IAEA Scientific Forum

Nuclear Technology for Climate

Mitigation, Monitoring, Adaptation

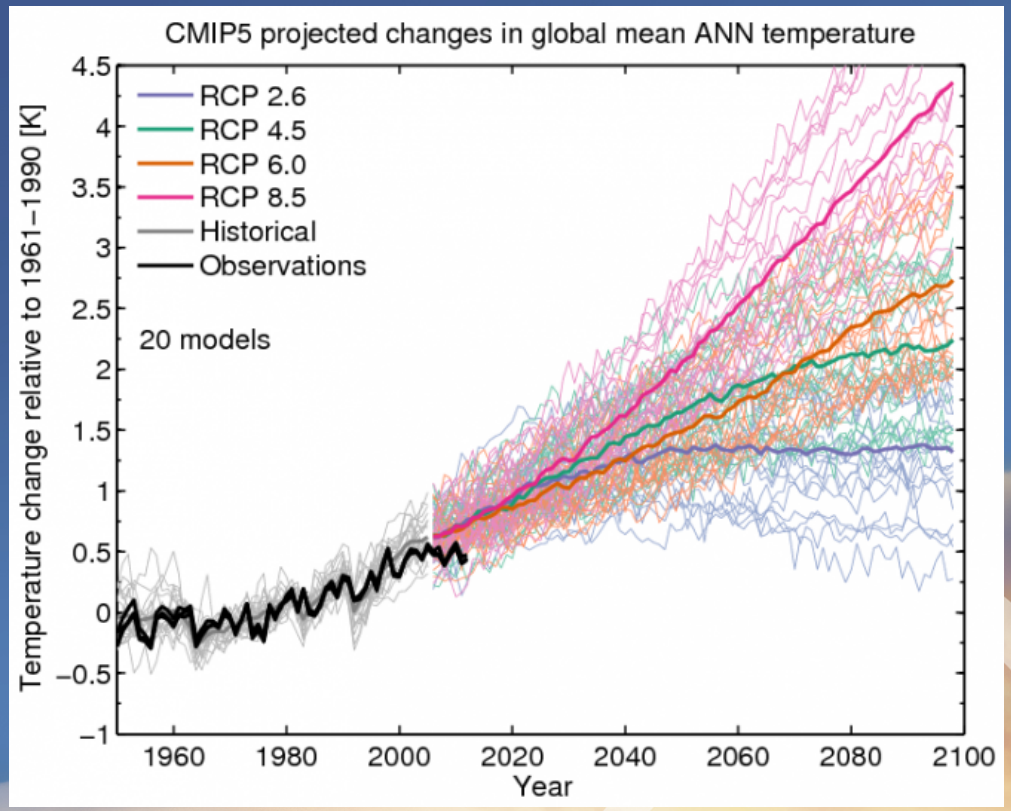
18–19 September 2018

Past Climate Conditions

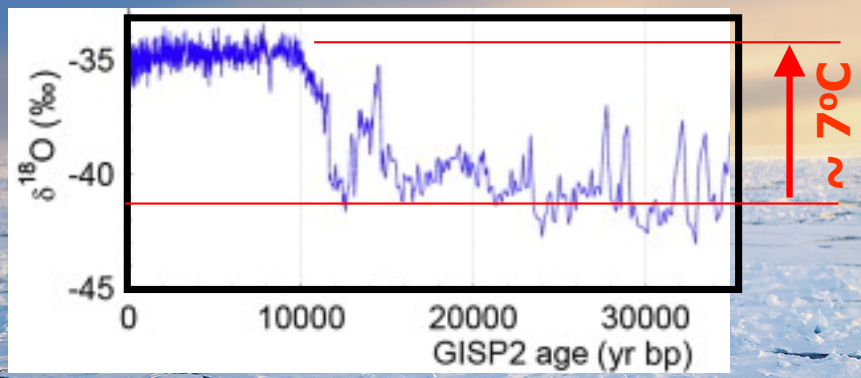
Prof. Heitor Evangelista

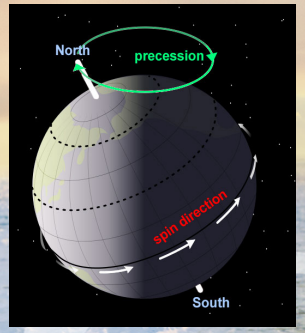
Rio de Janeiro State University - Brazil

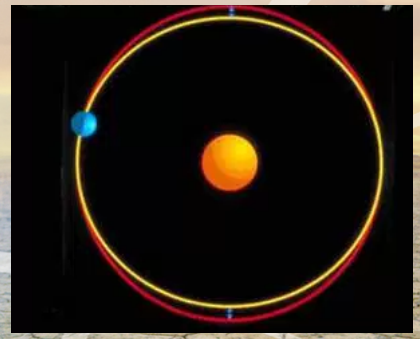
IPCC scenarios for the future …



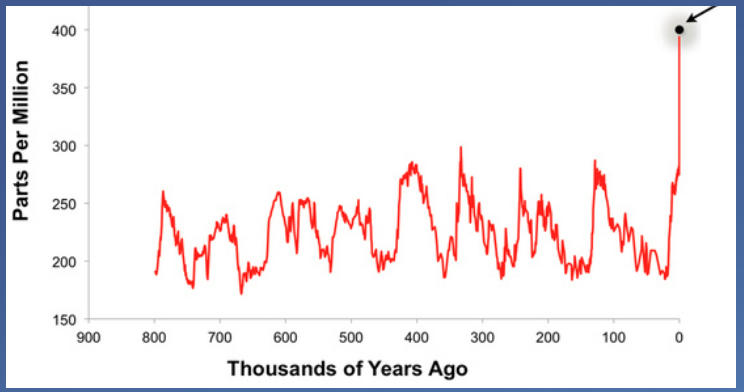
interglacial **glacial**

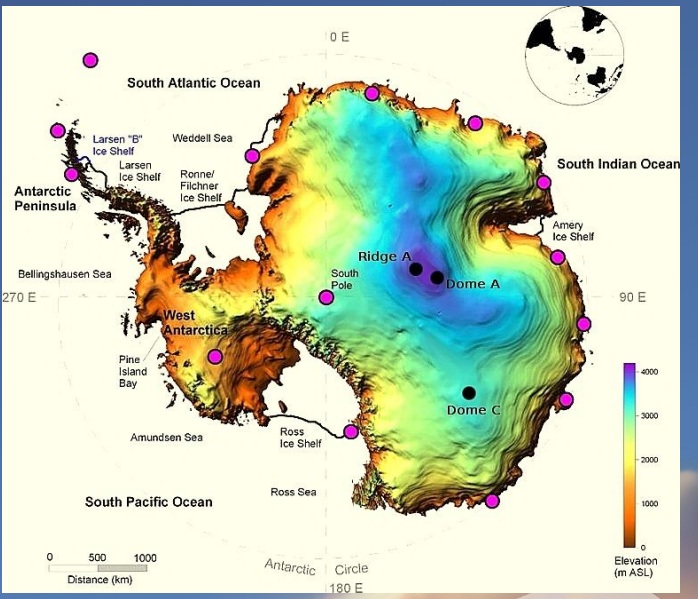


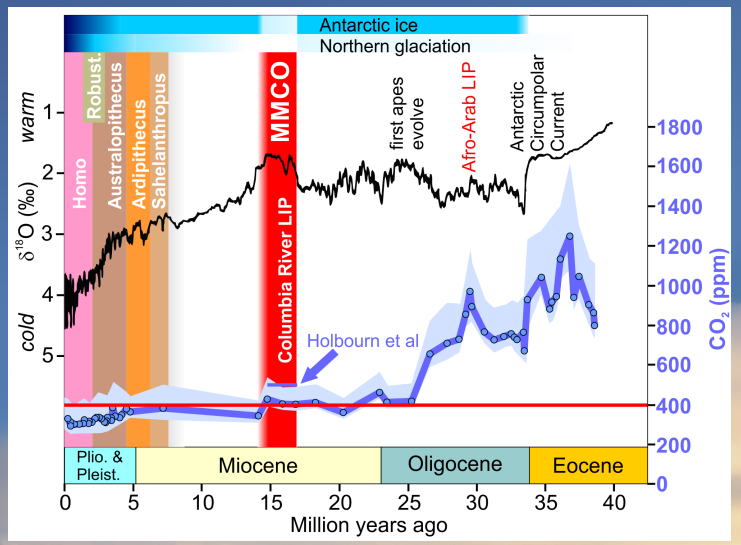


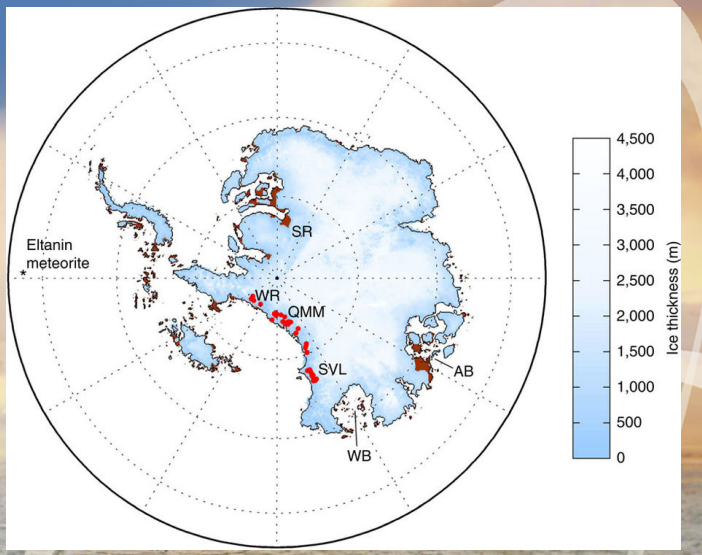


How do we recognize the Earth with 400 ppm of CO_2?





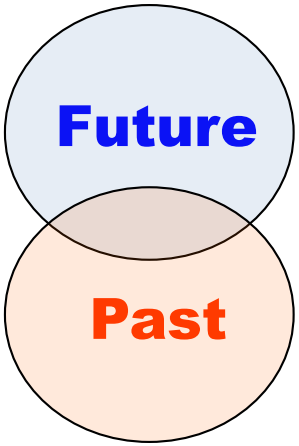




Pliocene epoch (5.3 Ma to 2.6 Ma)

1. 2-3°C warmer than today

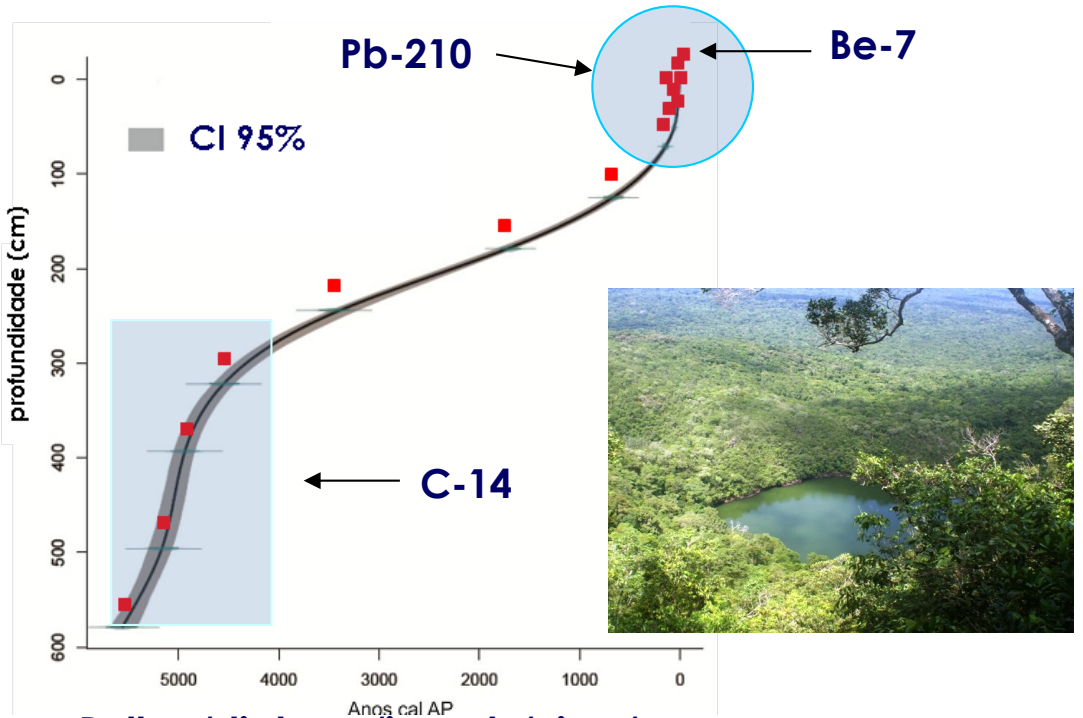
2. sea level 9-25m higher than today



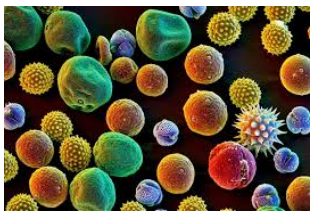
KEY-PARAMETER: The Nuclear Dating

Recovering the environmental history

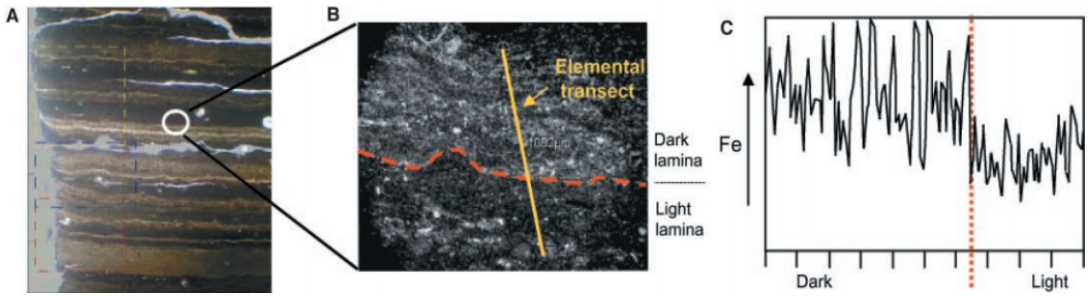
Nuclear Techniques associated with Biogeochemistry



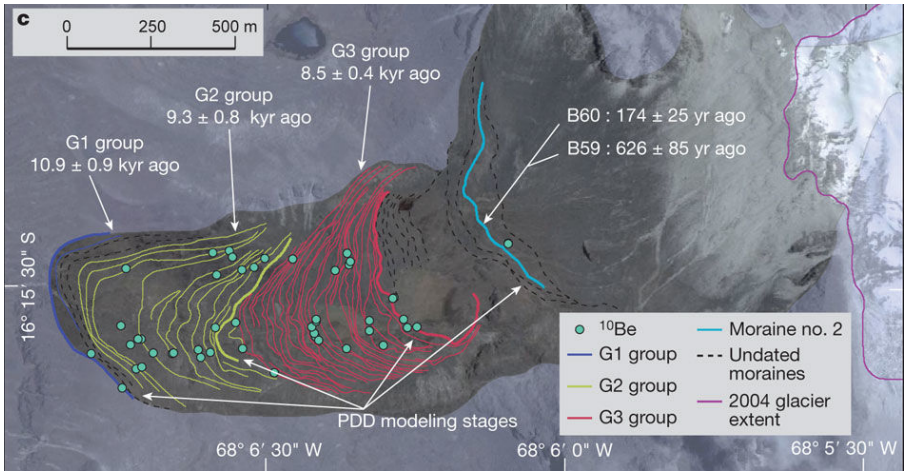
- Pollen/diatoms/insects/virus/...

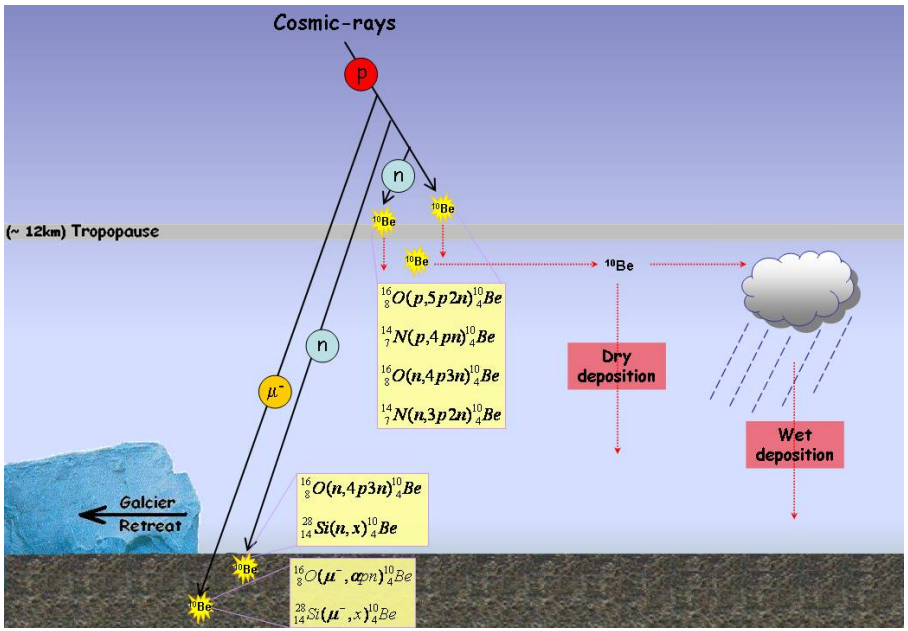


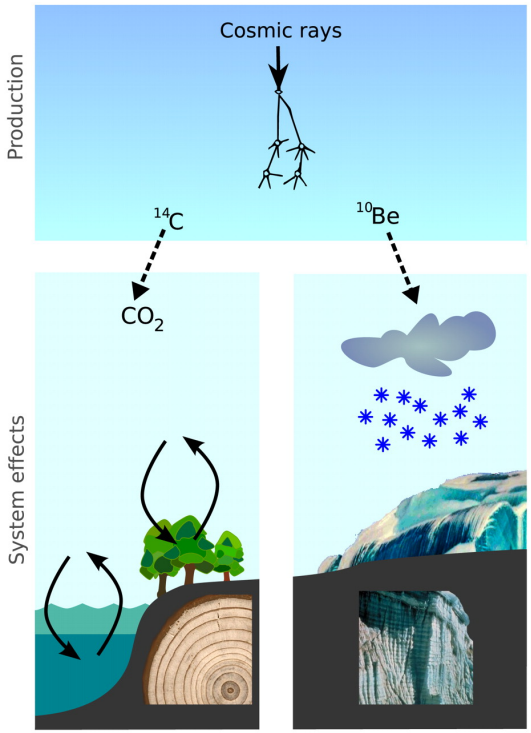
- Fe/Al; Ti/Ca

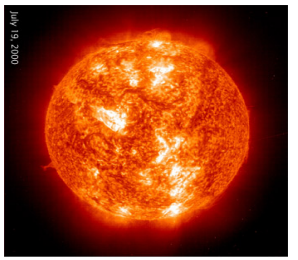


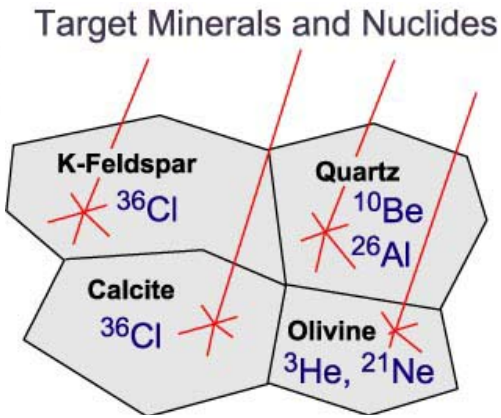
Glacier Retreats inferred from Cosmogenic Nuclides



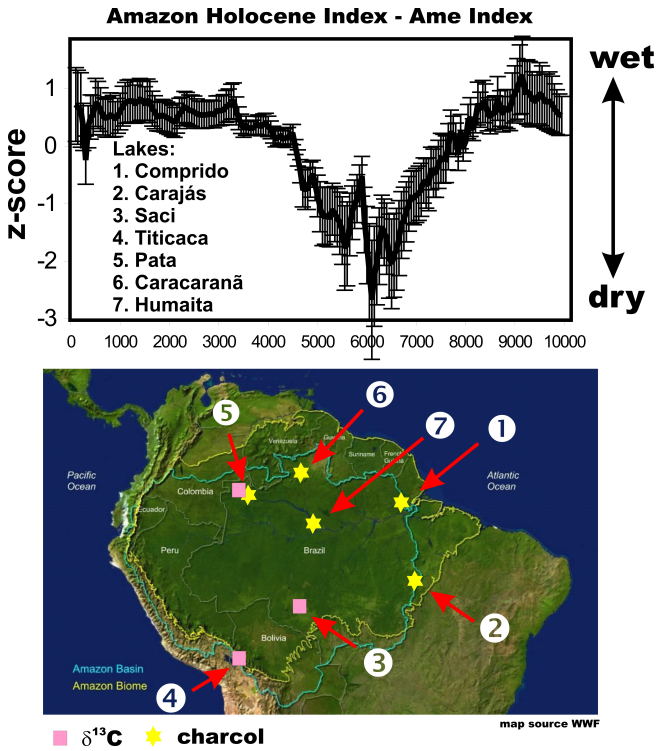


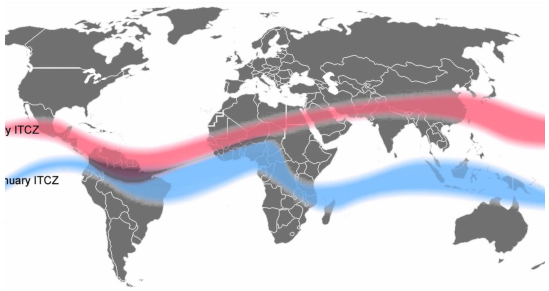


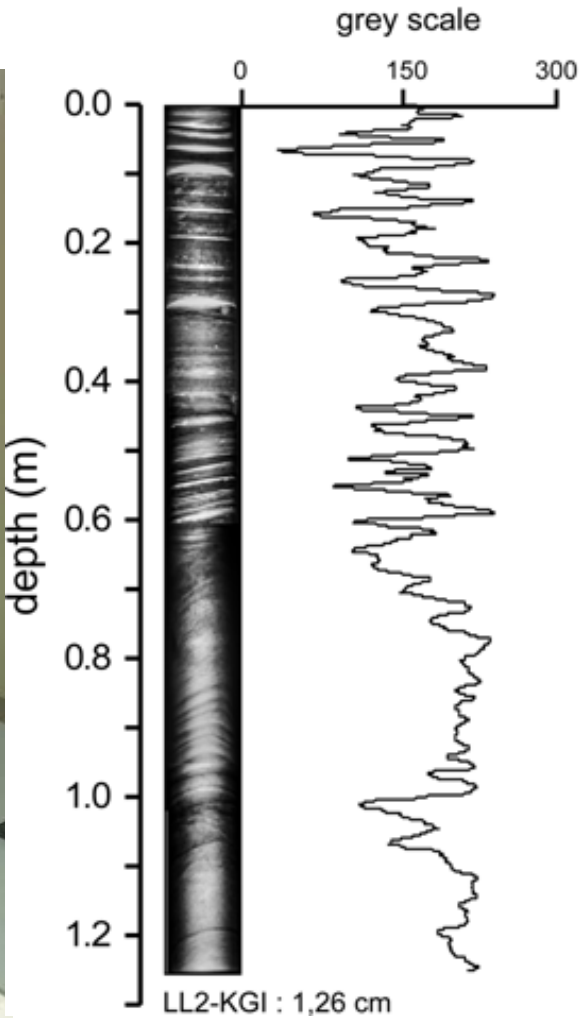




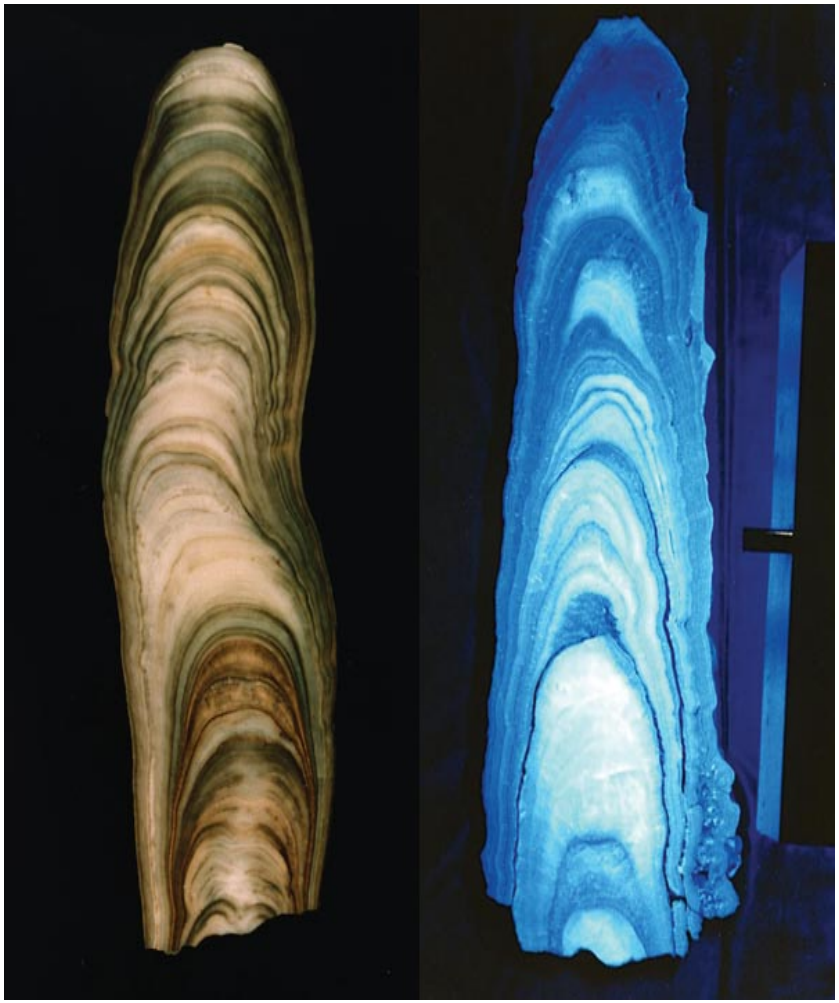
Dated Lake sediments provides Holocene history

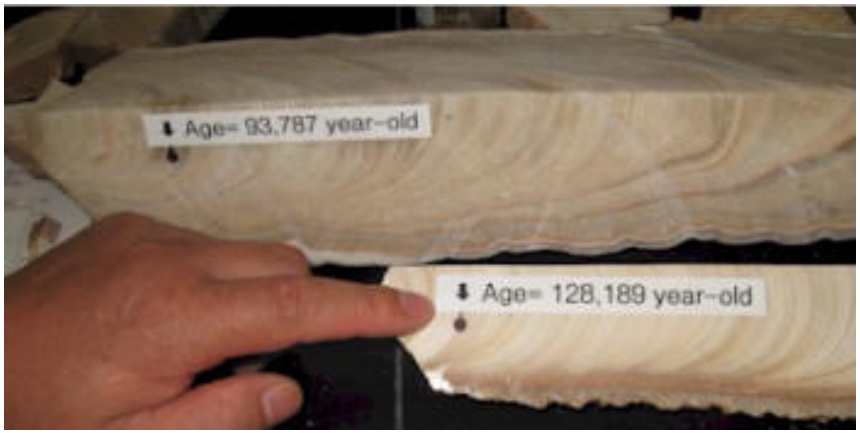


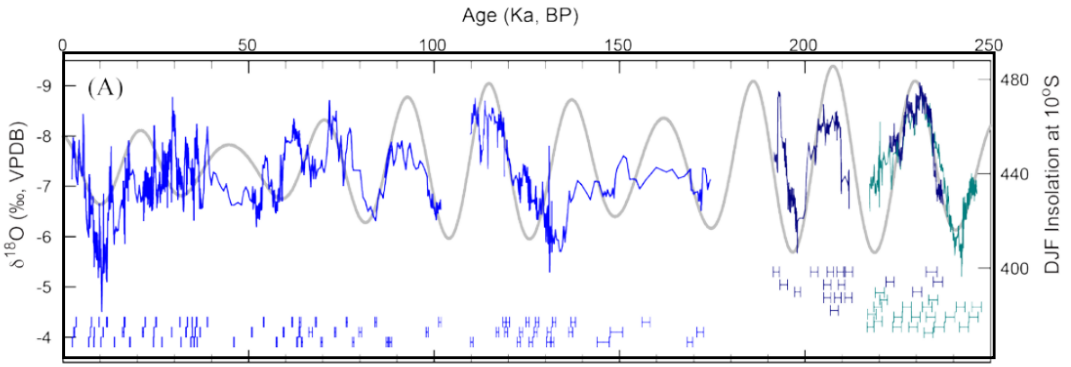




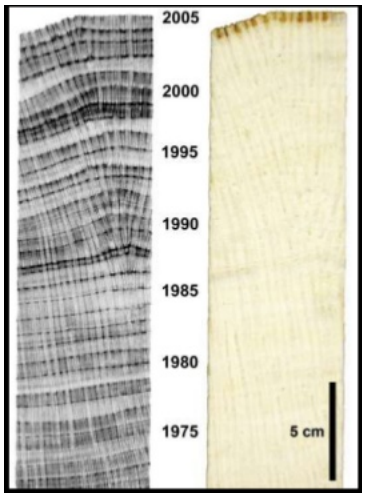
Dating of Sepeleothemes with Th-U method provides accurate tropical hydrological history

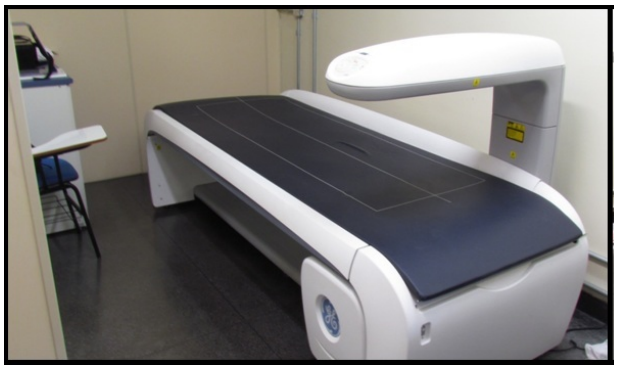




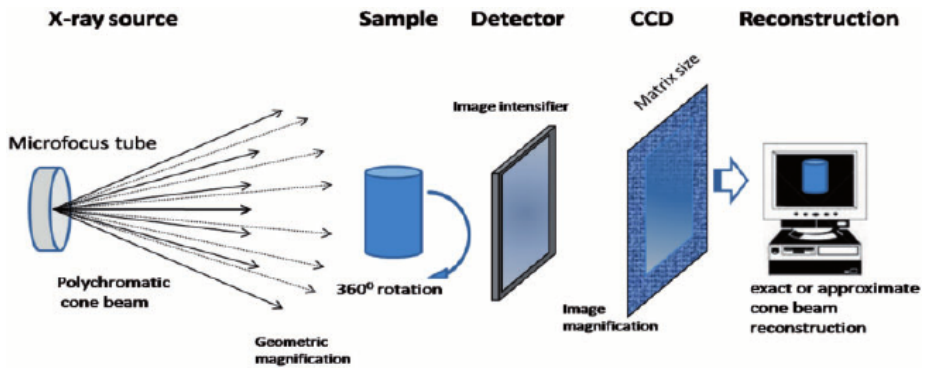


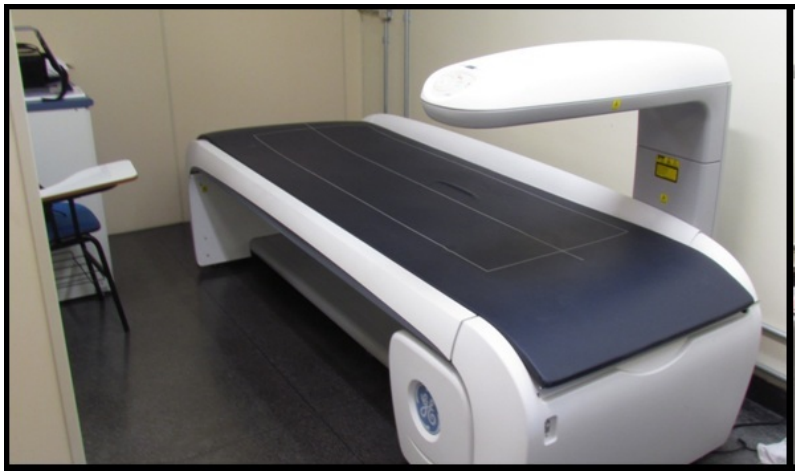
Coral-reef dated with Th-U method provides oceanography history and sea level evolution

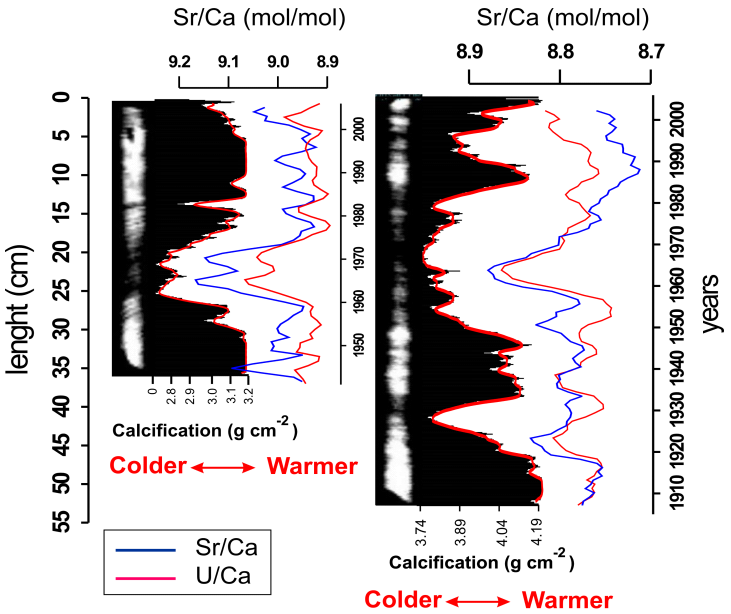


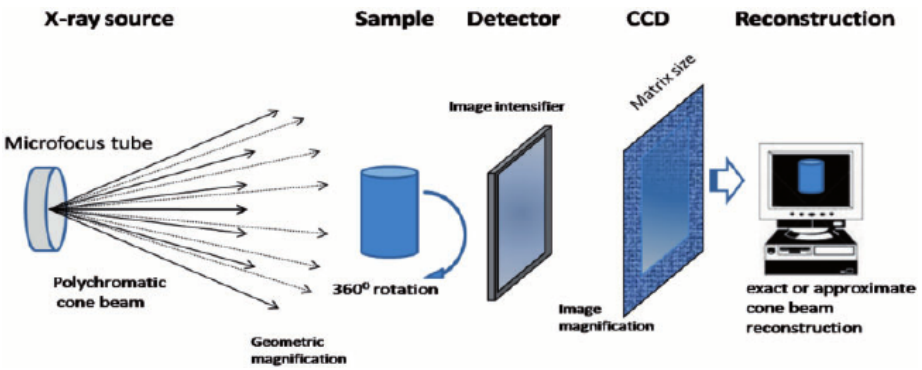


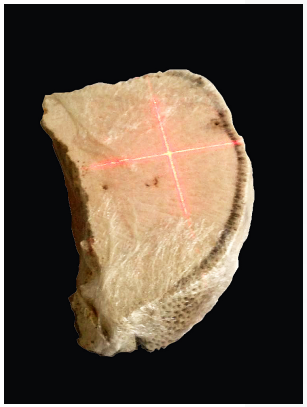
Coral:
X-ray
Radionuclide dating
Microtomography
Densitometry

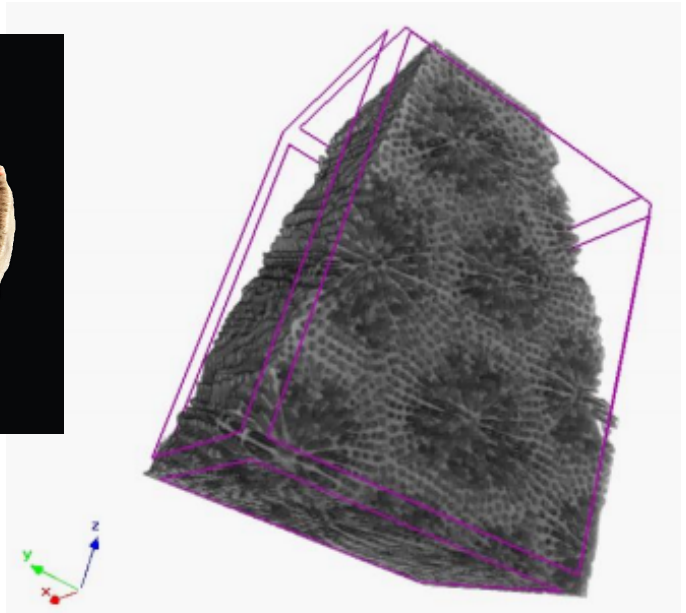




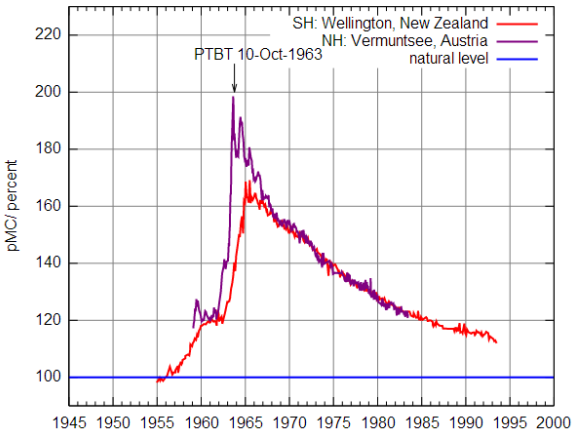

Sr/Ca (mol/mol)
9.2 9.1 9.0 8.9
Sr/Ca (mol/mol)
8.9 8.8 8.7
lenght (cm)
0 5 10 15 20 25 30 35 40 45 50 55
years
1910 1920 1930 1940 1950 1960 1970 1980 1990 2000
Calcification (g cm-2)
Colder ⟷ Warmer
Sr/Ca
U/Ca
Calcification (g cm-2)
Colder ⟷ Warmer

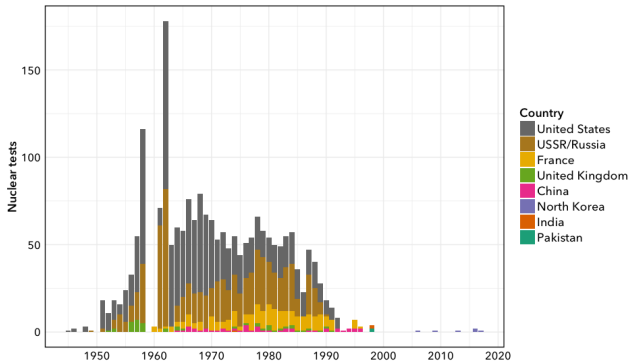

X-ray source
Sample
Detector
CCD
Reconstruction
Microfocus tube
Polychromatic cone beam
Geometric magnification
360° rotation
Image intensifier
Image magnification
Matrix size
exact or approximate cone beam reconstruction

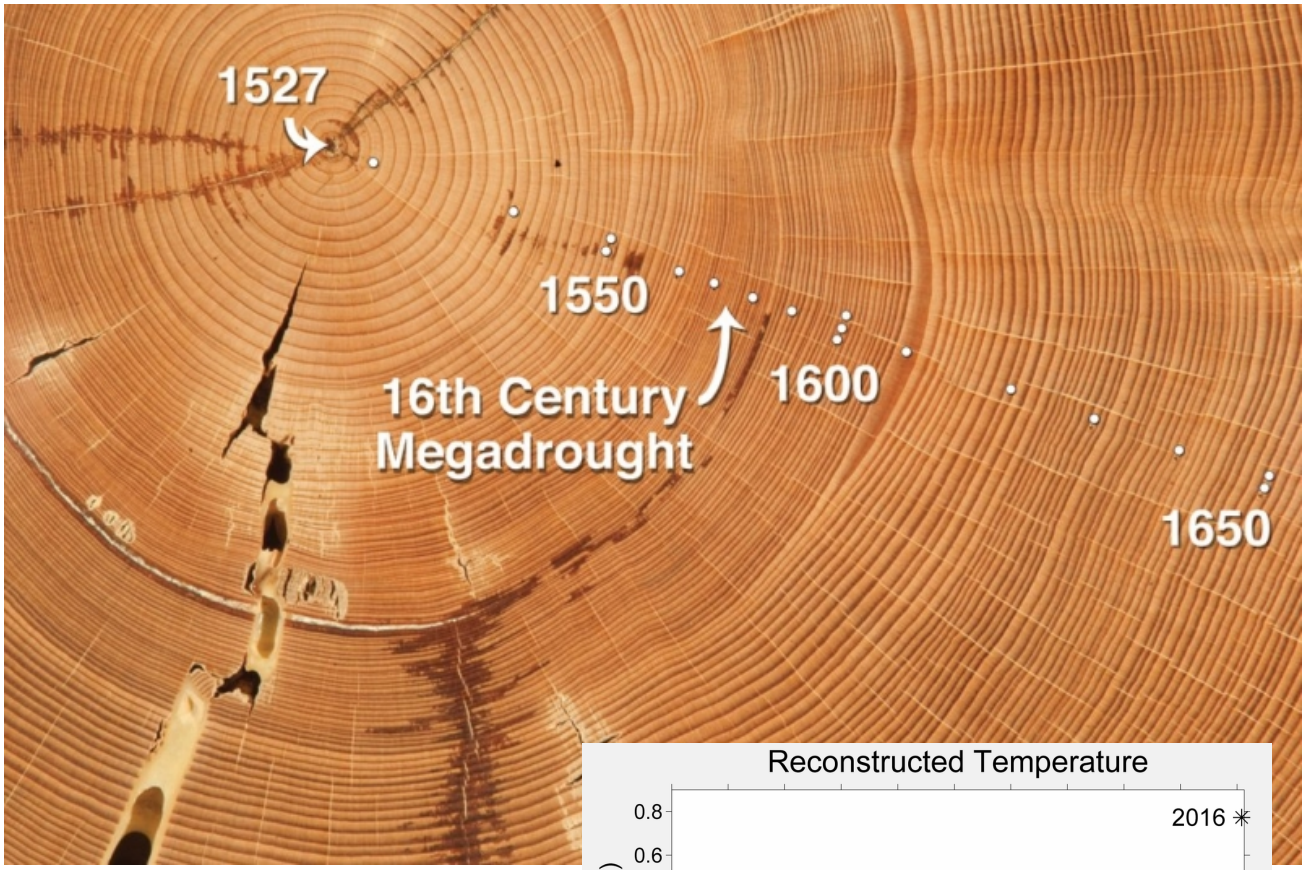


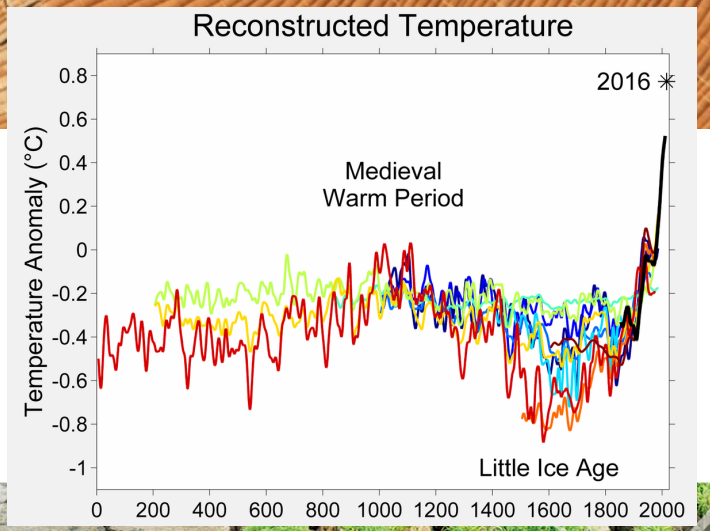


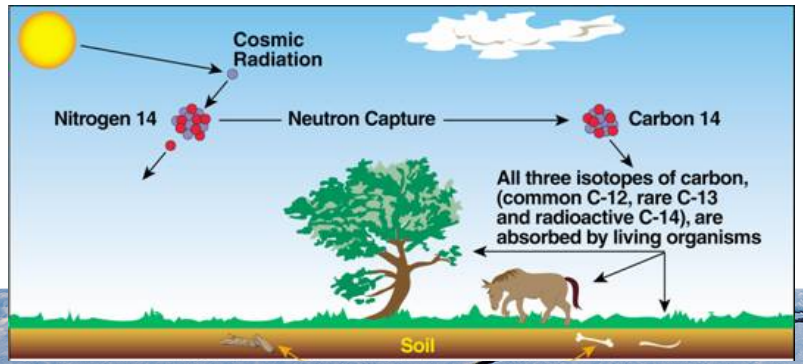
^{14}C in tree rings and temperature reconstruction











project: INT/5/153

IAEA International Atomic Energy Agency

1. Multidisciplinary issue

2. Social engagement and participation

Thanks for your attention !

Contact: evangelista.uerj@gmail.com