Is the Anthropocene distinct from the Holocene? [Abstract ID 72287 24.4.15]

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The inaugural meeting of the Anthropocene Working Group of the Subcommission on Quaternary Stratigraphy in Berlin (Oct. 2014) produced a consensus statement that "humans have altered geologic processes across the Earth system sufficiently to cause a planetary transition to a new interval of geological time", with the timing of the onset the focus of continued debate, but with a majority in favour of a mid-20th century beginning. The name has driven the assumption that the Anthropocene should be an epoch, but are its signatures truly driven out of the range evident for most of the Holocene, or are changes comparable or subsidiary to Holocene stages?

The evidence rests upon a broad range of signatures reflecting humanity's significant and increasing modification of Earth systems. These are visible in anthropogenic deposits in the form of the greatest expansion of novel minerals in the last 2.4 billion years and development of ubiquitous materials, such as plastics, present in the environment only in the last 60 years. Globally distributed spherical carbonaceous particles of fly ash represent another near-synchronous and permanent proxy. The artefacts we produce, the technofossils of the future, provide a decadal to annual stratigraphical resolution. These materials and deposits have in recent decades extended into the oceans and increasingly into the subsurface both onshore and offshore. These anthropogenic deposits are transported at rates exceeding those of the sediment carried by rivers by an order of magnitude, fluvial systems themselves showing widespread sediment retention in response to dam construction across most major river systems. The Anthropocene is evident in sediment and glacial ice strata as chemical markers. CO_2 in the atmosphere has risen by ~45 percent above pre-Industrial Revolution levels, mainly through combustion of hydrocarbons over a few decades. Although average global temperature increases and resultant sea-level rises are still comparatively small, the shift to more negative $\delta^{13}C$ values in tree-rings, limestones, speleothems, calcareous fossils and $\delta^{13}CO_2$ in ice forms a permanent record. Nitrogen and phosphorus contents in surface soils has approximately doubled through increased use of fertilizers to increase agricultural yields as the human population has also doubled in the last 50 years. Industrial metals such as Cd, Cr, Cu, Hg, Ni, Pb, Zn and persistent organic compounds have been widely and rapidly dispersed. A clear novel signature is radioactive fallout from atomic weapons testing, initiated in 1945 but becoming global in 1952 and in the case of Pu^{239} representing a long-lasting marker event. The Earth still has most of its complement of biological species, though many now as small populations: current trends of habitat loss and predation, if maintained, will push the Earth into the sixth mass extinction event in the next few centuries. Dramatic elapsed changes include trans-global species invasions and population modification through agricultural development on land and contamination of coastal zones. Although these changes are not synchronous, within near coastal environments microfauna/flora commonly show pronounced assemblage changes in the mid-20th century.

Considering the entire range of environmental changes reflected in stratigraphic signatures, the global, large and rapid scale of change related to the mid-20th century is clearly distinct from previous Holocene signatures, consistent with interpretation of the Anthropocene as a potential epoch.