Andrew Glikson (B.Sc., M.Sc., Ph.D.)
CV and Publications records to May 2018

Andrew Glikson – CV

1958-1962 - Studies toward the B.Sc. degree in geology, mineralogy-petrology and geography. B.Sc. - 1962.

1962-1964 - Studies and thesis work toward the M.Sc. degree, Thesis: structure of the northern Syrian-African rift valley.

1964-1968 - Thesis work toward the Ph.D degree. Thesis title: The Archaean geosynclinal succession between Coolgardie and Kurrawang, near Kalgoorlie, Western Australia. Ph.D. - 1968.

1968-1969 - Geologist Class 1 in the Bureau of Mineral Resources, Geology and Geophysics [BMR]. Project work including the study of the Gosses Bluff cryptoexplosion structure, N.T. and 1:250 000 mapping of the Reynolds Range, N.T..

1970-1971- Geologist Class 2 at the BMR. Project work including 1:100 000 mapping of the Cloncurry and Mary Kathleen Sheets [Qld].

1972-1974 - Geologist Class 3 at the BMR. Project work including 1:100 000 mapping of the Reynolds Range and Aileron Sheet areas, N.T., and geochemical studies of basic igneous rocks from the Mt Isa-Cloncurry region, Qld.

1974-1980 - Project work including the 1:100 000 mapping of the Anburla, Narwietooma and Glen Helen Sheets, N.T.

1975-1982 - Project work including the geochemical study of Archaean volcanic successions in the Pilbara Block, W.A./, as a joint study with the Geological Survey of Western Australia.

1981- Acting Geologist Class 4, in charge of the petrology/geochemistry subsection, Metalliferous Branch, BMR

1982 - Promoted to Senior Research Scientist, BMR.

1983 - Project leader of BMR's project on the study of layered intrusions and their contained PGE and Cr mineralization.

1985 - Promoted to Principal Research Scientist, BMR.

1986 - Study of the layered basic/ultrabasic intrusions of the Soanesville-Tambourah area, central Pilbara Block, W.A..

1976-1985 - Development of computer software for the calculation and graphic presentation of geochemical and mineralogical data.

1987-1994 - Leadership of the NGMA (National Geological Mapping Accord) Musgrave project, including the study of the Giles Complex layered basic/ultrabasic intrusions, western Musgrave Block, W.A. and S.A..

1968-1990 - Review of geochemical and tectonic evidence concerning early crustal evolution and vertical crustal zonation, including field work in South Africa, India and North America, publication of papers (see references), lecture trips and invited participation in scientific meetings.

1975-1996 - Investigation of the role of asteroid/comet mega-impacts in Precambrian crustal evolution (see references), including invited participation in conferences and lecture trips overseas.

1993-1994 - Study of image processing and remote sensing techniques on the IIS and ER Mapper systems. Production of a series of images in connection with the Musgrave NGMA project.

1994-1996 - Initiation, development and project management of the North Pilbara NGMA project (211.17), including development and application of multispectral remote sensing techniques to the systematic mapping and metallogenic studies of Archaean greenstone belts.

1996 - Publication of an AGSO Journal special volume on Australian Impact Structures, as both the editor and scientific contributor.

1996 - Publication of AGSO Bulletin 239 - Geology of the western Musgrave Block, with particular reference to the layered mafic/ultramafic Giles Complex.

From end-1996 - Independent researcher, collaborating with the Australian Geological Survey Organisation with Landsat and geochemical investigations of the Archaean Pilbara Craton.

1996 - A new impact structure in the Savory Basin, Western Australia, and an asteroid (5551 1982 BJ) are named as "Glikson" after myself by Emeritus Professor E.M. Shoemaker.

1997 - Geospectral Research - consulting in Precambrian geology and multispectral remote sensing surveys. Participation in several international conferences on impact geology (Kyoto meeting on comets and planetary evolution; Sudbury meeting on the effects on extraterrestrial impacts on crustal evolution).

1998-2013 – Australian National University Research School of Earth Science, Department of Earth and Marine Science, ANU Planetary Science Institute, University of Queensland Centre of Excellence in Geothermal Research and Geopscience Australia. Studies of Australian impact structures and impact ejecta units.

1998-2008 - Visiting Fellow, Research School of Earth Science and School of Archaeology and Anthropology, Australian National University, studying the effects of climate on prehistoric human evolution, the discovery of fire and its effects on human societies.

2008–2018 – Visiting Fellow, School of Archaeology and Anthropology, ANU, paleo-climate and human evolution and mastery of fire research. Publications on climate, fire and human evolution Books

Summary of research subjects

Sharp changes in the composition of the atmosphere through the history of Earth have been triggered by comet and asteroid impacts, volcanic events, eruptions of methane and possibly supernovae. Biological effects on the composition of the atmosphere known from natural history include enrichment of atmospheric oxygen by plants, sequestration of CO_2, enrichment of the atmosphere with CH_4 emanated by bacteria and animals, and emanations of H_2S emanations from anoxic acidic abyssal depths. The role of humans in perpetrating what is colloquially referred to as the "sixth mass extinction" during the Holocene, and in particular since the mid-19th century (Crutzen and Stoemer, 2000; Steffen et al., 2008), represents a phenomenon both distinct from, and at the same time similar in terms of its scale and consequences to, earlier mass extinctions through the history of Earth.

The scale of carbon emissions associated with industrial activity and land clearing is leading to a rise in atmospheric greenhouse gases (GHG) at a rate unprecedented in the Cainozoic record, excepting events triggered by global volcanic eruptions, large asteroid impacts and methane release. The evidence is leading to classification of a new geological era—the Anthropocene, defined in terms of the onset of the modern industrial age and its acceleration since about 1950.
The definition of the Anthropocoene could alternatively focus on the onset of Neolithic agriculture and gradual rise in carbon dioxide (CO_2) since ~7000-6000 years ago and of methane since 4000 years ago. The paper "The deep time dimensions of the Anthropocene" suggests an origin of the Anthropocene in terms of the mastery of fire and thereby the magnification of energy output and entropy in nature.

The discoveries of ignition of fire and its transfer have rendered Homo a unique genus from the minimum age of >1.8 million years (Ma) ago, regarded as a turning point in biological evolution and referred to as the Early Anthropocene. The onset of the Neolithic, allowed by stabilization of the Holocene climate, is referred to as the Middle Anthropocene, while the onset of the industrial age since about 1750 AD is referred to as the Late Anthropocene.

The project aims at analyzing the factors associated with the migration of *Homo erectus* through the Pleistocene in relation to climate changes, as indicated by ice cores and sediments, the mastering of fire, and the effects of the mastering of fire on *Homo erectus* in terms of survival and human emotional and intellectual development.

My principal collaboration has been with the late Professor Emeritus Colin Groves.

During 2015-2017 the following progress was made (see Attachments A – E appended with this submission.

1. Publication of the Book "*The Plutocene: Blueprints for a post-Anthropocene Greenhouse Earth*"

2. The book "*Climate, Fire and Human Evolution: the deep time dimensions of the Anthropocene*" by Glikson and Groves was published by Springer (227 pages) (attachment # A).

3. A paper titled "*Cenozoic GHG and temperature changes with reference to the Anthropocene"* was accepted for publication in the journal *Global Change Biology*. (Attachment # C)

<u>Books</u>

Glikson A.Y. 2017. *The Plutocene: Blueprints for a post-Anthropocene Greenhouse Earth*. Springer.

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Glikson A.Y. & Groves C., 2015. Climate, Fire and Human Evolution. *Springer, Modern Approaches in Solid Earth Sciences.* 227 pp.

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<u>Papers, 2000 – 2014</u>

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Glikson, A.Y. 2012 (Editor). *The Future of Homo Sapiens*, Manning Clark House Conference in honour of Phillip Adams, 60 pp.

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Glikson, A.Y. 2009. Mass Extinction of Species: The Role of External Forcing. *Journal of Cosmology*, 2: 230-234.

Glikson A.Y. 2009. Climate change debate between Andrew Glikson and Bob Carter. *Viewpoint Magazine*, Issue 1, October, 2009. http://www.viewpointmagazine.com.au/

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Glikson, A.Y. 2008. Implications of abrupt atmospheric changes in the recent history of Earth for 21st century climate projections. The Australian Geologist, 149:16-18.

Glikson, A.Y. 2008 (Editor). Imagining the Real: Life on a Greenhouse Earth. Manning Clark House Conference in honour of Barry Jones, 68 pp.

Glikson, A.Y. 2007. Milestones in the evolution of the atmosphere with reference to climate change. Australian Journal of Earth Sciences, 55: 123-127.

Glikson, A.Y. 2007. Homo sapiens on thin ice. The Australian Geologist, 142: 25-28.

Glikson, A.Y. 2007. Sea change: implications of the 4th IPCC report for 21st century climate change. The Australian Geologist, 143: 33-35.

Glikson, A.Y. 2006. Mass extinctions: the role of asteroid impacts in Australia. Australasian Science, Jan-Feb 2006.

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Glikson, A.Y. 2005 (Editor). Can Homo sapiens Survive? Manning Clark House Conference in honour of Frank Fenner, 36 pp.

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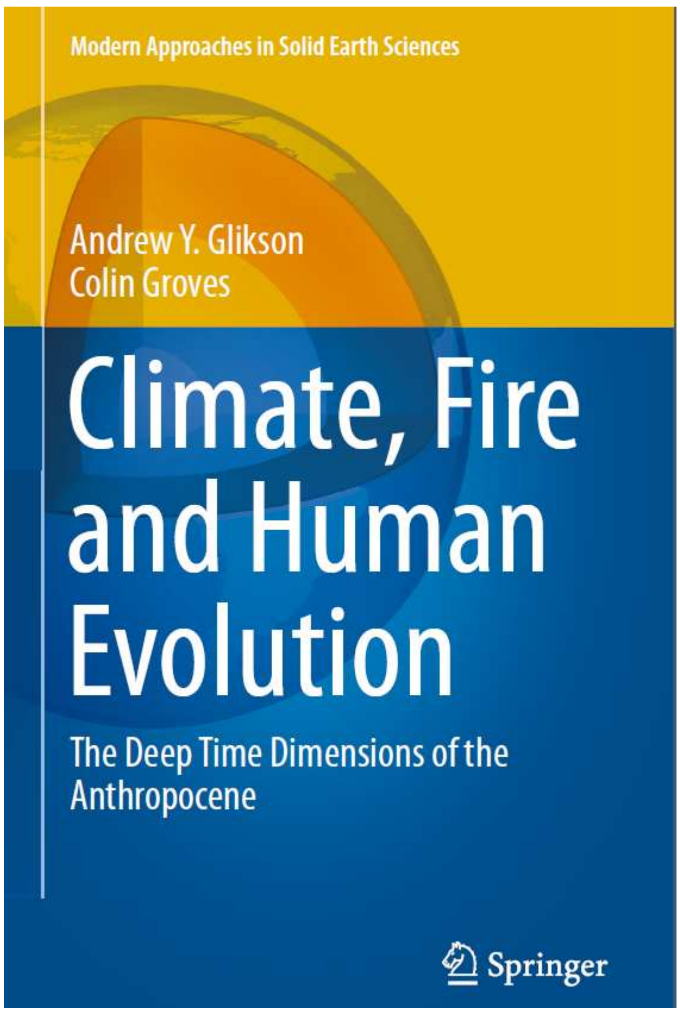
Attachment # A



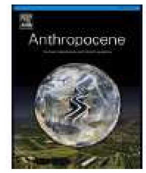
Attachment # B

Anthropocene xxx (2014) xxx–xxx

Contents lists available at ScienceDirect

Anthropocene

journal homepage: www.elsevier.com/locate/ancene



Short communication

Fire and human evolution: The deep-time blueprints of the Anthropocene

Andrew Glikson *

School of Archaeology and Anthropology, Australian National University, Canberra, ACT 2601, Australia

ARTICLE INFO

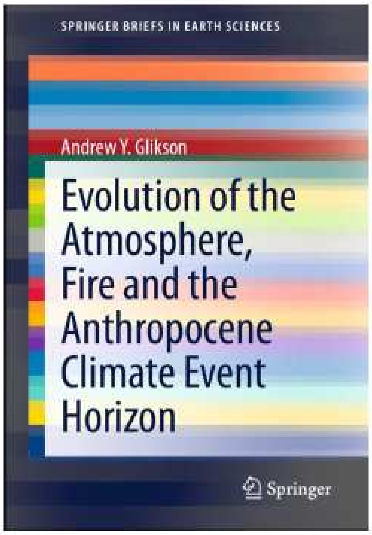
Article history:
Received 21 October 2013
Received in revised form 1 February 2014
Accepted 3 February 2014

Keywords:
Anthropocene
Fire
Ignition
Combustion
Homo
Prehistory

ABSTRACT

The scale of carbon emissions associated with industrial activity and land clearing is leading to a rise in atmospheric greenhouse gases (GHG) at a rate unprecedented in the Cainozoic record, excepting events triggered by global volcanic eruptions, large asteroid impacts and methane release. Such an evidence is leading to attempts at classification of a new geological era—the Anthropocene. The era has been defined in terms of the onset of the modern industrial age and its acceleration since about 1950. On one hand, it could be from the onset of Neolithic agriculture and gradual rise in carbon dioxide (CO_2) since ~6000 years ago and methane since ~4000 years ago. On the other hand, it may be an amalgamation of factors in an era referred to as the Palaeoanthropocene. This paper suggests the defining point leading to the Anthropocene and subsequently the 6th mass extinction of species hinges on the mastery of fire and thereby the magnification of energy output and entropy in nature over which, in the long term, the species has no control. The discoveries of ignition of fire and its transfer have rendered *Homo* a unique genus from the minimum age of >1.8 million years (Ma) ago, regarded as a turning point in biological evolution and termed here Early Anthropocene. The onset of the Neolithic, allowed by stabilization of the Holocene climate, is referred to as the Middle Anthropocene, while the onset of the industrial age since about 1750 AD is referred to as the Late Anthropocene.

Attachment # C



A.Y. Glikson, Australian National University, Canberrra, ACT, Australia

Evolution of the Atmosphere, Fire, and the Anthropocene Climate Event Horizon

with Foreword by Professor H.J. Schnellnhuber

Series: SpringerBriefs in Earth Sciences

Unique among all creatures, further to the increase in its cranial volume from Australopithecus to Homo sapiens, the use of tools and cultural and scientific creativity, the genus Homo is distinguished by the mastery of fire, which since about two million years ago has become its blueprint. Through the Holocene and culminating in the Anthropocene, the burning of much of the terrestrial vegetation, and combustion of fossil carbon from up to 420 million years-old biospheres, are leading to a global oxidation event on a geological scale, a rise in entropy in nature and the sixth mass extinction of species.

2014, XIV, 174 p. 90 illus., 85 in color.

ISBN 978-94-007-7331-8
Printed book
Softcover
▸ 49,99 € | £44.99 | $49.95
▸ *53,49 € (D) | 54,99 € (A) | CHF 67.00

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Contents:

Attachment # D

Global Change Biology

Global Change Biology (2016), doi: 10.1111/gcb.13342

RESEARCH REVIEW

Cenozoic mean greenhouse gases and temperature changes with reference to the Anthropocene

ANDREW GLIKSON
Australian National University, Canberra, ACT 2601, Australia

Abstract

Cenozoic greenhouse gases (GHG) variations and warming periods underscore the extreme rates of current climate change, with major implications for the adaptability and survivability of terrestrial and marine habitats. Current rise rate of greenhouse gases, reaching 3.3 ppm CO_2 per year during March 2015–2016, is the fastest recorded since the Paleocene-Eocene Thermal Event (PETM) when carbon release to the atmosphere was about an order of magnitude less than at present. The ice core evidence of concentration of (GHG) and temperatures in the atmosphere/ocean/cryosphere system over the last 740 kyr suggests that the rate of rise in GHG over the last ~260 years, CO_2 rates rising from 0.94 ppm yr^{-1} in 1959 (315.97 ppm) to 1.62 ppm yr^{-1} in 2000 (369.52 ppm) to 3.05 ppm yr^{-1} in 2015 (400.83 ppm), constitutes a unique spike in the history of the atmosphere. The reliance of pre-740 kyr paleoclimate estimates on multiple proxies, including benthic and plankton fossils, fossil plants, residual organic matter, major and trace elements in fossils, sediments and soils, place limits on the resolution of pre-upper Pleistocene paleoclimate estimates, rendering it likely recorded mean Cenozoic paleoclimate trends may conceal abrupt short-term climate fluctuations. However, as exemplified by the Paleocene–Eocene thermal maximum (PETM) and earlier GHG and temperature spikes associated with major volcanic and asteroid impact events, the long-term residence time of CO_2 in the atmosphere extends the signatures of abrupt warming events to within detection limits of multiple paleoproxies. The mean post-1750 temperature rise rate (approximately ~0.0034 °C per yr, or ~0.008 °C per yr where temperature is not masked by sulfur aerosols) exceeds those of the PETM (approximately ~0.0008–0.0015 °C per yr) by an order of magnitude and mean glacial termination warming rates (last glacial termination [LGT] ~ 0.00039; Eemian ~0.0004 °C per yr) by near to an order of magnitude. Consistent with previous interglacial peaks an increasing likelihood of collapse of the Atlantic Meridional Ocean Circulation is threatening a severe stadial event.

Keywords: cenozoic climate, CO_2, global warming, greenhouse gases, proxies, sea level

Received 30 November 2015 and accepted 30 April 2016

Introduction

This study aims at a brief review of the mean rates of greenhouse gas and temperature variations during Cenozoic warming periods, offering a perspective for post-18th century climate change, with implications for the adaptability and survivability of terrestrial and marine habitats (Quintero & Wiens, 2013; Ceballos *et al.*, 2015). A rapid advance in the study of multiple paleo-CO_2 and temperature proxies has produced a large body of data consistent with sedimentological and paleontological evidence. The emergence of land plants in the late Silurian (~420 Ma), the earliest being vascular plants (Cooksonia, Baragwanathia), the late Devonian (Le Hir *et al.*, 2009) and later in the Permian (299–251 Ma), including Cycads and Ginkgo, led to a gradual increase in photosynthetic oxygen, reaching a peak of ~31% O_2 in the early Permian (Berner *et al.*, 2007). The accumulation of carbon, including cellulose in trees, grasses, soils and bogs, methane hydrate and methane clathrate deposits in bogs, sediments and permafrost, when combined with oxygen emitted by photosynthesis, sets the stage for flammable land surfaces, repeatedly ignited by lightning, instantaneous combustion of peat and by volcanic eruptions. Under high O_2 partial pressure even moist vegetation can be ignited (Bowman *et al.*, 2009). Burial of carbon in sediments has stored the fuel over geological periods, buffering the surface inventory of combustible material, pending the arrival of the Homo sapiens. The rise and erosion of mountain range, photosynthesis and carbon burial in sediments, such as delta sediments (France-Lanord & Derry, 1997), and in marine carbonates, led to a lowering of atmospheric CO_2 (Ruddiman, 1997), exposing the Earth surface to orbital forcing represented by the Milankovic glacial–interglacial cycles.

Multiple paleoproxy methods indicate pre-34 Ma eras, including the early Paleozoic, early Mesozoic and early Eocene, were dominated by marked variations in

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Attachment # E

The Plutocene:
Portents for the Post-Anthropocene Geological Era

"For a species to learn to trigger ignition and to split the atom, enhancing its energy output that leads to an increase in entropy in nature by orders of magnitude higher than the species' own physical capacity, the species needs to be perfectly wise and responsible, lest the invention gets out of control, engulfing nature. It is unlikely any species can achieve such levels of wisdom and responsibility".[1] Consequently a greenhouse gas-dominated tropical anthropocentric era is born, from the late Anthropocene to the Plutocene, marked by a layer of $^{239+240}$Plutonium in the deep oceans, with radiation lasting for at least 24,100 years.

ARTICLE BY: **DR ANDREW GLIKSON**

Given time, a possibility may evolve into a probability, and a probability may become a certainty. By the late decades of the 20th century AD and the initial decades of the 21st century AD, as a shift takes place in the state of the atmosphere-ocean-ice sheets system, toward climate tipping points, a mass extinction of species occurs before our eyes, at a rate of 1000 to 10,000 times the natural background extinction rate[2]. It is becoming clear that, instead of channeling its efforts to protect its planetary biosphere – including its own civilisation – *Homo sapiens* continues to sink its remaining resources into genocidal wars and the proliferation of hair-trigger nuclear missile fleets, which threaten dissemination

Climate and paleoclimate publications

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