Università degli Studi di Ferrara

Dipartimento di Studi Umanistici

Ecologia Preistorica

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A.A. 2021-2022

Lezione 1

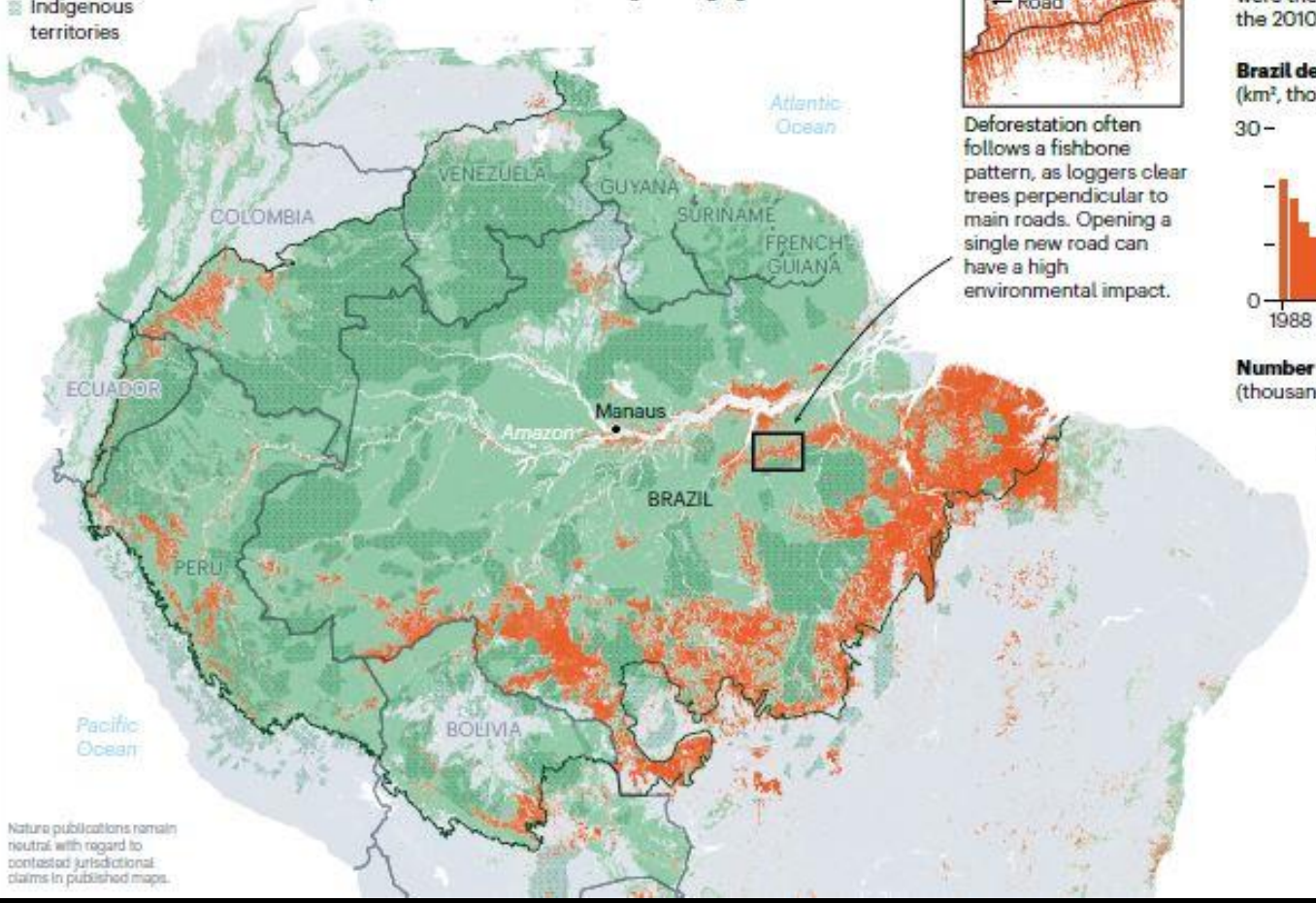
GROWING A WORLD WONDER

FOREST LOSS

The Amazon rainforest covers some 5 million square kilometres of land across nine countries; more than half is in Brazil, where more than 19% of the forest has been cleared. Brazil reduced deforestation after 2004, but amid political turmoil tree clearing is rising again.

Map key

- Deforestation (since 1988)
- Amazon rainforest biome
- Forest cover
- Indigenous territories

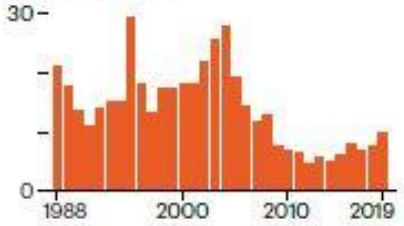


Deforestation often follows a fishbone pattern, as loggers clear trees perpendicular to main roads. Opening a single new road can have a high environmental impact.

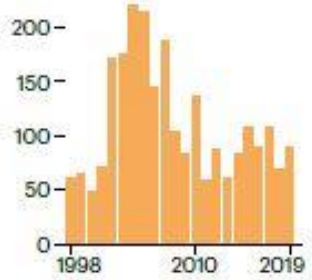
Deforestation and fires

Fires are often lit to clear deforested land. Data from the Brazilian Amazon show more fires in years of severe deforestation (such as 2004) or drought (2005, 2010 and 2015). Fires last August were the highest for any August since the 2010 drought.

Brazil deforested area
(km², thousands)

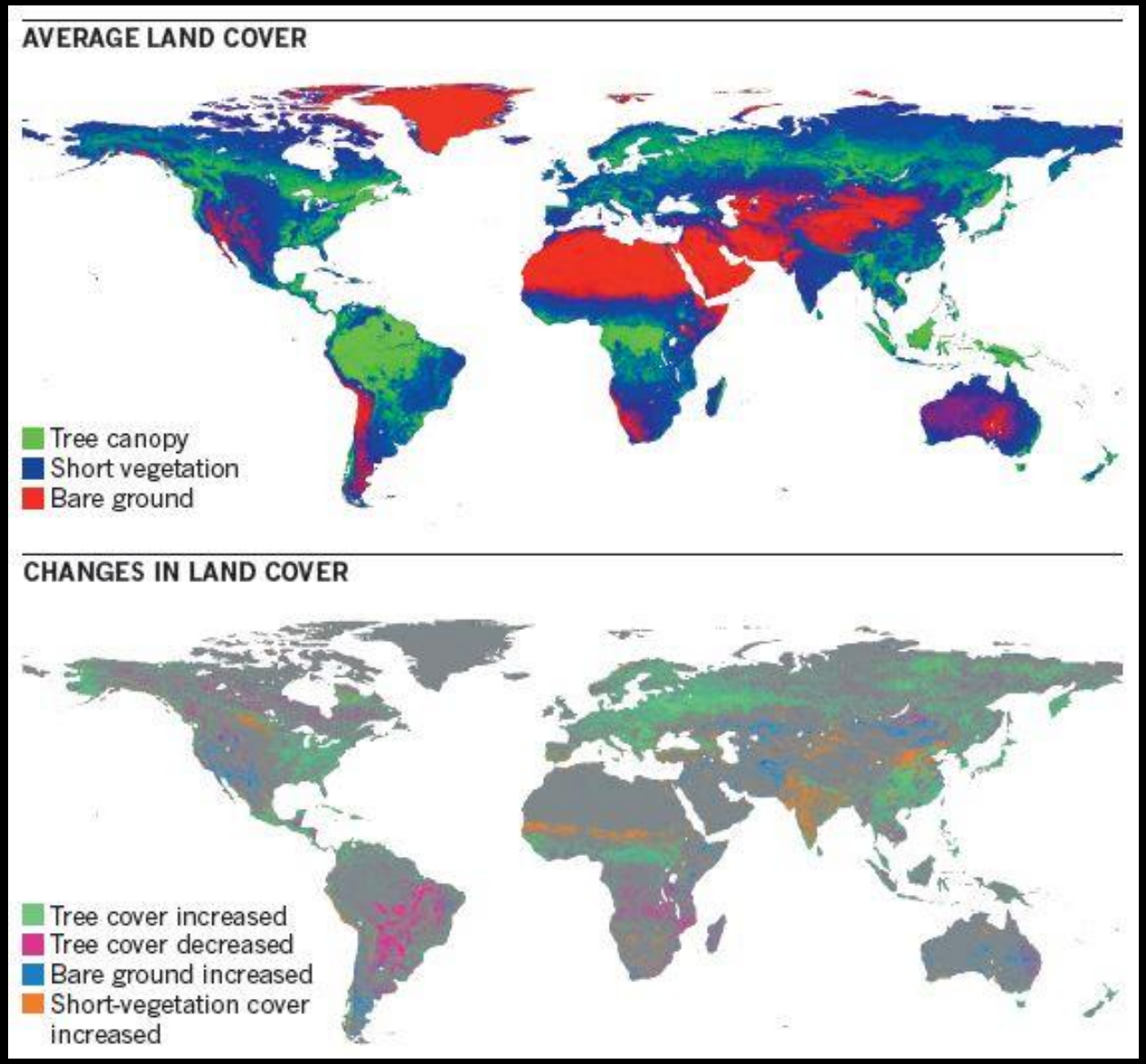


Number of fires
(thousands per year)



Where are the trees?

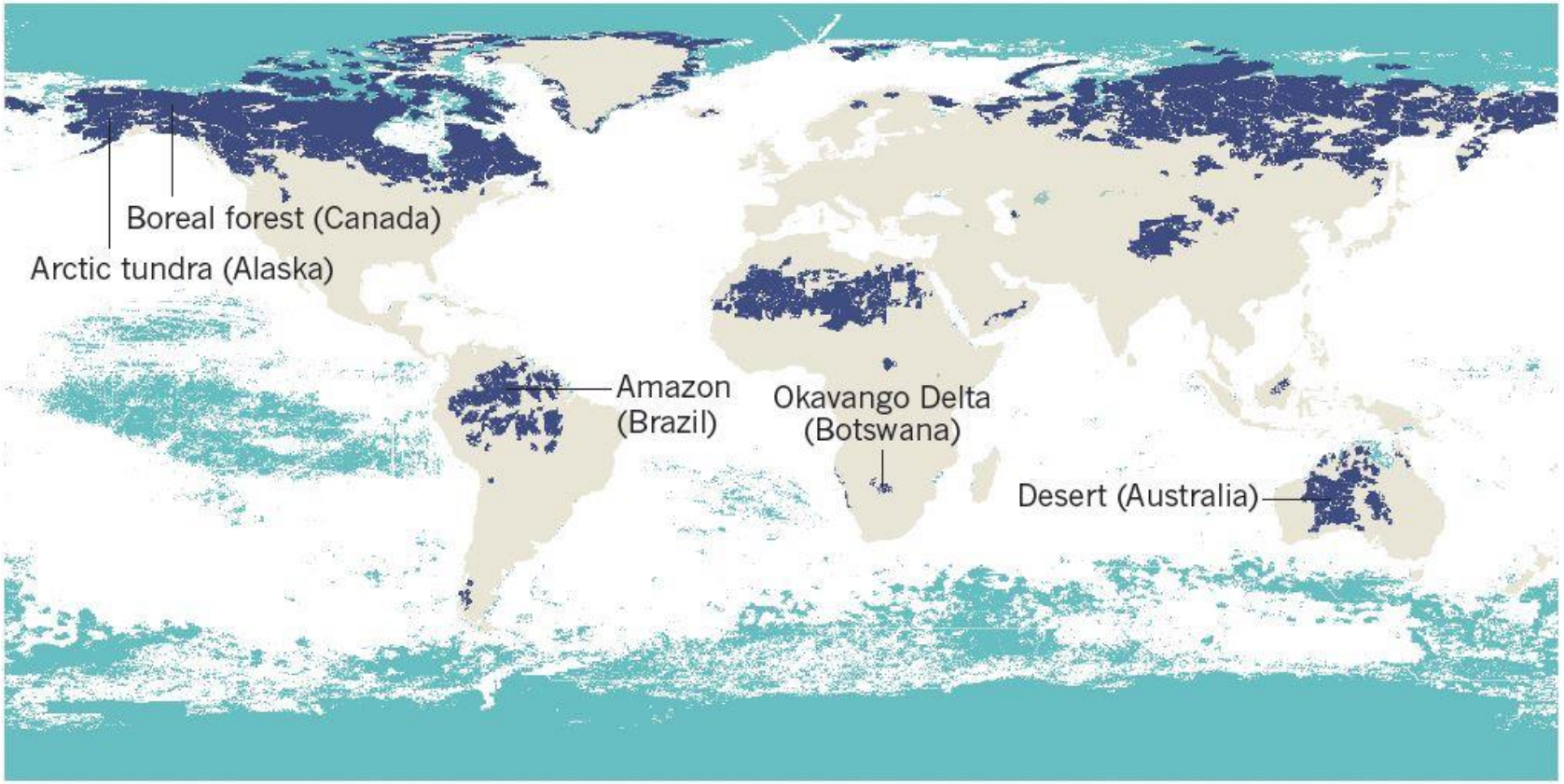
Satellite data reveal the different types of land cover across the globe from 1982 to 2016.



THE HUMAN FOOTPRINT

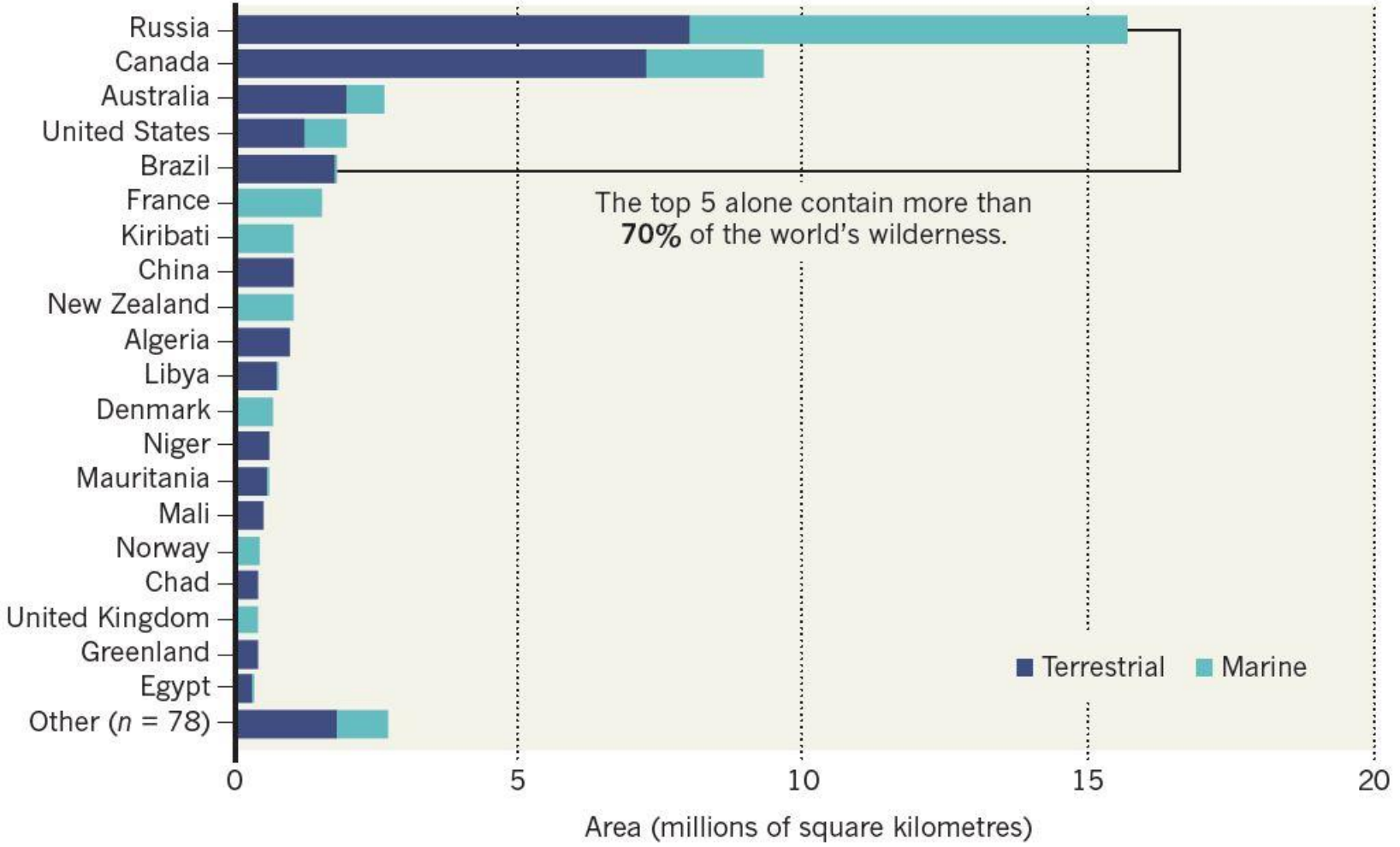
77% of land (excluding Antarctica) and 87% of the ocean has been modified by the direct effects of human activities.

REMAINING WILDERNESS: Terrestrial Marine



THE WILDEST COUNTRIES

Twenty countries contain 94% of the world's wilderness, excluding Antarctica and the high seas.



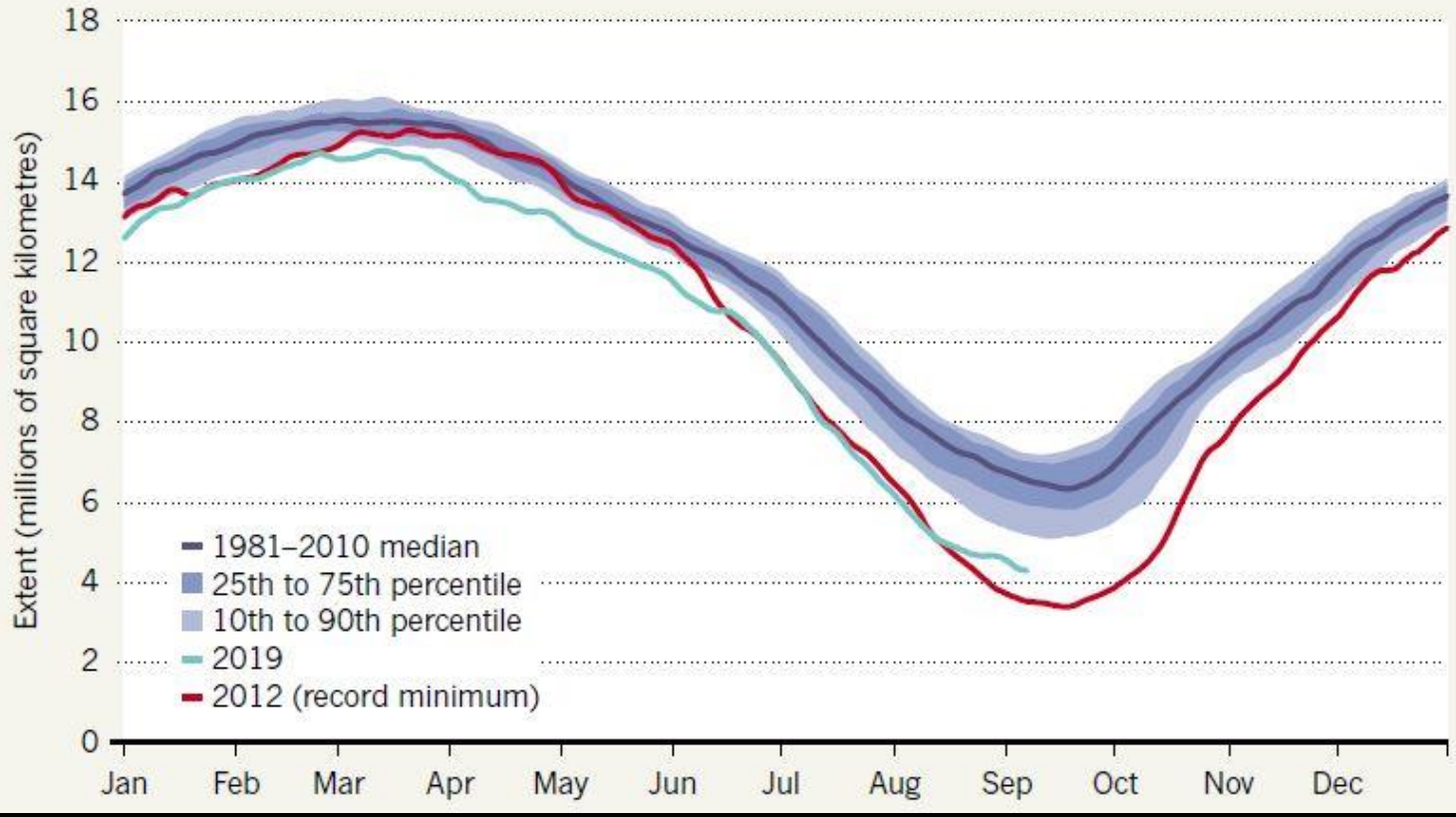
ECOLOGY

Dramatic sea-ice melt caps tough Arctic summer

From raging wildfires to melting ice in Greenland, the top of the world is screaming for help.

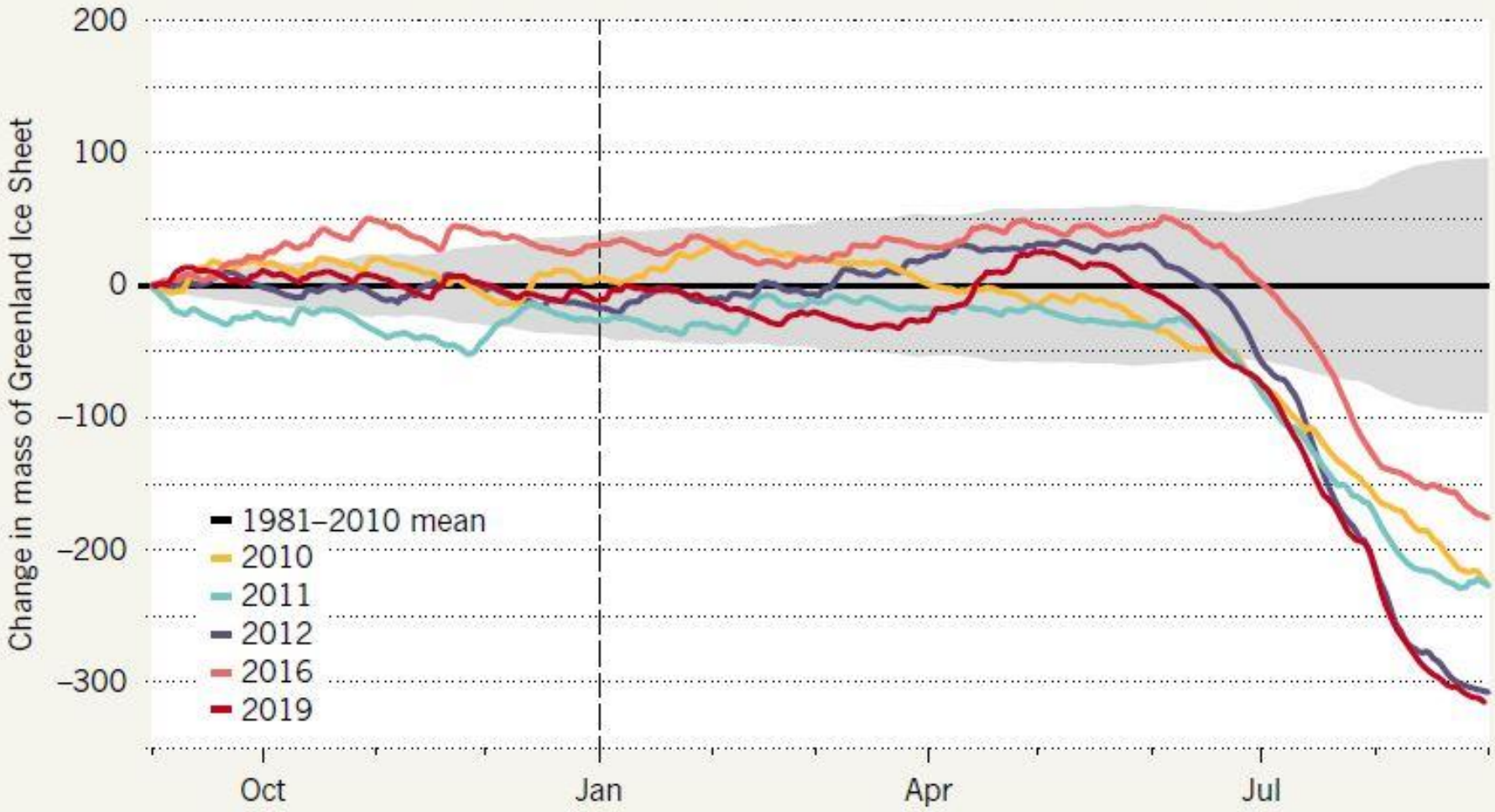
TO THE WIRE

The area covered by Arctic sea ice this summer is on track to be declared one of the lowest since satellite record-keeping began in 1979.



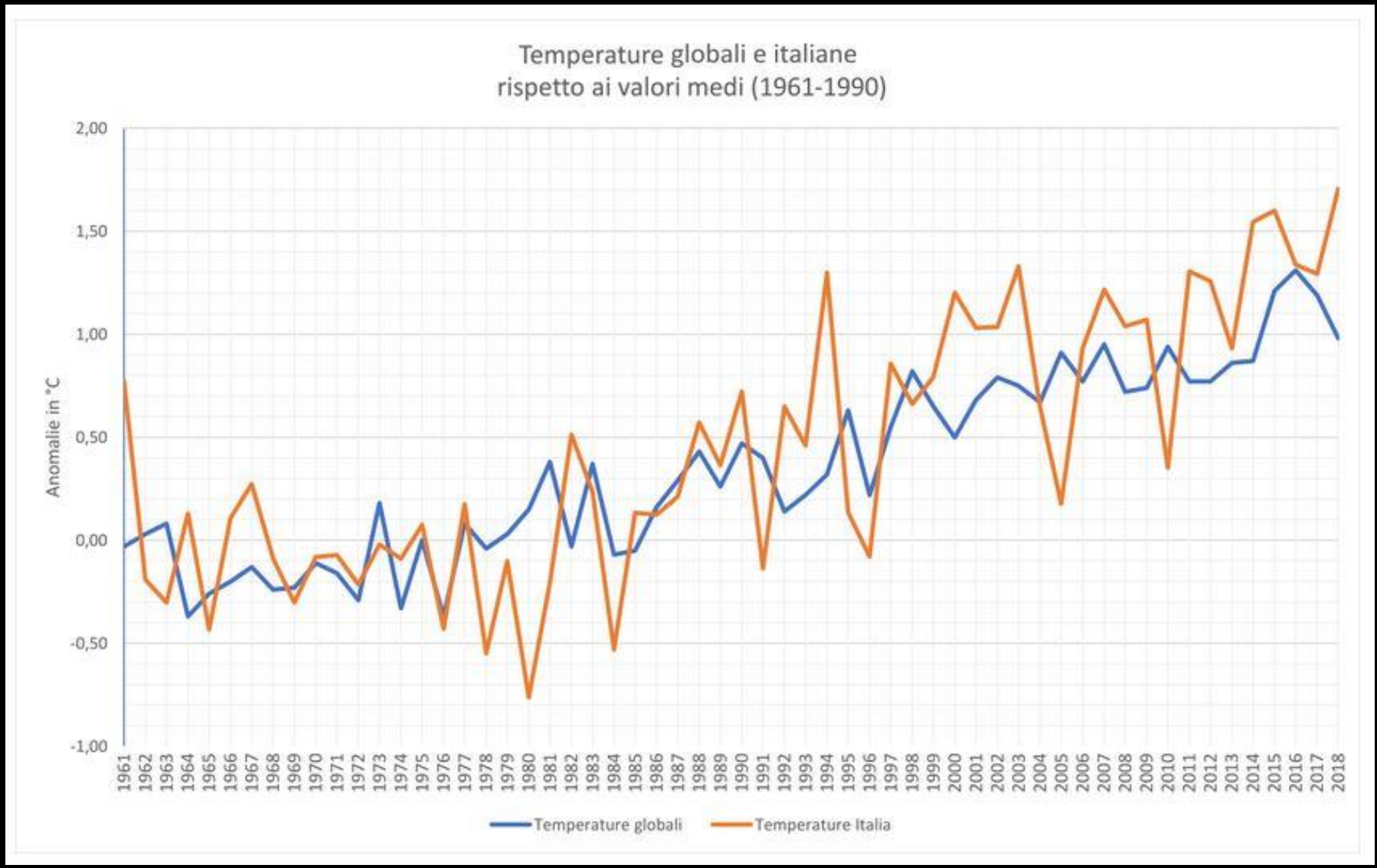
MASSIVE MELT

Greenland's vast ice sheet underwent unusual — and widespread — surface melting in the summer of 2019.



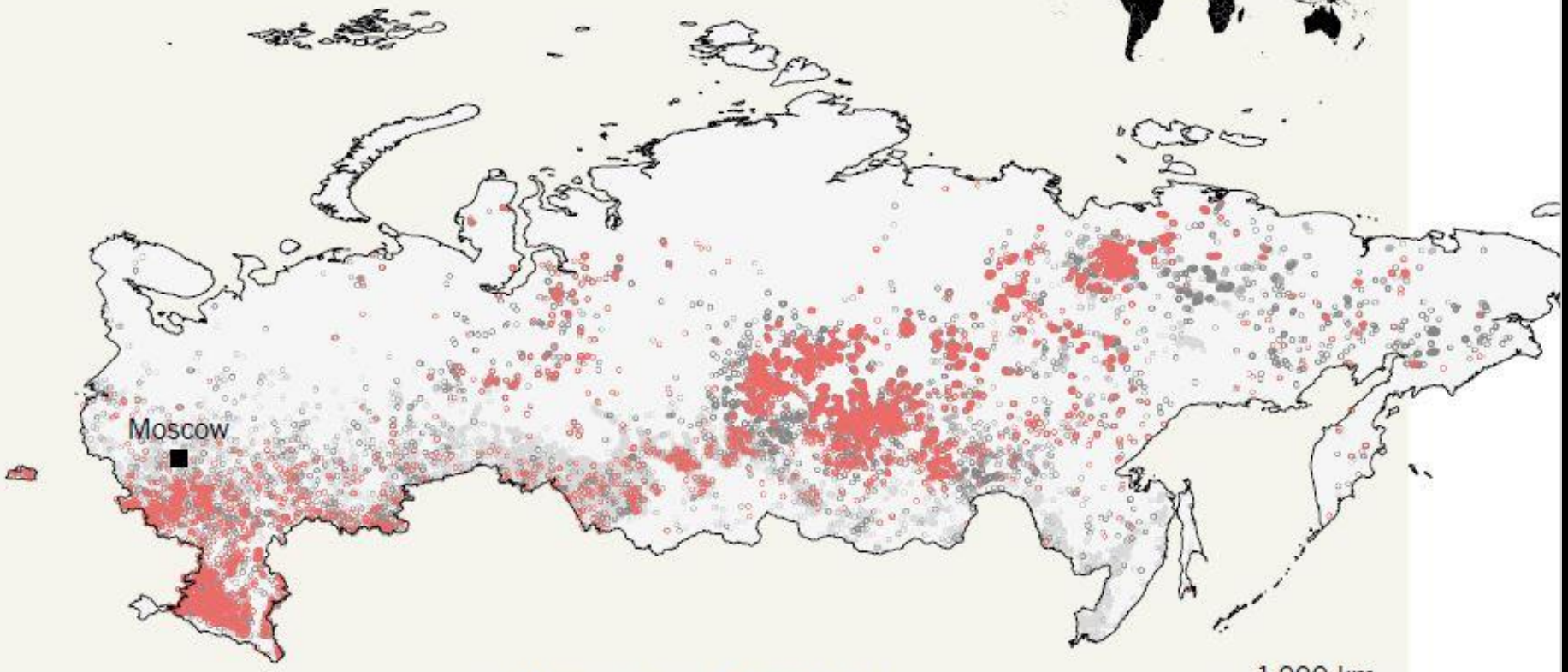
1902

1996


Temperature globali e italiane
rispetto ai valori medi (1961-1990)
Anomalie in °C
2,00
1,50
1,00
0,50
0,00
-0,50
-1,00
1961 1962 1963 1964 1965 1966 1967 1968 1969 1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018
Temperature globali
Temperature Italia

HAZY OUTLOOK

High temperatures set the stage for intense wildfires in Siberia and other parts of Russia this summer.



Pre-COVID-19

COVID-19

ONUITALIA.IT

SEGRETARIATO ONU

5 GIUGNO – GIORNATA MONDIALE DELL'AMBIENTE

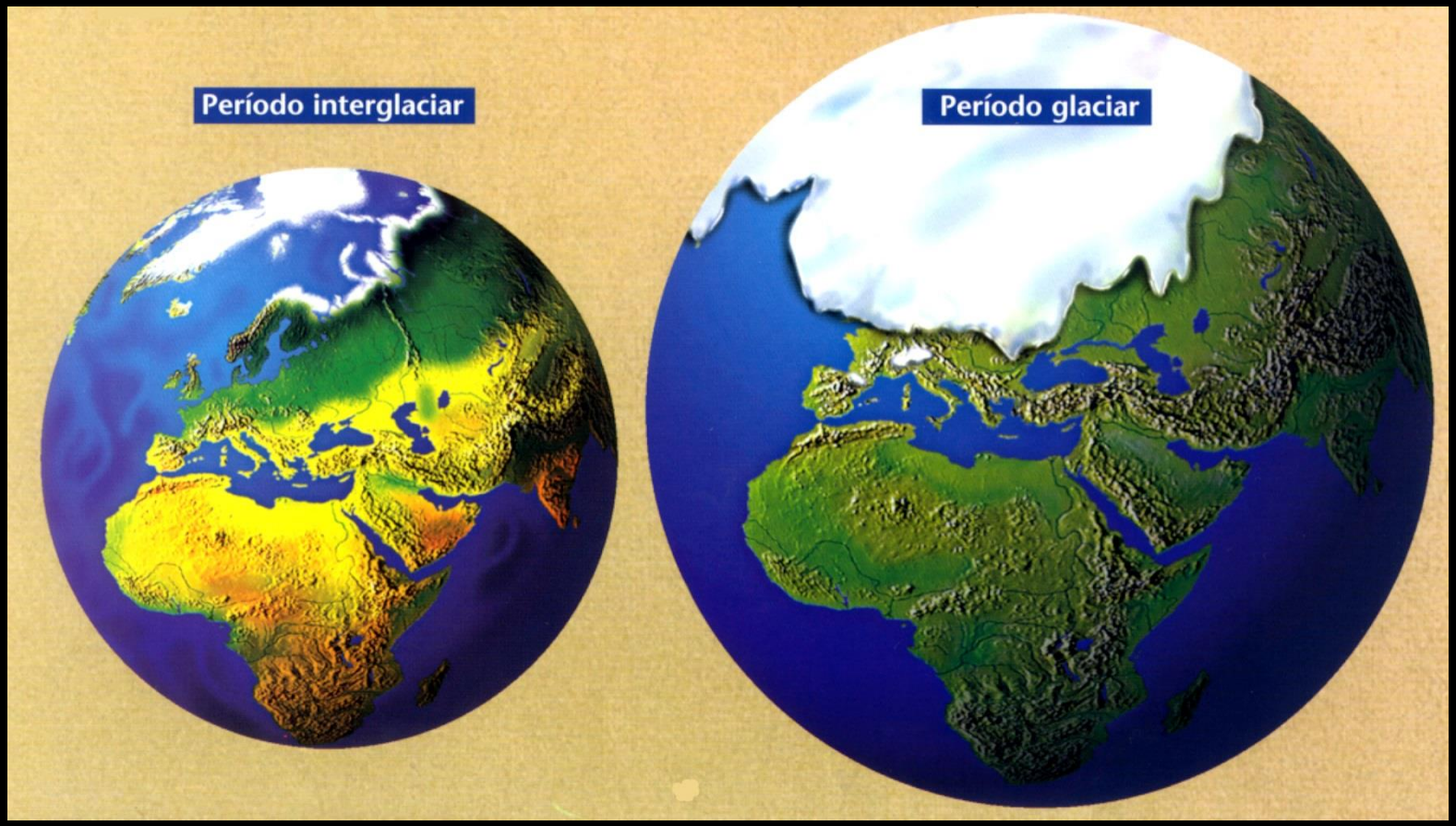
Ecologia preistorica: obiettivi formativi

Il corso permetterà di acquisire una conoscenza di ampia scala sulla variabilità climatica e la diversità ecologica nel corso dell'evoluzione umana, con riguardo principalmente ai continenti africano e europeo.
Partendo dalla definizione di ecologia umana, il corso toccherà aspetti metodologici ed applicativi inerenti la ricostruzione del paleoclima e dei paleoambienti, per poi trattare le forme di interazione Uomo-ambiente nel lungo percorso evolutivo che fin dalle prime forme ominine ha portato allo sviluppo delle società agricole Preistoriche e Protostoriche.

Contenuti del corso

- Presentazione, introduzione e quadro cronologico - astronomico
- Ecologia ed Ecologia umana: definizioni e breve storia della materia.
- Metodi per la ricostruzione paleogeografica, paleoclimatica e paleoecologica.
- Conservazione dei materiali in rapporto all'ambiente di deposizione e metodi di studio.
- La variabilità climatica nel Pliocene africano e la comparsa degli ominini.
- Il Pleistocene inferiore e la diffusione di Homo. Territori e ambienti glaciali e interglaciali tra 800mila e 11mila anni fa: nicchie eco-culturali Neandertal e sapiens.
- Il riscaldamento olocenico, i contesti ecologici degli ultimi cacciatori-raccoglitori e l'impatto ambientale della Neolitizzazione. Ambienti e contesti nella Protostoria.

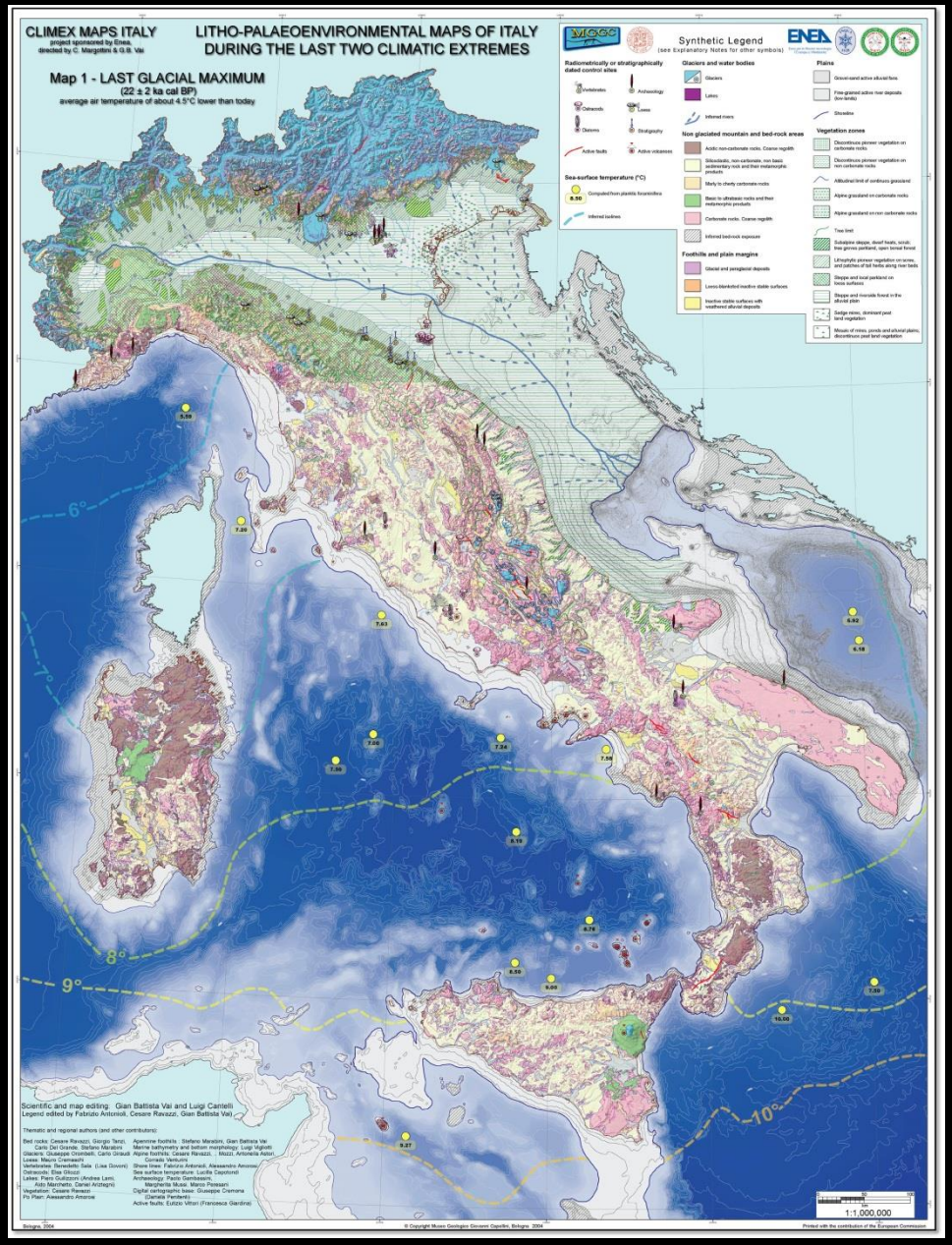
Climatic change and geographic and ecological impact during the Middle and Late Pleistocene

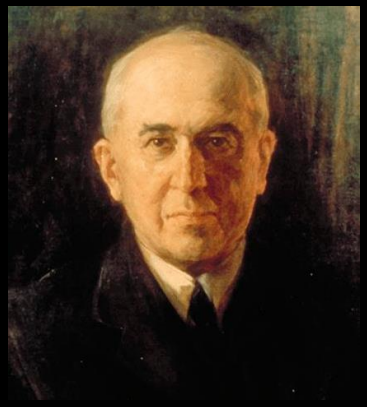


The LGM Map of Italy

By Antonioli F. & Vai G.B. Eds.

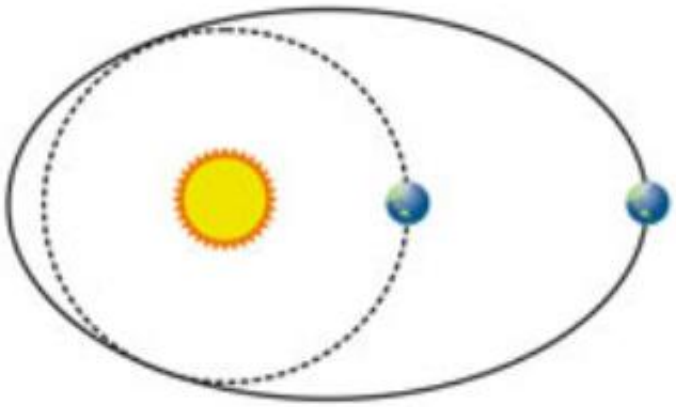
- **lithological, geological and geomorphological units**
- **vegetation zones**
- **palaeontological, palaeobotanical, archaeological, limnological evidence and other proxies of palaeoclimatic relevance.**



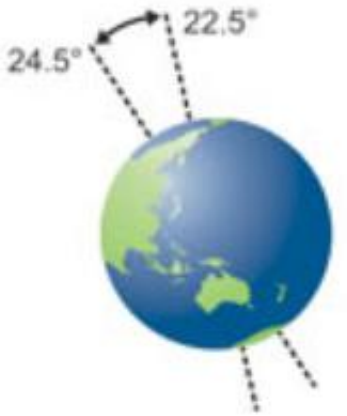


Milutin Milankovitch
(1879- 1958)

Milankovitch Cycles



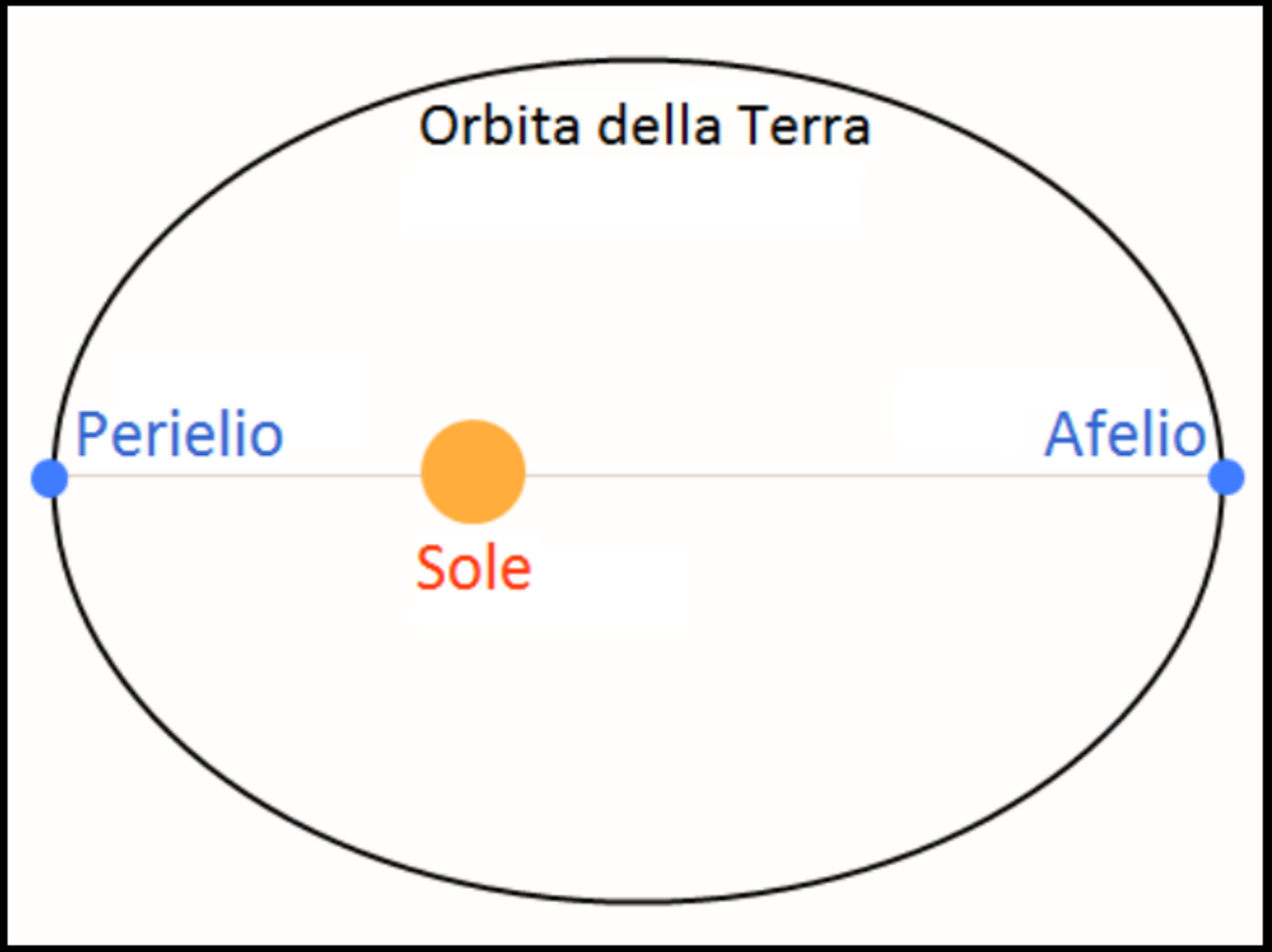
Eccentricity



Obliquity

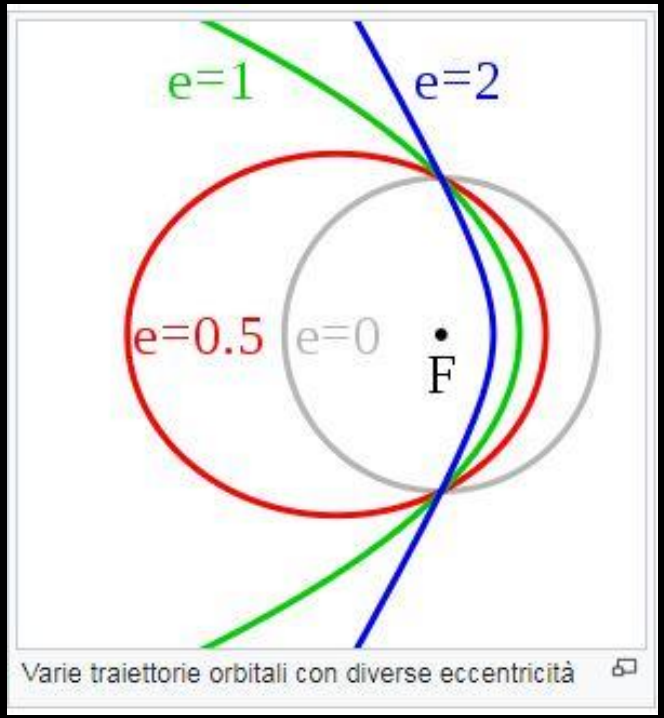
Precession

Eccentricità dell'orbita terrestre



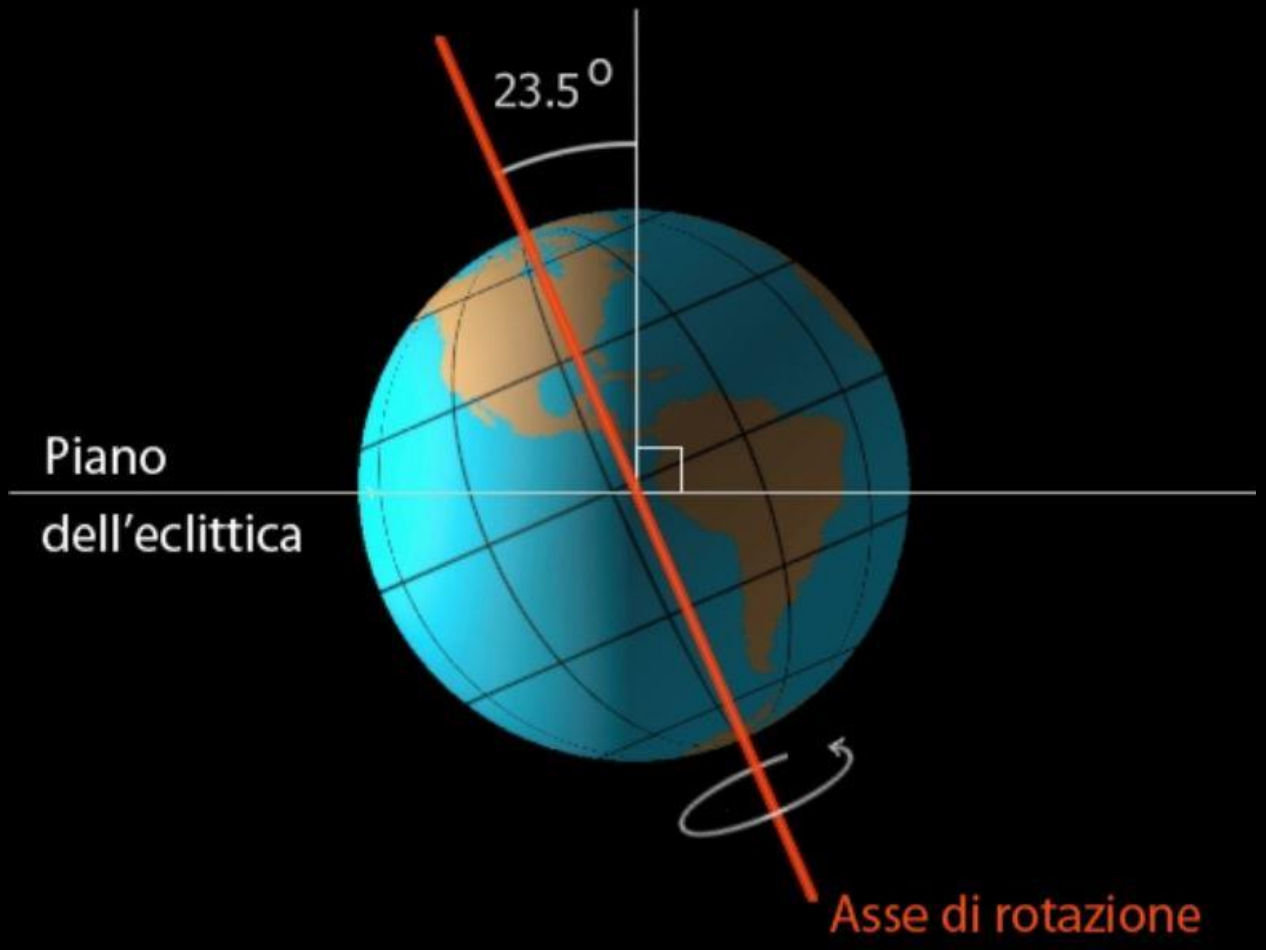
Variazione dell’eccentricità dell’orbita

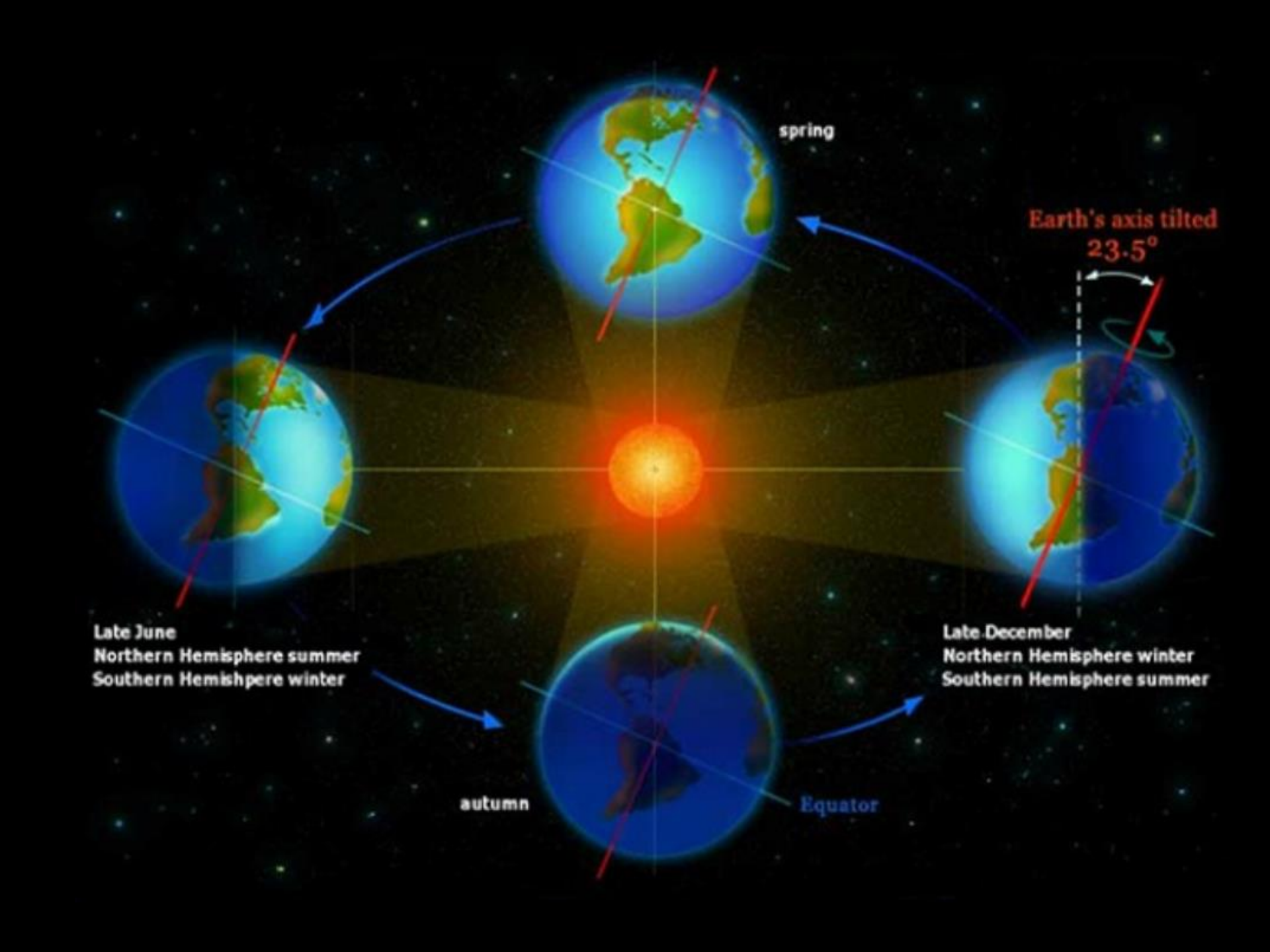
Il rapporto tra la distanza del Sole dal centro dell'orbita e la lunghezza del semiasse maggiore di questa (legata alla differenza tra le distanze Sole-afelio e Sole-perielio) varia in un periodo di circa **92000** anni da un minimo (corrispondente a un valore di eccentricità di circa 0,003) a un massimo (pari a un valore di eccentricità di circa 0,054).



Varie traiettorie orbitali con diverse eccentricità

Inclinazione dell'asse terrestre

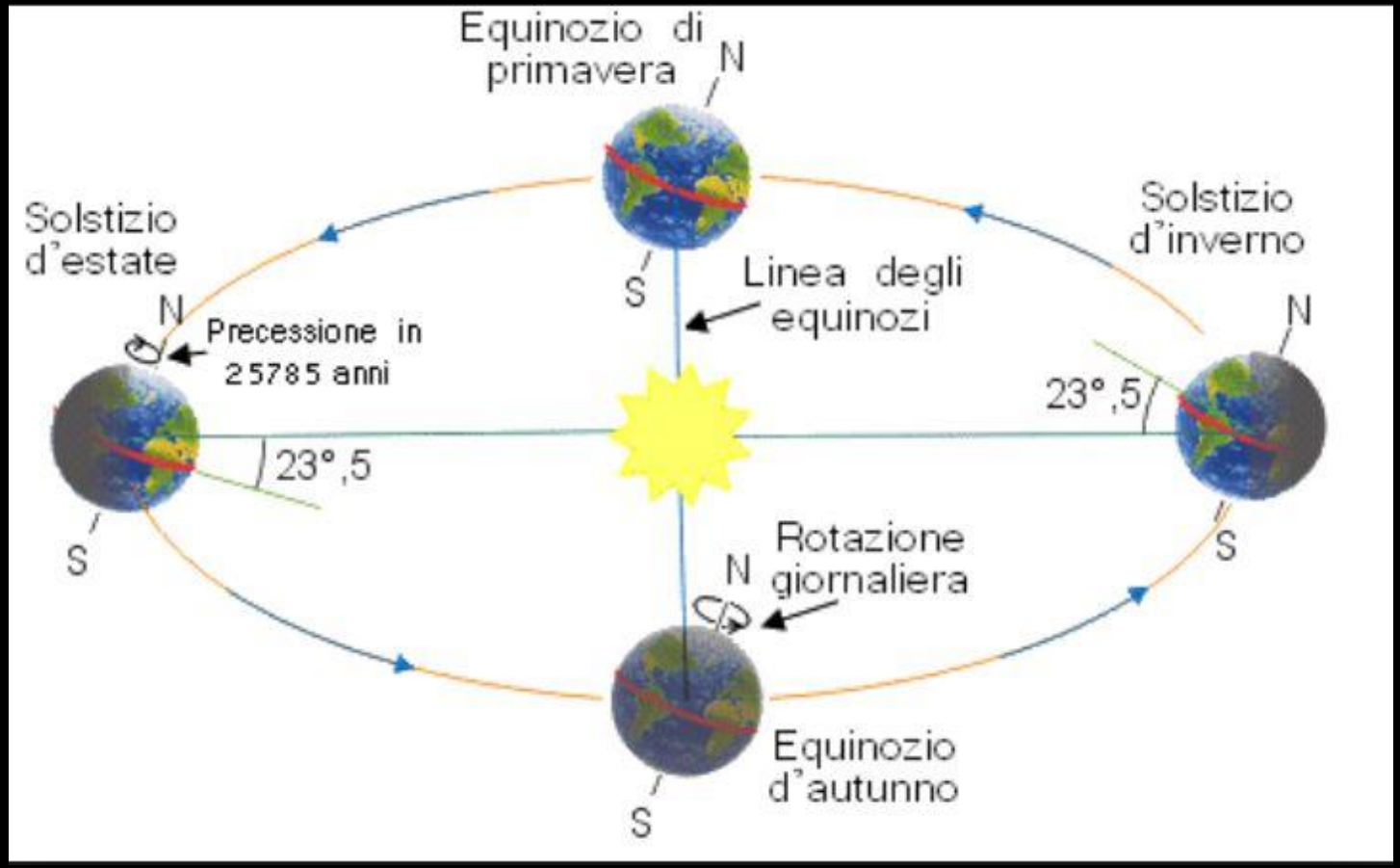


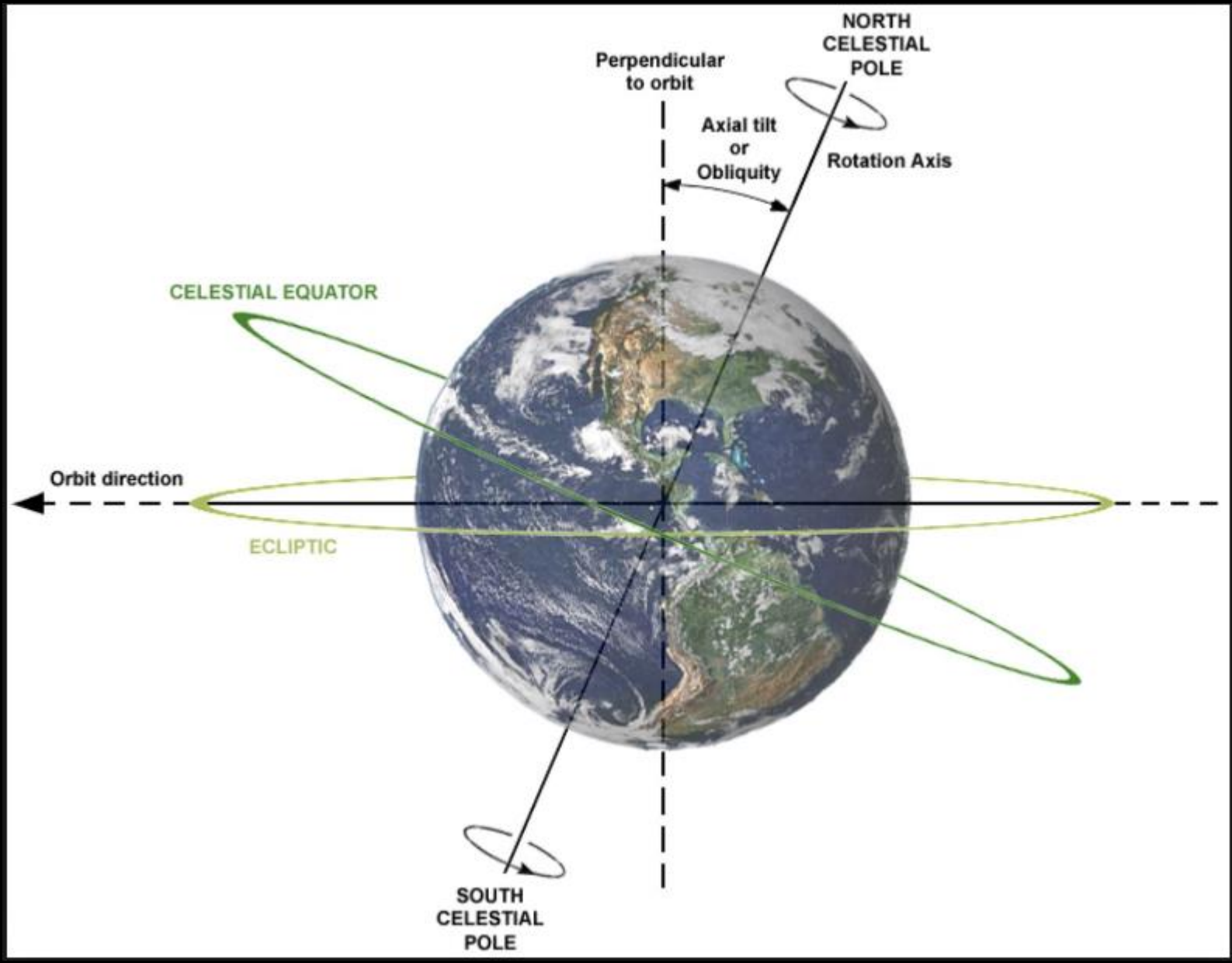

spring
Earth's axis tilted
23.5°
Late June
Northern Hemisphere summer
Southern Hemishpere winter
Late December
Northern Hemisphere winter
Southern Hemisphere summer
autumn
Equator

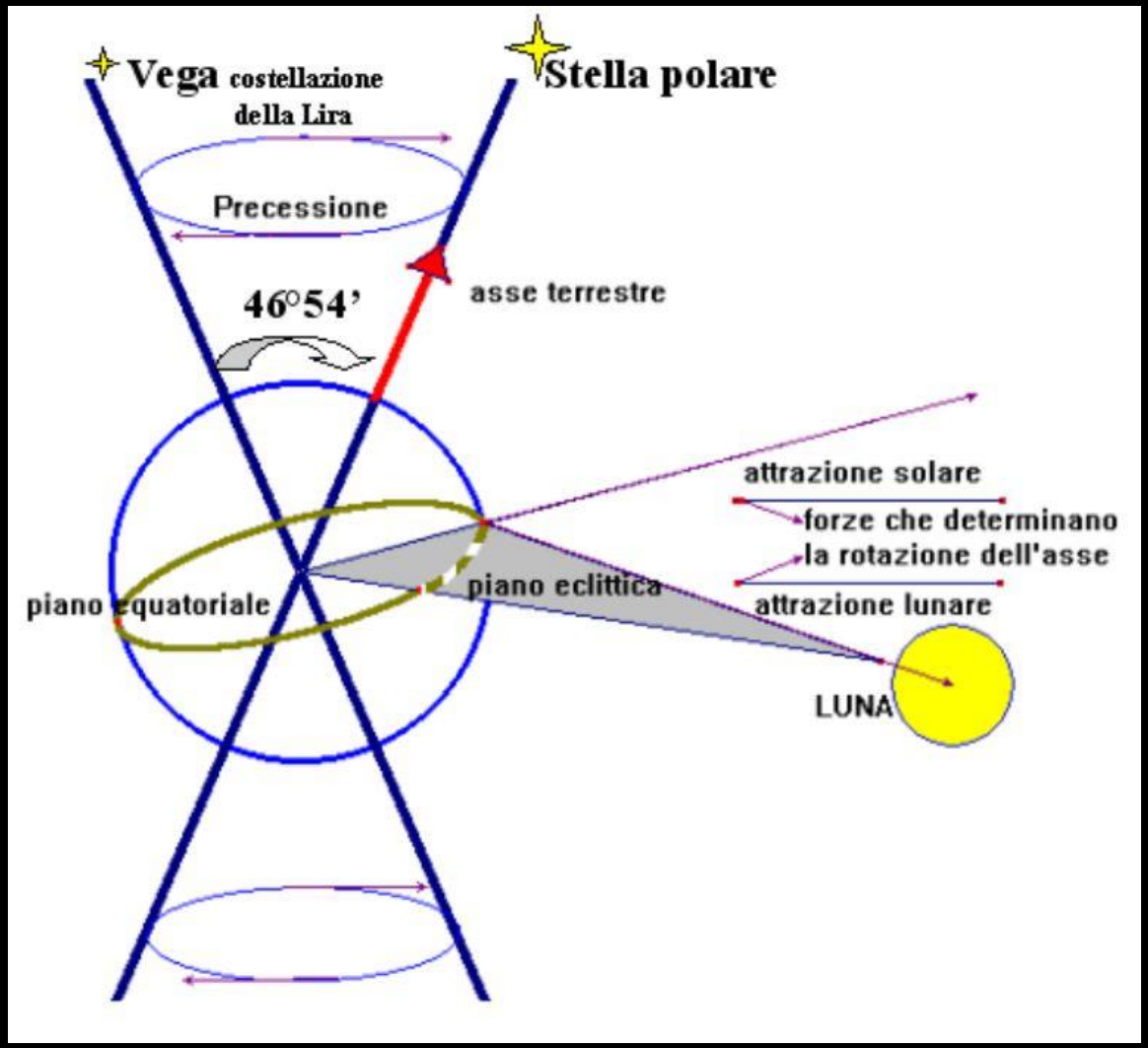
Variazione dell’inclinazione dell’asse terrestre

In un periodo di circa **40000** anni l'angolo che l'asse terrestre forma con la perpendicolare al piano dell'orbita passa da un minimo di 22° 55' a un massimo di 24° 50'.

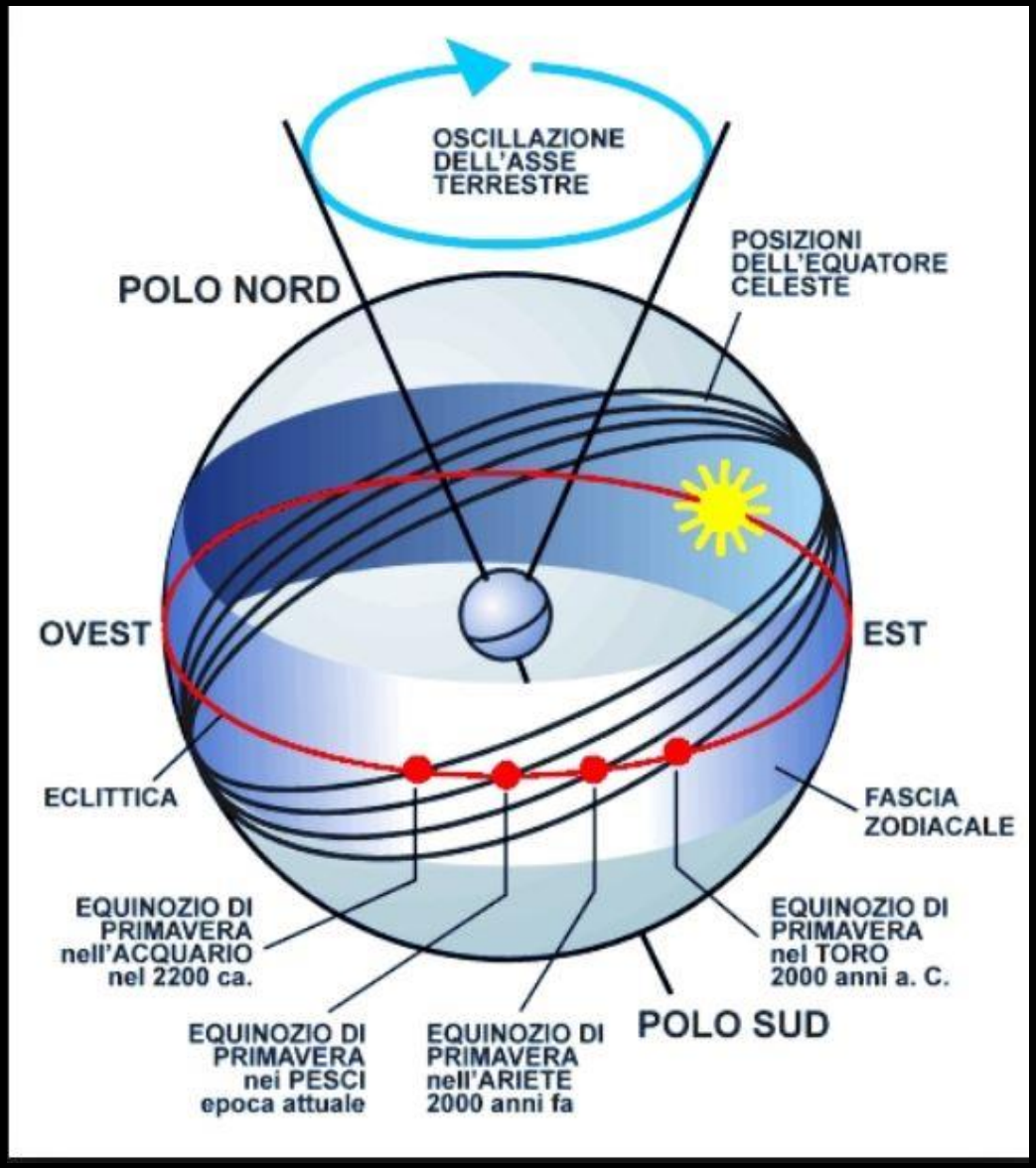
Precessione degli equinozi



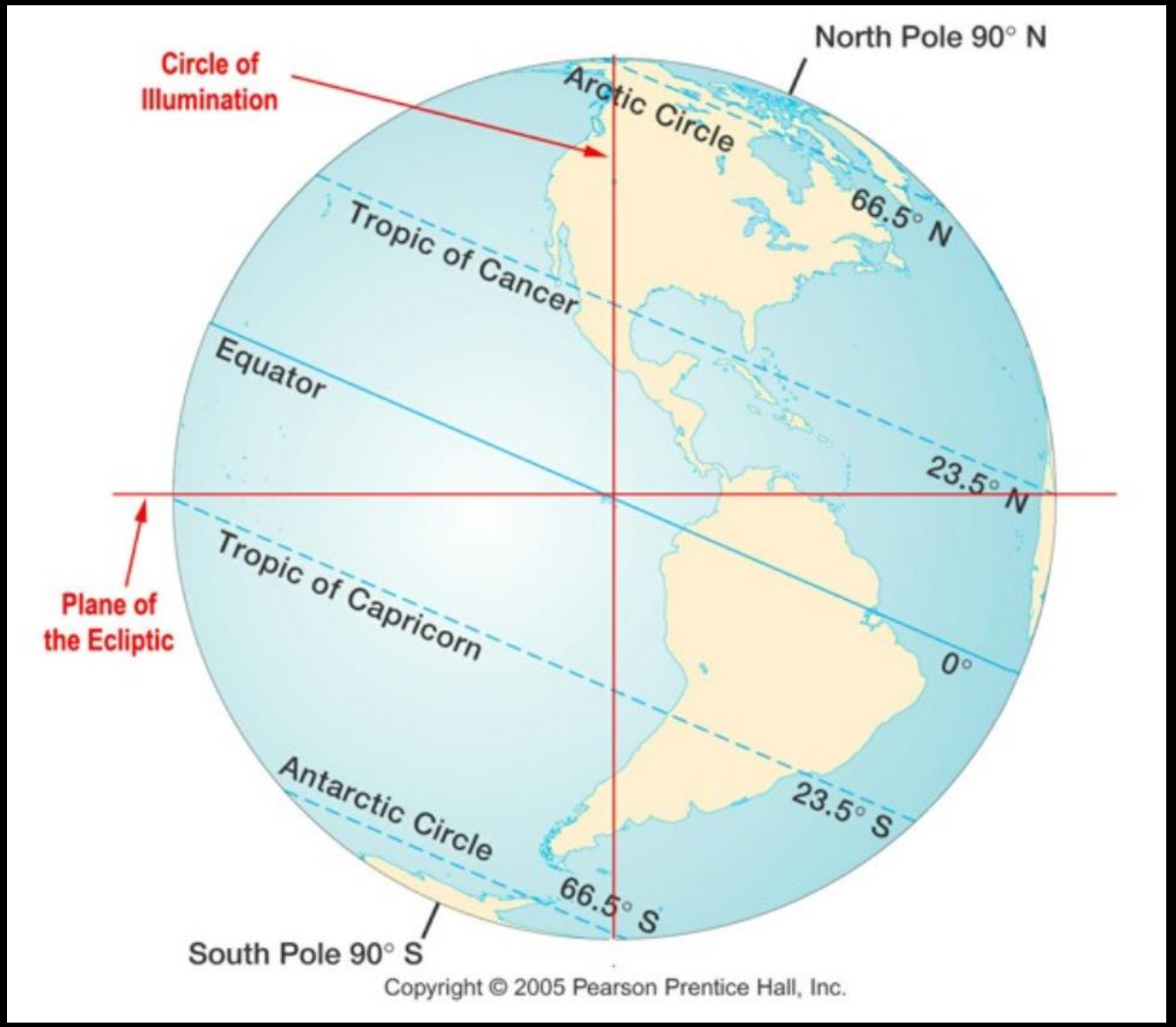

NORTH
CELESTIAL
POLE
Perpendicular
to orbit
Axial tilt
or
Obliquity
Rotation Axis
CELESTIAL EQUATOR
Orbit direction
ECLIPTIC
SOUTH
CELESTIAL
POLE



Le forze di attrazione del Sole e della Luna, facendo perno al centro della terra, fanno oscillare l'asse che compie un giro completo del cono tracciato nello spazio in circa **25.800** anni, durante il quale la posizione delle stelle sulla sfera celeste varia lentamente.



La precessione causa l'anticipo di 50 secondi ogni anno degli equinozi.



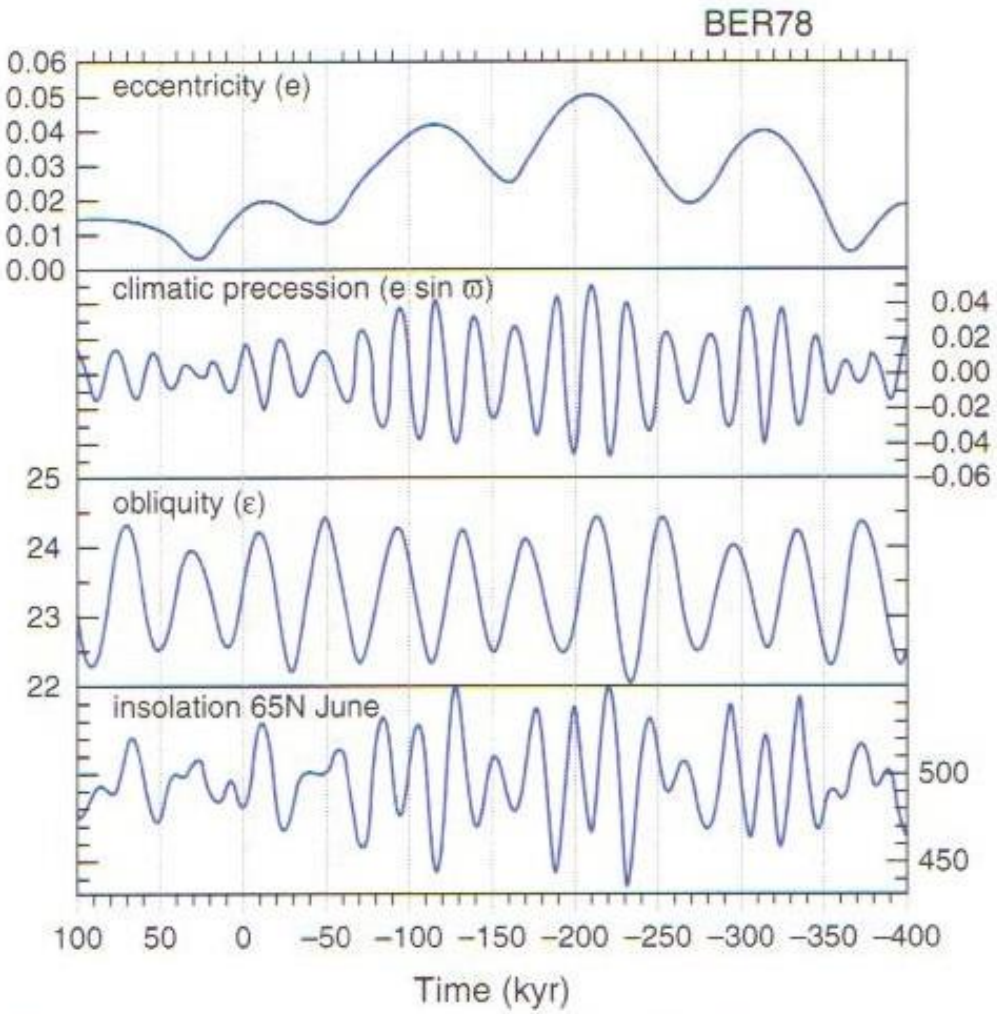
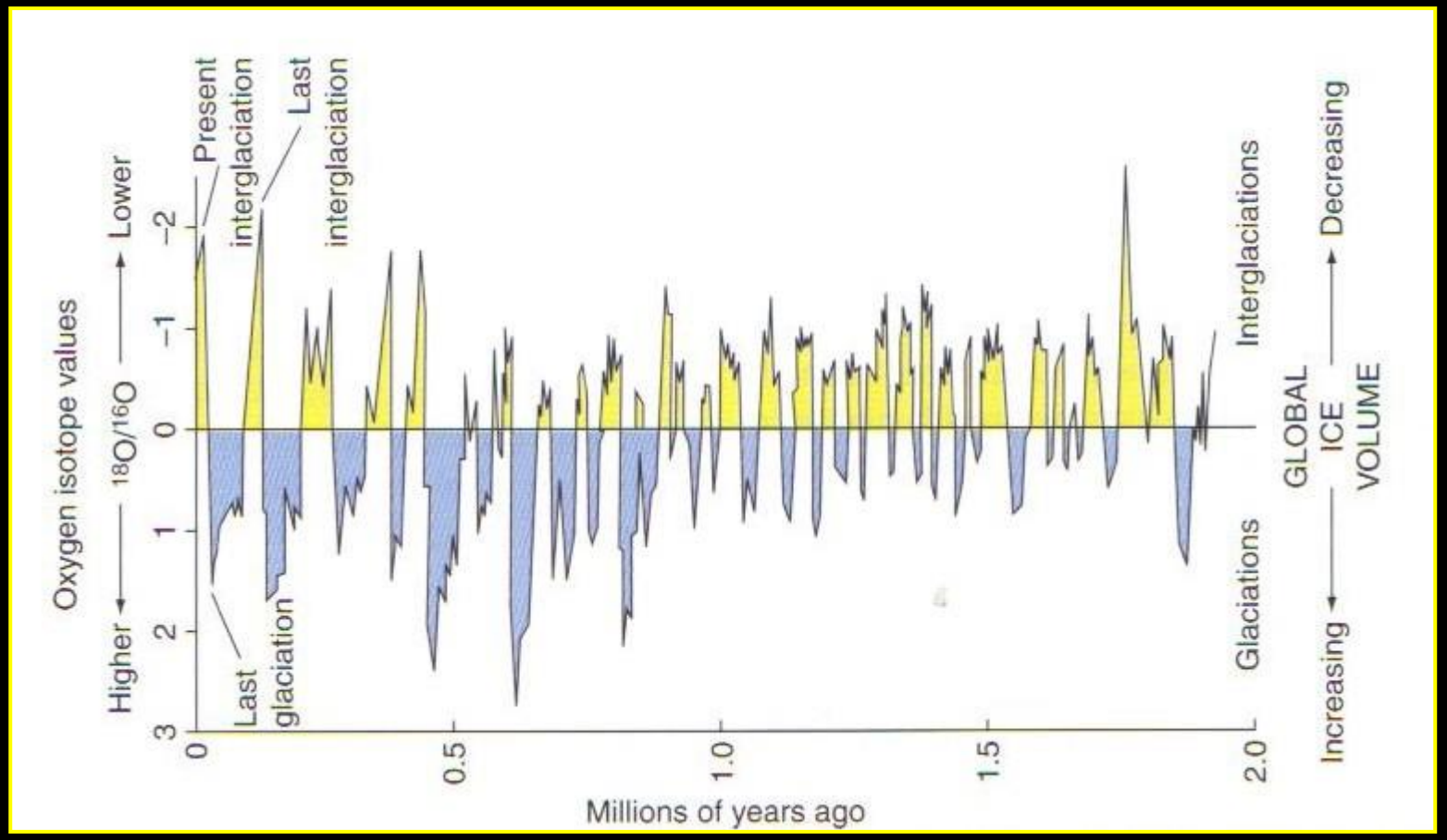


Figure 1 Long-term variations over the last 400 ky and the next 100 ky of eccentricity, climatic precession, obliquity, and 65 °N insolation at the summer solstice in WM^{-2} (Berger, 1978). This insolation is shown as an example of Milankovitch (1941) principles. It must be stressed that all latitudes and days are used in the LLN models. Ky, thousand years; LLN, Louvain-la-Neuve.

Change in the magnitude of glacial cycles after the Middle Pleistocene Revolution



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Earth Science for the Global Community

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With 121 national members, the Union aims to promote development of the Earth sciences through the support of broad-based scientific studies relevant to the entire Earth system; to apply the results of these and other studies to preserving Earth's natural environment, using all natural resources wisely and improving the prosperity of nations and the quality of human life; and to strengthen public awareness of geology and advance geological education in the widest sense.

News and Information

IUGG Electronic Journal
Volume 17 No. 10 - October 2017 (Posted 02.10.2017)

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The International Commission on Stratigraphy is the largest and oldest constituent scientific body in the International Union of Geological Sciences (IUGS). Its primary objective is to precisely define global units (systems, series, and stages) of the International Chronostratigraphic Chart that, in turn, are the basis for the units (periods, epochs, and age) of the International Geologic Time Scale; thus setting global standards for the fundamental scale for expressing the history of the Earth.

IUGS

News & Meetings

- STRATI 2019 will be held at Milano, Italy, 2-5 July 2019 [2017-08-22]
- Official launch of the GSSP of the Chattian Stage (Oligocene Series), Monte Cagnero section, Italy, May 13, 2017 [2017-08-21]
- New official website of the Triassic Subcommission available now [2017-08-21]
- Revised ICS Statutes ratified by IUGS EC [2017-05-15]
- New ICS Executive Officers for term of 2016-2020 [2015-11-09]

GBDB

Geobiodiversity

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Italian Association for the Study of the Quaternary

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AIQUA Associazione Italiana per lo Studio del Quaternario

L'Associazione Italiana per lo Studio del Quaternario (AIQUA) raccoglie studiosi provenienti sia dal mondo accademico che professionale, accomunati da un interesse nello studio delle epoche più recenti della storia della Terra, il Pleistocene e l'Olocene.

Nell'associazione sono attivi ricercatori di settori diversi, tra cui la geologia, la geomorfologia, la paleontologia, la geocronologia, l'archeologia, la paleoclimatologia e la paleoecologia.

L'AIQUA:

- rappresenta l'organizzazione italiana di riferimento per lo studio dell'evoluzione del Quaternario, del clima e delle modificazioni del territorio intercorse in questo periodo;
- promuove gli studi attraverso la rivista "AMQ - Alpine and Mediterranean Quaternary", già "Il Quaternario - Italian Journal of Quaternary Sciences" e l'organizzazione di conferenze, scuole estive ed escursioni sul terreno;
- è il referente italiano dell'INQUA – International Union for Quaternary Research;

Calendario eventi

Ottobre 2017

Lun	Mar	Mer	Gio	Ven	Sab	Dom
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Lingua:

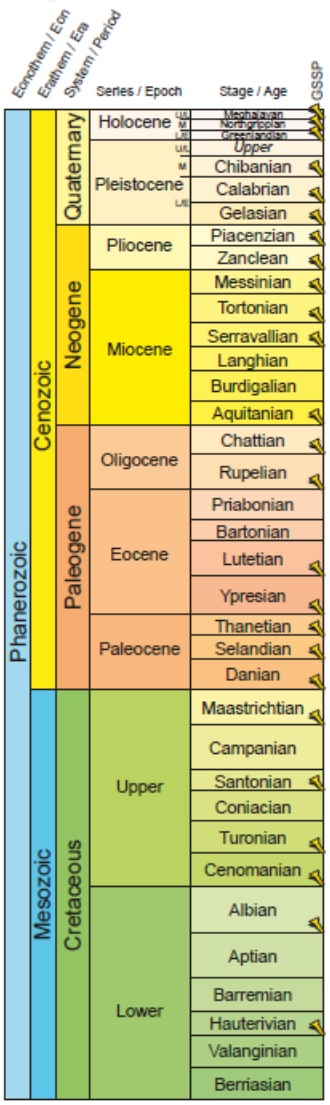
INTERNATIONAL CHRONOSTRATIGRAPHIC CHART

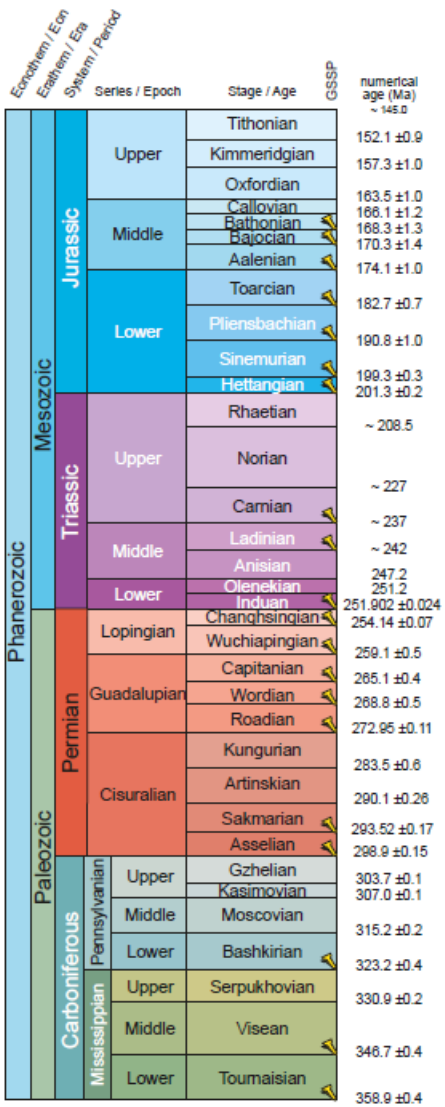
IUGS

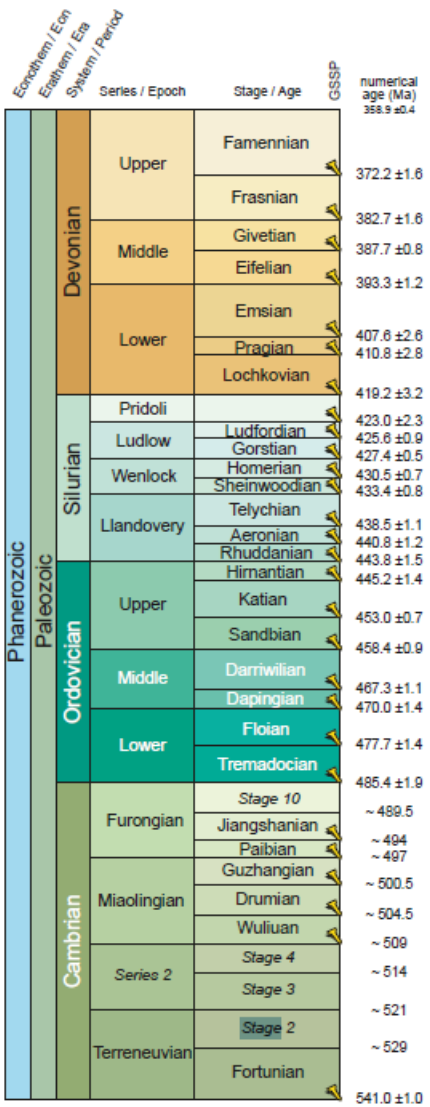
www.stratigraphy.org

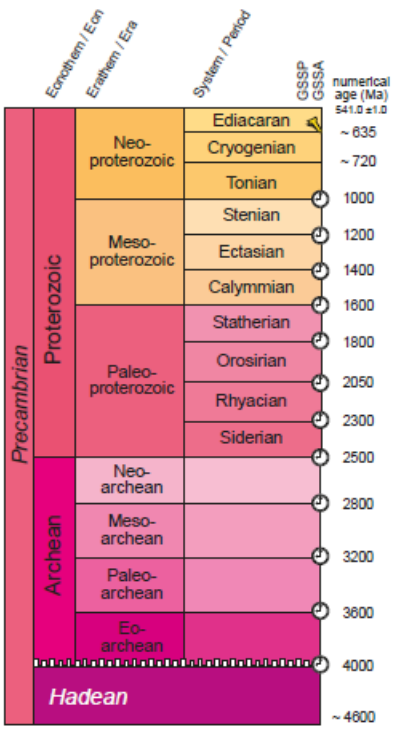
International Commission on Stratigraphy

v 2020/01









Units of all ranks are in the process of being defined by Global Boundary Stratotype Section and Points (GSSP) for their lower boundaries, including those of the Archean and Proterozoic, long defined by Global Standard Stratigraphic Ages (GSSA). Italic fonts indicate informal units and placeholders for unnamed units. Versioned charts and detailed information on ratified GSSPs are available at the website http://www.stratigraphy.org. The URL to this chart is found below.

Numerical ages are subject to revision and do not define units in the Phanerozoic and the Ediacaran; only GSSPs do. For boundaries in the Phanerozoic without ratified GSSPs or without constrained numerical ages, an approximate numerical age (~) is provided.

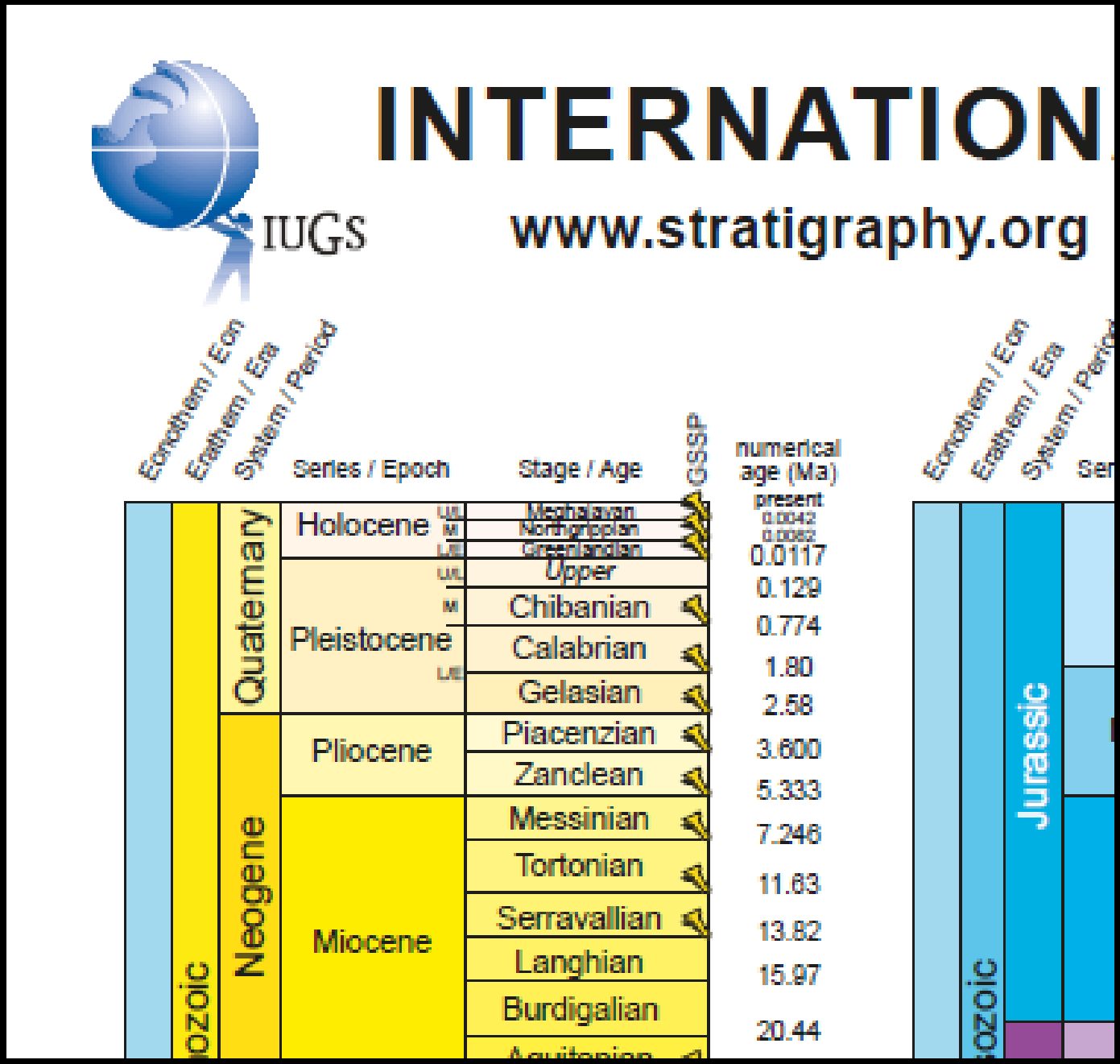
Ratified Subseries/Subepochs are abbreviated as U/L (Upper/Late), M (Middle) and L/E (Lower/Early). Numerical ages for all systems except Quaternary, upper Paleogene, Cretaceous, Triassic, Permian and Precambrian are taken from 'A Geologic Time Scale 2012' by Gradstein et al. (2012), those for the Quaternary, upper Paleogene, Cretaceous, Triassic, Permian and Precambrian were provided by the relevant ICS subcommissions.

Colouring follows the Commission for the Geological Map of the World (www.ccgm.org)

Chart drafted by K.M. Cohen, D.A.T. Harper, P.L. Gibbard, J.-X. Fan

To cite: Cohen, K.M., Finney, S.C., Gibbard, P.L. & Fan, J.-X. (2013; updated) The ICS International Chronostratigraphic Chart. Episodes 36: 199-204.

URL: http://www.stratigraphy.org/ICSchart/ChronostratChart2020-01.pdf


INTERNATION
IUGS
www.stratigraphy.org
Eonothem / Eon
Erathem / Era
System / Period
Series / Epoch
Stage / Age
GSSP
numerical age (Ma)
present
0.0042
0.0082
Holocene
Meghalayan
Northgrippian
Greenlandian
0.0117
Pleistocene
Upper
Chibanian
0.129
0.774
Calabrian
1.80
Gelasian
2.58
Quaternary
Neogene
Pliocene
Piacenzian
3.600
Zanclean
5.333
Miocene
Messinian
7.246
Tortonian
11.63
Serravallian
13.82
Langhian
15.97
Burdigalian
20.44
Jurassic

by K.M. Cohen[1], S.C. Finney[2], P.L. Gibbard[3], and J.-X. Fan[4]

The ICS International Chronostratigraphic Chart

ICS: International Commission of Stratigraphy

Episodes, 2013

Global Boundary Stratotype Section and Point (GSSP) of the International Commission on Stratigraphy

Stage	Numerical Age (Ma)	GSSP Location	Latitude, Longitude	Boundary Level	Correlation Events	Status	Reference
Phanerozoic Eon							
Cenozoic Era							
Quaternary System							
Holocene Series							
Holocene Stage	0.011784	NorthGRIP ice core, central Greenland	75.1000°N 42.3200°W	1492.45m depth in Borehole NGRIP2	Climatic -- End of the Younger Dryas cold spell, which is reflected in a shift in deuterium excess values	Ratified 2008	Episodes 31/2, 2008; J. Quaternary Sci., Vol. 24 pp. 3-17, 2009
Pleistocene Series							
Upper Stage							
Middle Stage							
Calabrian Stage	1.80	Vrica, Italy	39.0385°N 17.1348°E	base of the marine claystone overlying the sapropelic marker Bed 'e' (Mediterranean Precession Related Sapropel, MPRS 176)	Magnetic -- ~15 kyr after end of Olduvai (C2n) normal polarity chron	Ratified 1985 as base of Pleistocene; Ratified 2011 as base of Calabrian	Episodes 8/2, p. 116 – 120, 1985; Episodes 35/3, p. 388-397, 2012
Gelasian Stage	2.58	Monte San Nicola, Sicily, Italy	37.1469°N 14.2035°E	base of marly layer overlying sapropel MPRS 250	Magnetic -- Matuyama/Gauss boundary (C2r/C2An) is 1m below GSSP. GSSP level is within Marine Isotope Stage 103.	Ratified 1996 as base of Gelasian; Ratified 2009 as base of Pleistocene and Quaternary	Episodes 21/2, p. 82–87, 1998; Episodes 33/3, p. 152-158, 2010
Neogene System							
Pliocene Series							

The Pliocene-Pleistocene Boundary

by E. Aguirre and G. Pasini

The base of the Pleistocene Series is defined formally in a stratotype section at Vrica, Calabria, southern Italy. Biostratigraphic criteria for correlating the boundary level are well supported by magnetostratigraphic and geochronologic data.

Episodes, 1985

by Maria Bianca Cita[1], Philip L. Gibbard[2], Martin J. Head[3], and the ICS Subcommission on Quaternary Stratigraphy[†]

Formal ratification of the GSSP for the base of the Calabrian Stage (second stage of the Pleistocene Series, Quaternary System)

The Calabrian Stage is now formally defined by the Global Boundary Stratotype Section and Point (GSSP) at Vrica, Calabria, Italy.

Episodes, 2012

by D. Rio[1], R. Sprovieri[2], D. Castradori[3], and E. Di Stefano[2]

The Gelasian Stage (Upper Pliocene): A new unit of the global standard chronostratigraphic scale

The Gelasian has been formally accepted as third (and uppermost) subdivision of the Pliocene Series, thus representing the Upper Pliocene. The Global Standard Stratotype-section and Point for the Gelasian is located in the Monte S. Nicola section (near Gela, Sicily, Italy).

Episodes, 1998

JOURNAL OF QUATERNARY SCIENCE (2009)

Published online in Wiley InterScience
(www.interscience.wiley.com) DOI: 10.1002/jqs.1338

Formal ratification of the Quaternary System/Period and the Pleistocene Series/Epoch with a base at 2.58 Ma

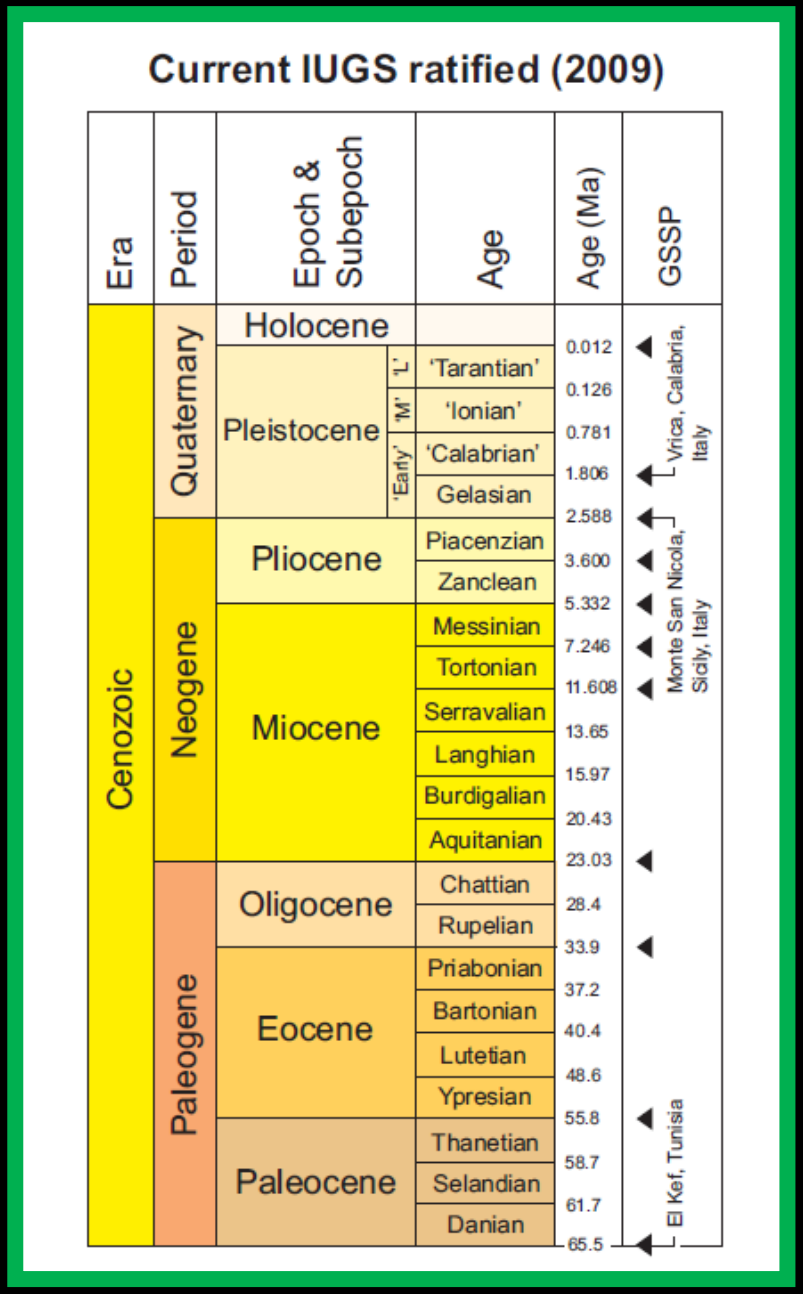
PHILIP L. GIBBARD,[1*] MARTIN J. HEAD,[2] MICHAEL J. C. WALKER[3,4]
and THE SUBCOMMISSION ON QUATERNARY STRATIGRAPHY[†]

by Philip L. Gibbard[1] and Martin J. Head[2]

The newly-ratified definition of the Quaternary System/Period and redefinition of the Pleistocene Series/Epoch, and comparison of proposals advanced prior to formal ratification

[1]Chair of the ICS Subcommission on Quaternary Stratigraphy; Department of Geography, University of Cambridge, Downing Place, Cambridge CB2 3EN, United Kingdom. *E-mail: plg1@cam.ac.uk*

In June 2009, the Executive Committee of the International Union of Geological Sciences (IUGS) formally ratified a proposal by the International Commission on Stratigraphy to lower the base of the Quaternary System/Period to the Global Stratotype Section and Point (GSSP) of the Gelasian Stage/Age at Monte San Nicola, Sicily, Italy.



The IUGS-sanctioned in 2009 timescale for the Cenozoic, in which the Quaternary and Pleistocene are conterminous with the base of the Gelasian Stage at 2.6 Ma. Stage names and boundary ages are from the ICS website, with the Calabrian and Ionian stages following Cita et al. (2006, 2008) and the provisional Tarantian Stage following Cita (2008). Currently defined GSSPs are indicated by black arrows.

Figure 3 Panoramic view of the Monte San Nicola section in southern Sicily. The view is to the north and shows a sequence of uplifted Mediterranean precession-related sapropels (MPRS) spanning the Piacenzian and Gelasian stages. Obliquity-controlled glacial cycles are also evident as dark layers in this section. The arrow indicates the position of the sapropelic (dark) Nicola bed, which is the correlative of MPRS-250 (Rio *et al.*, 1998). The Gelasian–Pleistocene–Quaternary GSSP is at the base of the marly (light) layer immediately overlying the Nicola bed, and lies within the Monte Narbone Formation. Photograph courtesy of E. Di Stefano/S. Bonomo

JOURNAL OF QUATERNARY SCIENCE (2009) **24**(1) 3–17

Published online 3 October 2008 in Wiley InterScience
(www.interscience.wiley.com) DOI: 10.1002/jqs.1227

Formal definition and dating of the GSSP (Global Stratotype Section and Point) for the base of the Holocene using the Greenland NGRIP ice core, and selected auxiliary records

MIKE WALKER,[1*] SIGFUS JOHNSEN,[2] SUNE OLANDER RASMUSSEN,[2] TREVOR POPP,[2,3] JØRGEN-PEDER STEFFENSEN,[2] PHIL GIBBARD,[4] WIM HOEK,[5] JOHN LOWE,[6] JOHN ANDREWS,[7] SVANTE BJÖRCK,[8] LES C. CWYNAR,[9] KONRAD HUGHEN,[10] PETER KERSHAW,[11] BERND KROMER,[12] THOMAS LITT,[13] DAVID J. LOWE,[14] TAKESHI NAKAGAWA,[15] REWI NEWNHAM[16] and JAKOB SCHWANDER[17]

The Greenland ice core from NorthGRIP (NGRIP) contains a proxy climate record across the Pleistocene–Holocene boundary of unprecedented clarity and resolution. Analysis of an array of physical and chemical parameters within the ice enables the base of the Holocene, as reflected in the first signs of climatic warming at the end of the Younger Dryas/Greenland Stadial 1 cold phase, to be located with a high degree of precision.

Japan Puts Its Mark on Geologic Time with the Chibanian Age

Earth's newest geologic time interval has been named after a jurisdiction outside Tokyo, Japan. The International Union of Geological Sciences (IUGS) recently ratified the name "Chibanian," meaning "Chiba age," for a period of time stretching from 770,000 to 126,000 years ago, during the Pleistocene epoch.

Brunhes–Matuyama reversal, named after Bernard Brunhes and Motonori Matuyama, was a geologic event, approximately 781,000 years ago, when the Earth's magnetic field last underwent reversal.

JOURNAL OF QUATERNARY SCIENCE (2019) **00**(0) 1–14 ISSN 0267-8179. DOI: 10.1002/jqs.3097

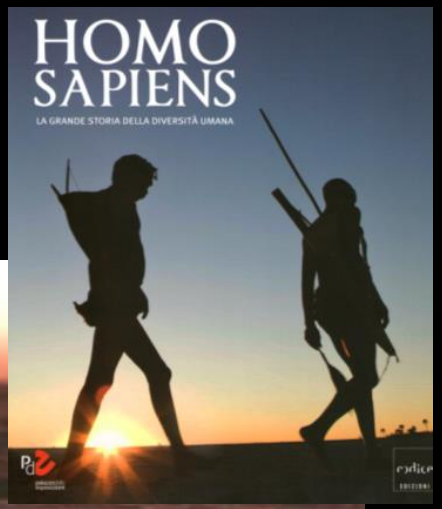
JQS Journal of Quaternary Science QRA Quaternary Research Association

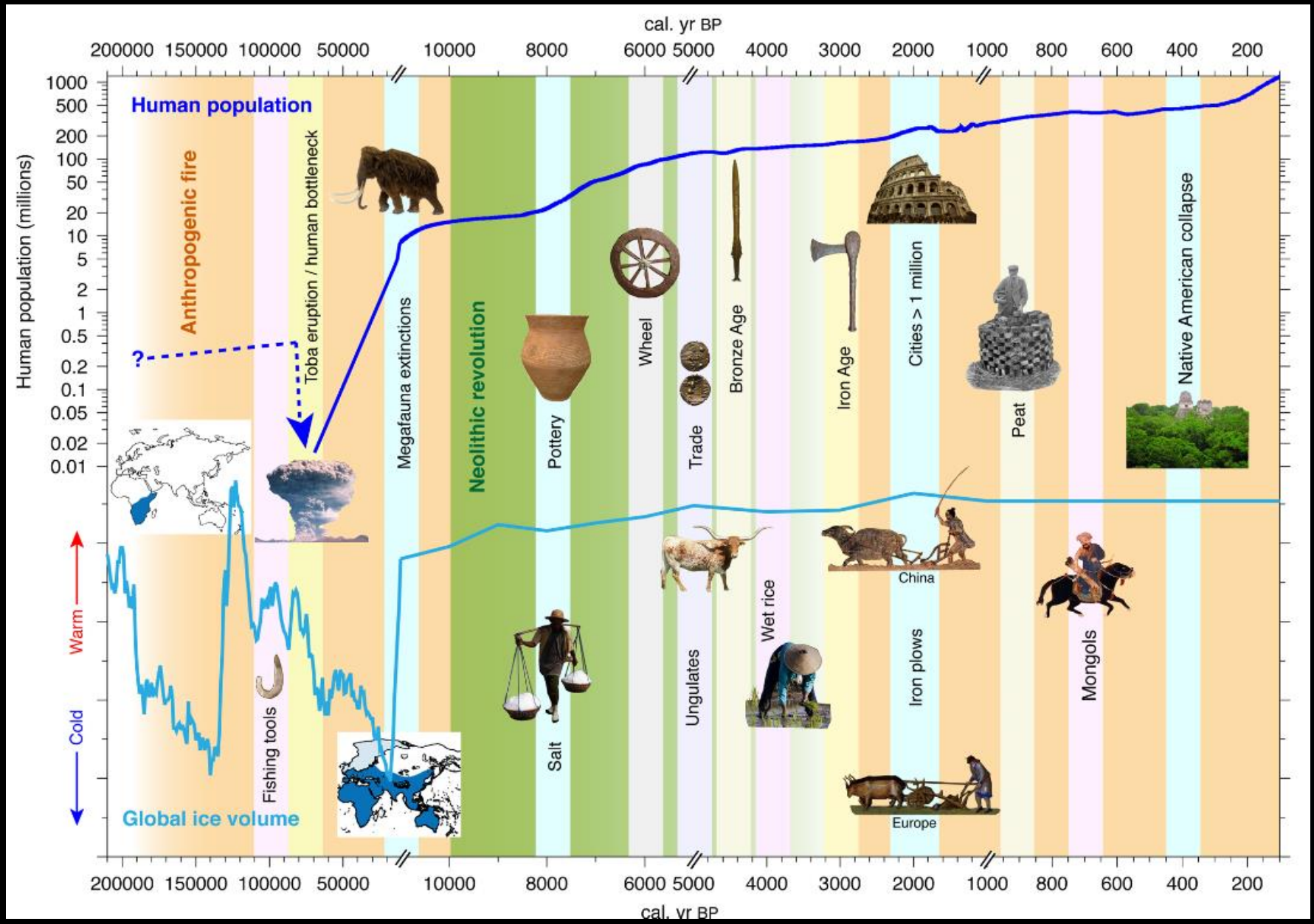
Subdividing the Holocene Series/Epoch: formalization of stages/ages and subseries/subepochs, and designation of GSSPs and auxiliary stratotypes

MIKE WALKER,[1,2*] MARTIN J. HEAD,[3] JOHN LOWE,[4] MAX BERKELHAMMER,[5] SVANTE BJÖRCK,[6] HAI CHENG,[7,8] LES C. CWYNAR,[9] DAVID FISHER,[10] VASILEIOS GKINIS,[11] ANTONY LONG,[12] REWI NEWNHAM,[13] SUNE OLANDER RASMUSSEN[11] and HARVEY WEISS[14]

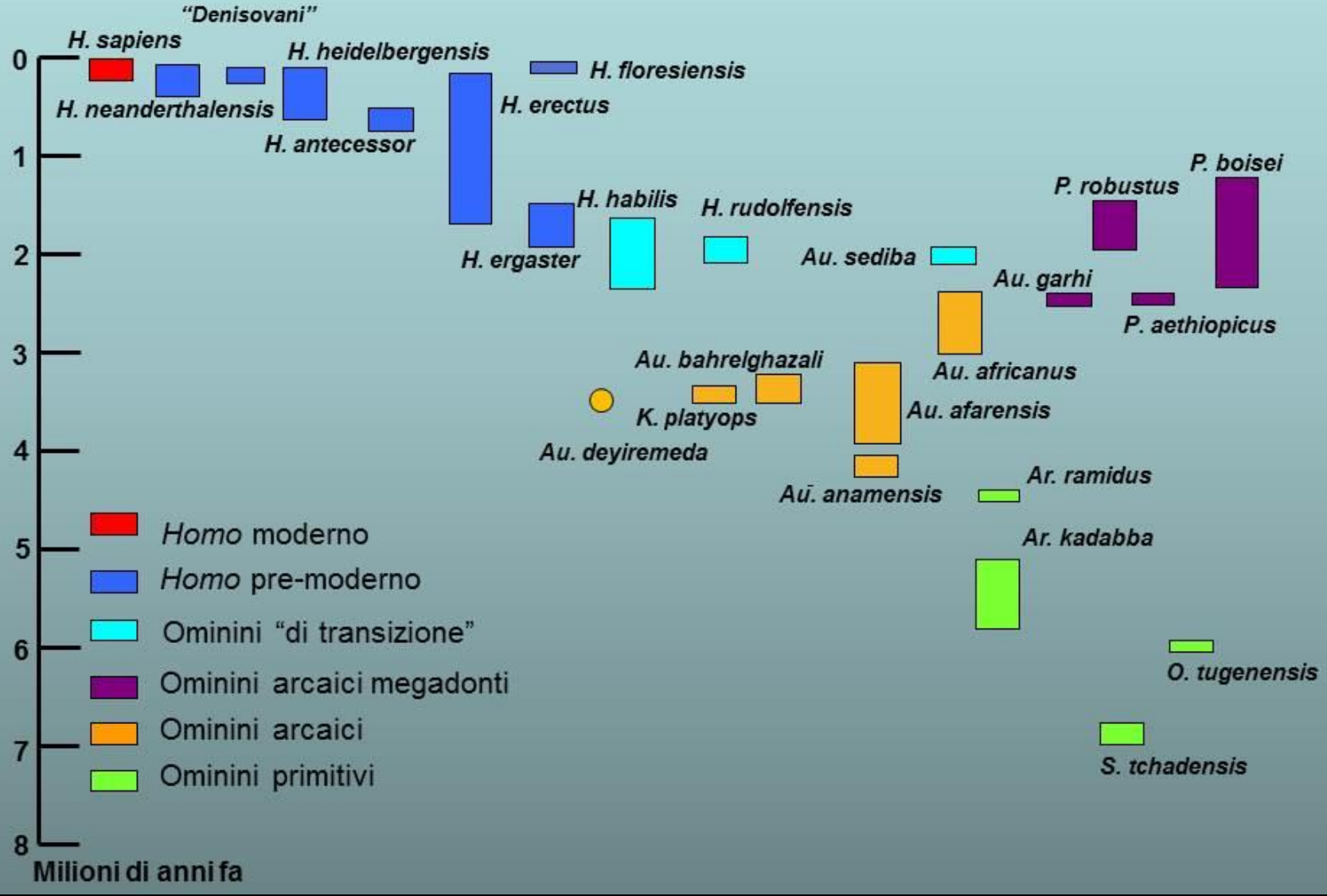
Eon	Era	Period	Epoch	Subepoch	Age	
Phanerozoic (pars)	Cenozoic (pars)	Quaternary (pars)	Holocene	Late	Meghalayan	present
				Middle	Northgrippian	4250 a b2k
				Early	Greenlandian	8236 a b2k
						11,700 a b2k

The origins of Humankind

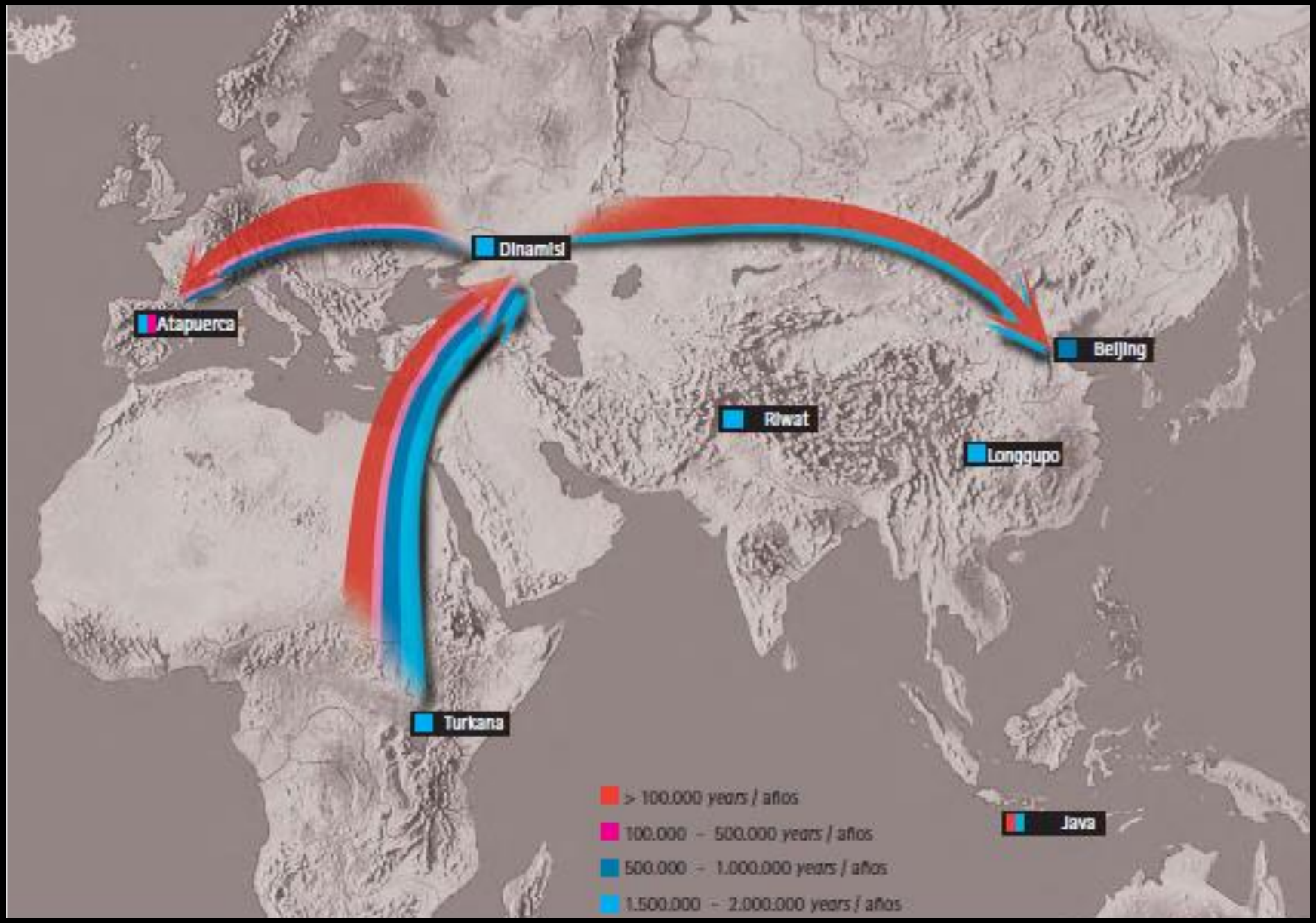



cal. yr BP
200000 150000 100000 50000 10000 8000 6000 5000 4000 3000 2000 1000 800 600 400 200
Human population
Human population (millions)
1000 500 200 100 50 20 10 5 2 1 0.5 0.2 0.1 0.05 0.02 0.01
Anthropogenic fire
?
Toba eruption / human bottleneck
Megafauna extinctions
Neolithic revolution
Pottery
Wheel
Trade
Bronze Age
Iron Age
Cities > 1 million
Peat
Native American collapse
Warm
Cold
Global ice volume
Fishing tools
Salt
Ungulates
Wet rice
China
Iron plows
Europe
Mongols
200000 150000 100000 50000 10000 8000 6000 5000 4000 3000 2000 1000 800 600 400 200
cal. yr BP

Il nostro 'albero di famiglia'

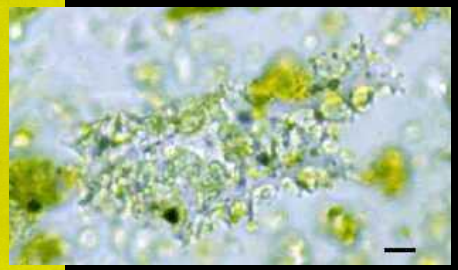


Dispersal routes out of Africa



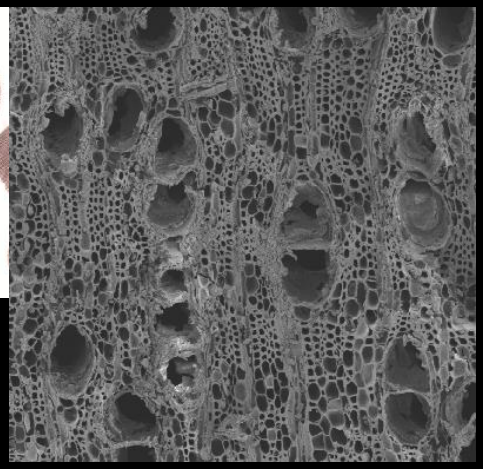
Resti micro e macrobotanici

Polline triporato di *Betula*



Fitoliti

Semi



Carbone (immagine al SEM)

Legni

Manufatto in legno di pioppo

Micro e macrofauna

Molluschi terrestri e marini

Rettili

Uccelli

Roditori, Insettivori

Macromammiferi

Partial skeleton of an adult male *Elephas antiquus* from Ambrona

Reduced visibility for the Lower Palaeolithic due to huge erosion and sedimentation in the Alps and surrounding regions