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Stratigraphy as arbiter of the Anthropocene

The Anthropocene Working Group & Social Values

Presentation Overview

Background
- Anthropocene discourse
- Anthropocene as geological epoch
- The Anthropocene Working Group

Research Rationale
- Stratigraphy as an arbiter of the Anthropocene
- Responses within stratigraphic literature
  - Question of Ability
  - Question of Preparedness

Research Design
- Connection between ability and preparedness
- Linking Stratigraphic markers and surface processes
- Methodology

Background

Defining the Anthropocene

Anthropocene Discourse

- Age in which humanity's aggregate influence on the Earth system has become so large that it is on a par with the geophysical forces of the Earth

  - But ever widening discourse with different meanings of the term

- Emphasizes the vast extent of anthropogenic Earth system change

'Geology of mankind' (Crutzen, 2002)

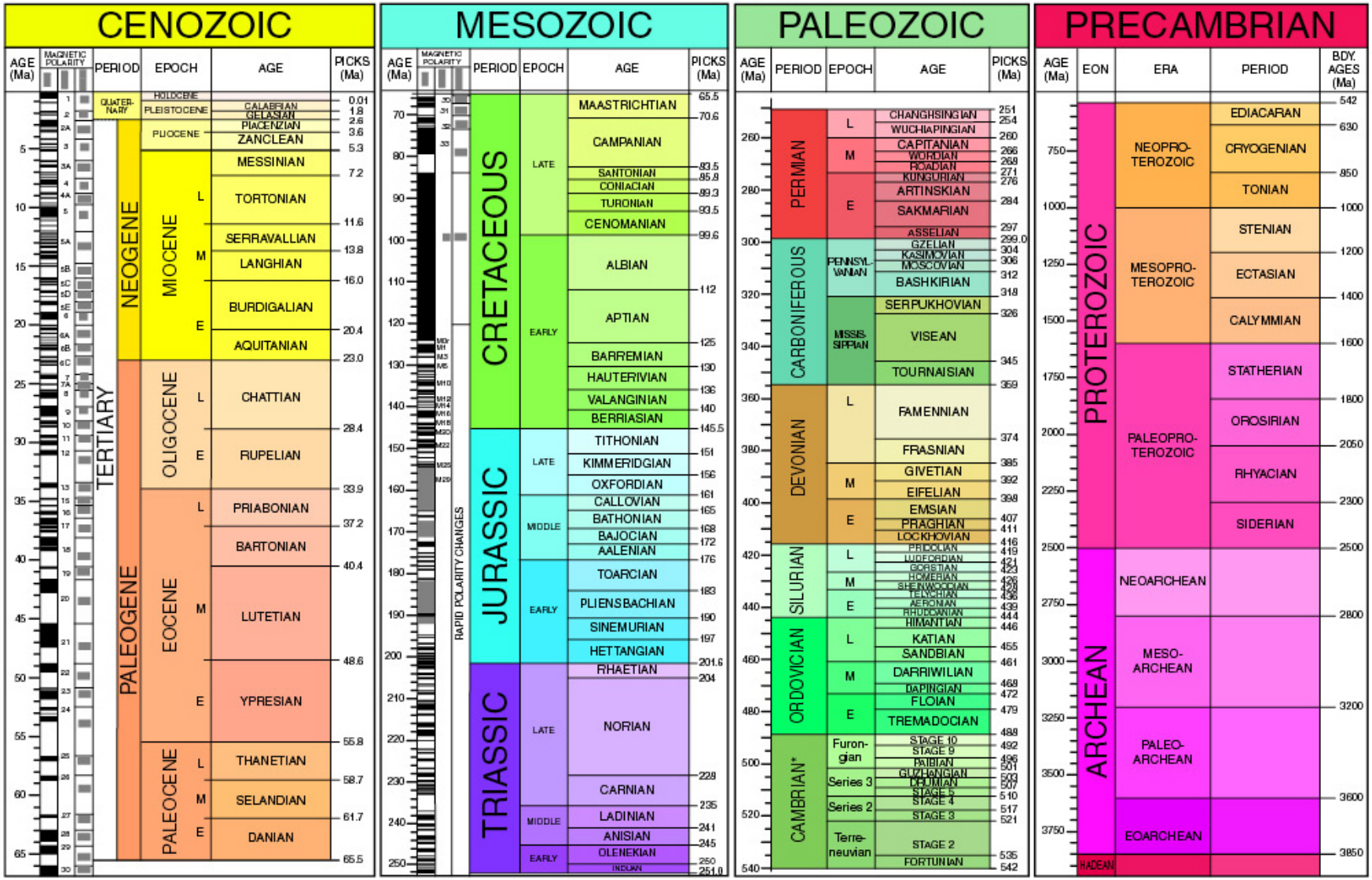
- New geological epoch ('cene') that can be distinguished form other such units in the Earth's history by way of the traces that human changes ('Anthropo') to the Earth system have left in the Earth's crust.

Anthropocene as geological epoch

Codified approach of stratigraphy

- single physical manifestation of a change recorded in a stratigraphic section
  - ‘GSSP’: stratigraphic marker (section + point) to define lower boundary
    - Internally consistent → complete sedimentation
    - Distinguishable from other stratotypes
    - Global representation
  - GSSA alternative

2009 GEOLOGIC TIME SCALE



*International ages have not been fully established. These are current names as reported by the International Commission on Stratigraphy.

Walker, J.D., and Geissman, J.W., compilers, 2009, Geologic Time Scale: Geological Society of America, doi: 10.1130/2009.CTS004R2C.

Sources for nomenclature and ages are primarily from Gradstein, F., Ogg, J., Smith, A., et al., 2004, A Geologic Time Scale 2004: Cambridge University Press, 589 p. Modifications to the Triassic after: Furin, S., Preto, N., Rigo, M., Roghi, G., Gianolla, P., Crowley, J.L., and Bowring, S.A., 2006, High-precision U-Pb zircon age from the Triassic of Italy: Implications for the Triassic time scale and the Carnian origin of calcareous nannoplankton and dinosaurs: Geology, v. 34, p. 1009–1012, doi: 10.1130/G22967A.1; and Kent, D.V., and Olsen, P.E., 2008, Early Jurassic magnetostratigraphy and paleolatitudes from the Hartford continental rift basin (eastern North America): Testing for polarity bias and abrupt polar wander in association with the central Atlantic magmatic province: Journal of Geophysical Research, v. 113, B06105, doi: 10.1029/2007JB005407.

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Anthropocene Working Group

International Commisison on Stratigraphy (ICS) approves the time, name, rank and stratigraphic markers of new geological periods

- Extensive process

Anthropocene Working Group is currently preparing a first recommendation for 2016

- Comparatively large group of ~ 40
- Interdisciplinary (50 % of members have training in geology)
- Global (mainly USA, EU) network with no independent funding

Research Rationale

Focus & Questions

Wider relevance of stratigraphy

Irrelevant

- Origin within the Earth system science community (Crutzen and Stoermer, 2000)
- Advanced interdisciplinary knowledge about surface processes
- Public discourse independently evolving (Castree, 2014; Nature Editorials, 2015; Braje, 2015)

Relevant

- Lends credibility to work of ESS community (see etymology)
- Suffix '-cene' prevalent in wider discourse
- Public attention on stratigraphic discussions
  - Major media outlets (Zeit, SZ, NYT, The Guardian, The Independent, various blogs)
  - Policy makers (Ger/UNEP/WEF)

Stratigraphy as a scientific arbiter of the Anthropocene

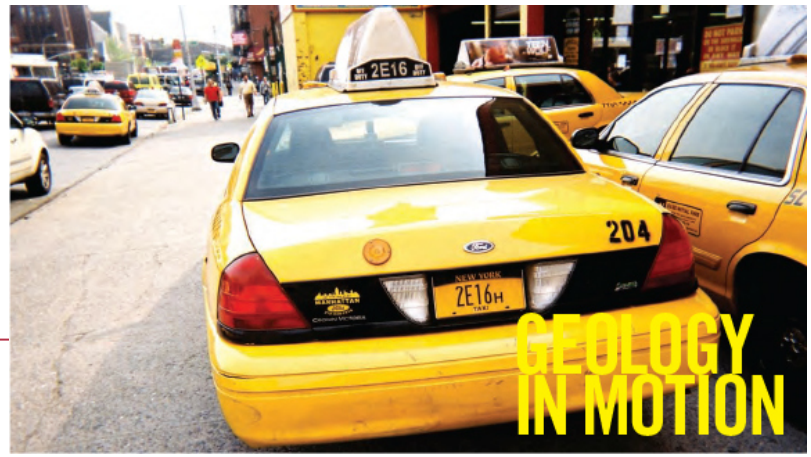
- Wider demand for the ICS to validate (or dismiss) the Anthropocene as a viable scientific idea
- Although stratigraphic knowledge is not necessary to appreciate Earth system change,…
- …. stratigraphy gains wider relevance in the context of ‘our desire for the imprimatur of scientific authority.' (Baskin, 2014: 5)

A new role for stratigraphy

Challenges posed by the Anthropocene

- Rethink stratigraphic practice
  - Study of deep past vs. study of recent past & future
- Rethink of relationship to society (and the values therein)
  - Sudden public attention

How does the stratigraphic community / AWG respond to these challenges that derive from its role as arbiter of the Anthropocene?



‘Question of Ability’ to act as arbiter for the Anthropocene

Is the stratigraphic community (with its established methods and the nomenclature) *able* to account for the multidisciplinary evidence of anthropogenic Earth system changes?

Technical controversies

- Difficulties with dating methods; marker criteria for GSSP; change of stratigraphic hierarchy

Meta-reflections

- Conservative vs. liberal application of nomenclature
- ‘What constitutes good stratigraphic practice?’
  - Epistemic values

‘Question of Preparedness’ to act as arbiter of the Anthropocene

Is the stratigraphic community *prepared* to take account of the societal context (& the implicit social values) of its practice?

- ‘pop-culture’ & issues of environmental awareness should be kept apart from stratigraphic practice (Autin and Holbrook, 2012: 61)

vs.

- Wider popular interest is welcome but stratigraphers should disassociate themselves from it:
  - ‘We are aware of the narratives that may be built around the Anthropocene, and how these may be influenced by boundary choice. However, we suggest that the positioning of a stratigraphic boundary should simply be pragmatically and dispassionately chosen’ (Zalasiewicz et al., 2015: 124)

… voices from outside stratigraphy

- The Anthropocene is not advanced from-scientists-for-scientists but it is ‘a politically savvy way of presenting to non-scientists the sheer magnitude of global biophysical changes.’ (Castree, 2014a: 247)
- The Anthropocene is less a scientific concept than an ideology. It is an ‘attention-grabbing way [for scientists] of framing their own worries’ (Baskin, 2014: 248)

Is the AWG prepared to act as an arbiter of the Anthropocene by taking account of the societal context (& the implicit social values) of its practice?

Research Design

Theoretical Premises & Methodology

Connection between social and epistemic values

Value-free ideal

- Social values play a role in the 'external stages' of research
  - E.g. Funding, application of science
  - But they are exogenous to scientific practice itself
    - They reflect individual preferences, not rational arguments

Contextualist account

- Social values also play a role in 'internal stages' of science
  - Social values influence scientific practice indirectly - through epistemic values
  - Various interactions are feasible

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Dating the Anthropocene: Linking stratigraphic markers & Earth system change

'Early Anthropocene' option (Ruddiman et al., 2011)

- Marker: e.g. rising CO2 and CH4 levels
- Earth system change: deforestation; inefficient rice cultivation
- Time/ Historical conjuncture: 8000 - 5000 years BP / agriculture & farming technologies

'Colonisation of the Americas' option (Lewis and Maslin, 2015b) - contentiously rejected by AWG

- Marker: e.g. decline of atmospheric CO2 / cross-ocean range extension in the fossil record of pollen indicating
- Earth system change: forest regrowth); transoceanic movement of species
- Time/ Historical conjuncture: 1570 to 1620 (1610) / European genocide of native Americans

'Industrial Revolution' option (Crutzen and Stoermer, 2000; Crutzen, 2002) - original proposal

- Marker: e.g. rising CO2 and CH4 level
- Earth system change: e.g. deforestation, use of fossil energy
- Time/ Historical conjuncture : 1783 / Industrial revolution (Watt's invention of steam engine)

'Great Acceleration' option (Waters et al., 2015) - AWG preference

- Marker: several e.g. radioactive isotopes
- Earth system change: accelerated use of global sinks and resources
- Time / Historical conjuncture: 1950s / rise of consumer culture; nuclear bomb testing

Future option (Zalasiewicz and Freedman, 2008) – no GSSP

- Marker: Do not yet exist – future archaeological evidence such as petrified cities
- Earth system change: land use change; movement of sediment
- Time / historical conjuncture: present / urbanisation

Linking stratigraphic markers & surface processes

- Normative *implications* of dating Anthropocene (‘external stages’)
  - Historical conjunctures point to causes for ES change
  - Baseline for ‘natural’ (= acceptable?) environmental change
- Normative *presuppositions* of dating the Anthropocene (‘internal stages’)
  - Stratigraphic Markers & events in Earth history are not the same, but are connected in complicated ways
  - Find a maker where there is no Earth system change event, or focus on event even if there is no marker?

‘*the marker is not the epoch;* it is just a marker. The Anthropocene is defined not by nuclear blasts but by a human-induced change in the functioning of the Earth System, one mainly due to climate change from the burning of fossil fuels. The nuclear explosions did not in any way change the functioning of the Earth System; the layer of radionuclides […] are merely a signifier, and have nothing directly to do with the Anthropocene.

They do, however, have a great deal to do with it indirectly, because they signaled unambiguously the dawn of the era of global economic domination by the United States of America, which was intimately tied to the economic boom of the post-war years and so the rapid increase in greenhouse gas emissions and associated warming.

Lewis and Maslin, however, are fixated on the marker at the expense of what is marked […] – completely forgetting what this ‘golden spike’ is supposed to signify, a change in the functioning of the Earth System due to human activity.‘ (Hamilton, 2015: 4)

Methodology

Qualitative document analysis

- AWG publications (GSL; RS), newsletters, …
- Inductive process
- Likely focus: scientific controversies & epistemic values

Survey

- Sample: all current & former AWG members
- Inquire into AWG members‘ positions on scientific controversies and their links to societal context (e.g. surface processes)

Semi-structured Interviews

- Sample: selected group of AWG members
- Directly inquire about the Question of Preparedness

Thank you!

(References upon request)