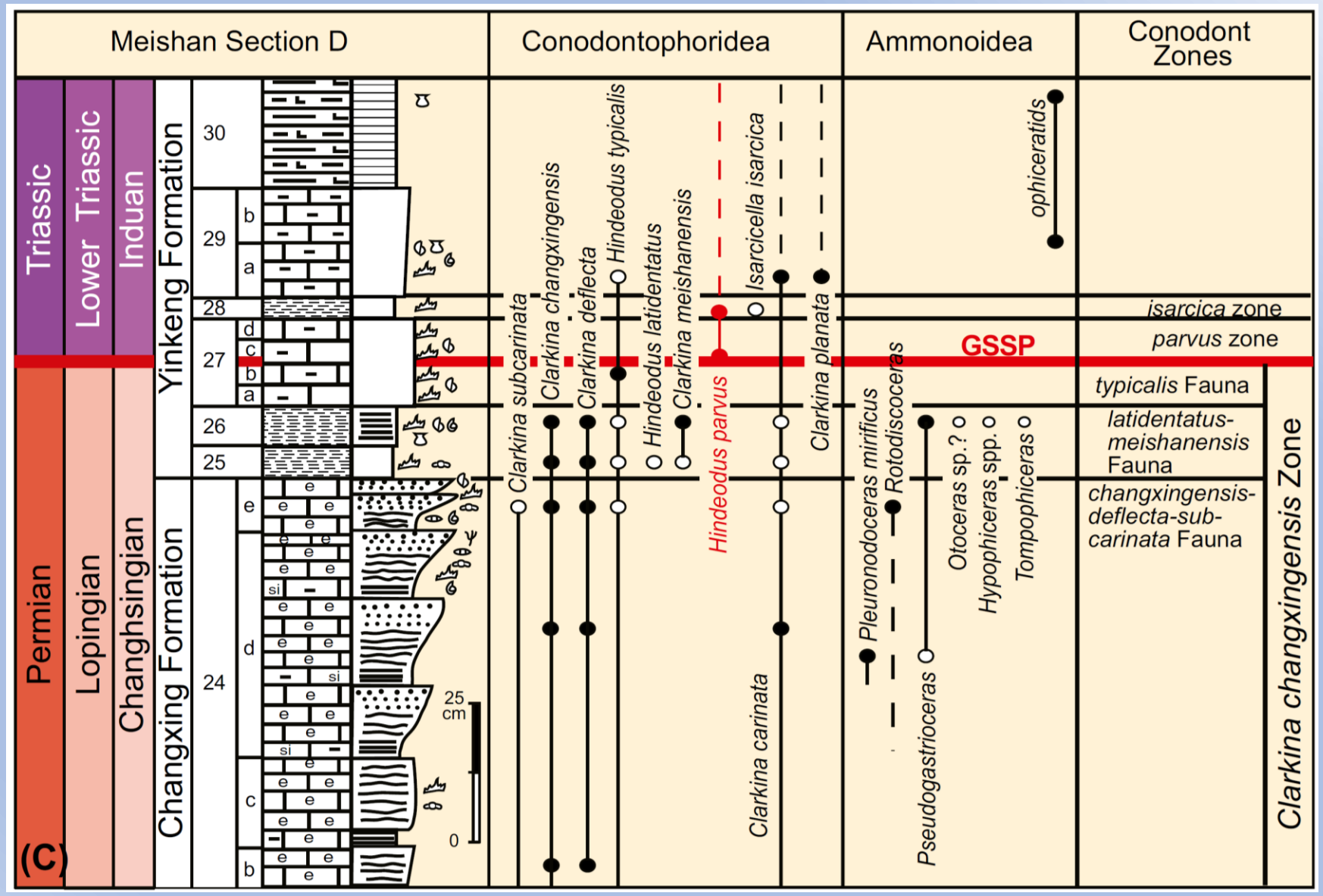
Stage	GSSP Location	Latitude, Longitude	Boundary Level	Correlation Events	Reference
* *Rhaetian*	*Candidates are Pizzo Mondello, Sicily, Italy, and Steinbergkogel, Austria*			*Near FADs of conodont* Misikella posthernsteini *s.s. or* Misikella posthernsteini *s.l.*	
* *Norian*	*Candidates are Black Bear Ridge in British Columbia (Canada) and Pizzo Mondello, Sicily, Italy*			*FAD of conodont* Metapolygnathus parvus. *Near base of* Stikinoceras kerri *ammonoid zone and FAD of bivalve* Halobia austriaca	
Carnian	Section at Prati di Stuores, Dolomites, Italy	46°31'37"N 11°55'49"E	GSSP is base of marly limestone bed SW4, 45 m from base of San Cassiano Formation	FAD of ammonoid *Daxatina canadensis*, conodont *Quadralella polygnathiformis* and *Halobia* bivalves	Episodes **35**/3, 2012
Ladinian	Bagolino, Province of Brescia, Northern Italy	45°49'09.5"N 10°28'15.5"E	base of a 15 – 20 cm thick limestone bed overlying a distinctive groove ("Chiesense groove") of limestone nodules in a shaly matrix, located about 5 m above the base of the Buchenstein Beds	Ammonoid, FAD of *Eoprotrachyceras curionii*	Episodes **28**/4, 2005
* *Anisian*	*Candidates are Desli Caira (Romania), Kçira (Albania), Wantou (Guangxi Province, S. China) and Guandao (Guizhou Province, S. China)*			*FAD of conodont* Chiosella timorensis *or base of magnetic normal- polarity chronozone MT1n*	
* *Olenekian*	*Candidates are Chaohu, China and Mud (Muth) village, Spiti Valley, India*			*FAD of conodont* Novispathodus waageni, *near base of* Flemingites *ammonoid genera*	
* **Induan**	Meishan, Zhejiang Province, China	31°4'47.28"N 119°42'20.90"E	base of Bed 27c in the Meishan Section	Conodont, FAD of *Hindeodus parvus*	Episodes **24**/2, 2001

* according to Google Earth

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