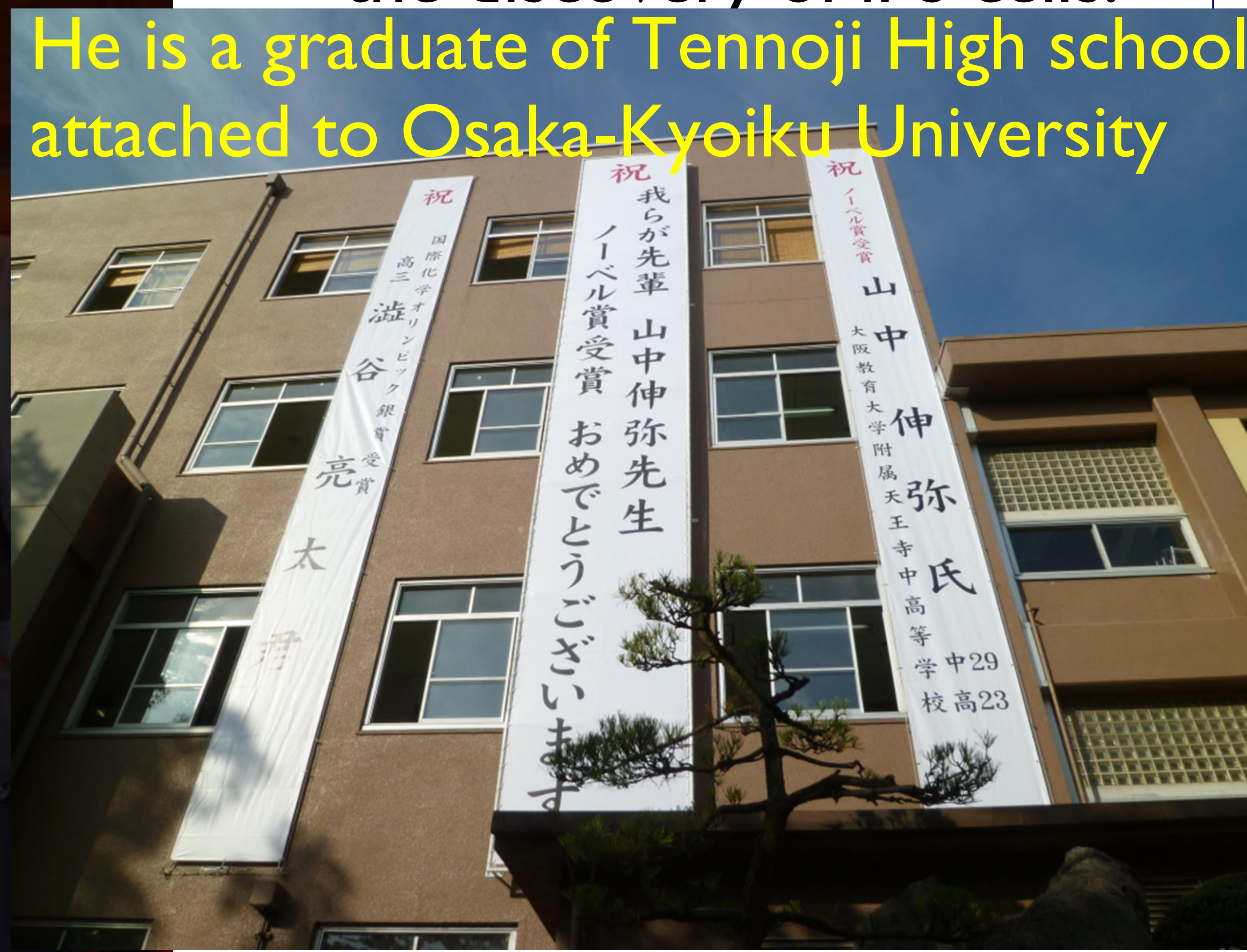

祝
国際化学オリンピック銀賞受賞
高三 澁谷亮太君
祝
我らが先輩 山中伸弥先生
ノーベル賞受賞 おめでとうございます
祝
ノーベル賞受賞 山中伸弥氏
大阪教育大学附属天王寺中高等学校 中29 高23
A Noble Prize Winner
No teacher supervise in exam classes
Crazy 30hours walking event etc.

Two Japanese novel prize winners

Shinya Yamanaka **山中伸弥**

The 2012 Nobel Prize for Physiology or Medicine for the discovery of iPS cells.

He is a graduate of Tennoji High school attached to Osaka-Kyoiku University



Nobel Prizes and Laureates

The Nobel Prize in Chemistry 2002
John B. Fenn, Koichi Tanaka, Kurt Wüthrich

Share this: 0

The Nobel Prize in Chemistry 2002

John B. Fenn
Prize share: 1/4

Koichi Tanaka
Prize share: 1/4

Kurt Wüthrich
Prize share: 1/2

The Nobel Prize in Chemistry 2002 was awarded *"for the development of methods for identification and structure analyses of biological macromolecules"* with one half jointly to John B. Fenn and Koichi Tanaka *"for their development of soft desorption ionisation methods for mass spectrometric analyses of biological macromolecules"* and the other half to Kurt Wüthrich *"for his development of nuclear magnetic resonance spectroscopy for determining the three-dimensional structure of biological macromolecules in solution"*.

Photos: Copyright © The Nobel Foundation

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Koichi Tanaka (田中 耕一 Tanaka Kōichi, born August 3, 1959) is a Japanese engineer who shared the Nobel Prize in Chemistry in 2002 for developing a novel method for mass spectrometric analyses of biological macromolecules with John Bennett Fenn and Kurt Wüthrich (the latter for work in NMR spectroscopy)

THE PRIZE STORY

The Prize Story

The Road to Success

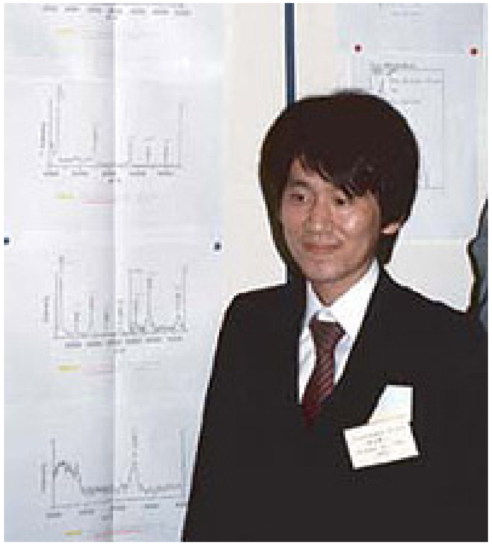
Tanaka answering questions from reporters at the press conference at 9:00pm, October 9th, 2002.

'83: A Quintet Team Is Created

Back in 1980 Shimadzu Corporation newly established a Central Research Laboratory comprising three research groups (C for chemistry, M for mechanics and E for electronics), each staffed by over ten researchers. Sometime later Koichi Tanaka was to find himself affiliated to E-group where one of the research themes was "lasers" a leading technology at the time.

The Prize Story

The Road to Success



Koichi Tanaka in front of a poster-arranged announcement at the 2nd Japan-China Joint Symposium on Mass Spectrometry held in Takarazuka, Japan in 1987 (Photo by courtesy of Dr. Cotter)

Meeting The "World" In '87

Koichi Tanaka first met the "world" in September 1987 at the 2nd Japan-China Joint Symposium on Mass Spectrometry held in Takarazuka, Japan. It was to this event that Dr. Robert Cotter a leading authority, even at that time, in the mass spectrometry field had been invited. He stated in his address that it was more than likely impossible to detect macromolecules using laser ionization mass spectrometry. After the address, Tanaka, who was present at the symposium on behalf of the research team to organize a poster-arranged presentation, approached Dr. Cotter and informed him of their research results showing the amazing data in which detection reached a mass number of 72,000. This data had a profound impact on Dr. Cotter, who promptly took report copies back to the USA and, in joint co-operation with Dr. Catherine Fenselau, a biological macromolecule researcher, introduced Shimadzu research results to many researchers in Europe and USA.

DETECTION OF HIGH MASS MOLECULES BY LASER DESORPTION TIME-OF-FLIGHT MASS SPECTROMETRY

Koichi Tanaka, Yutaka Ido, Satoshi Akita,
Yoshikazu Yoshida and Tamio Yoshida

Central Research Laboratory, Shimadzu Corporation,
1 Nisinokyo-Kuwabaracho, Nakagyo-ku, Kyoto 604, Japan

[Introduction]

The laser desorption time-of-flight mass spectrometer has been developed in order to analyze non-volatile, thermally labile and high mass organic molecules. In this spectrometer we have made improvements on all stages of mass spectrometer (ion source, mass separation, detector, electronics).

[Equipment]

The construction of the laser desorption time-of-flight mass analyzer is shown in Fig.1. Figure 2 shows the block diagram of TOF spectrum measurement system.

-- Ion source --

N_2 laser (Wavelength:337nm, Pulse width:about 15nsec, Pulse energy:4mJ Max.) was used for ionization. "Rapid heating" [1] is achieved by irradiating pulsed laser on sample surface. As for sample preparation, "Ultra fine metal powder (UFP) and glycerol matrix method " was found to be very effective for increasing the yield of high mass molecular ions, and decreasing the yield of fragment ions[2].

In comparison with Bulk, UFP has the following features

- High photo-absorption
- Low heat capacity
- Extremely large surface area per unit volume

This UFP matrix method seemed to enhance the speed of heating even further.

-- Mass separation --

Generally, TOF-MS has the following characteristics

- Very high transmission
- Measurement time of less than a few hundreds μ sec

- Unlimited mass range
- Low mass resolution

A new gradient-electric field ion reflector for a time-of-flight mass spectrometer has been developed in order to improve mass spectral resolution by energy focusing [3]. In the TOF mass spectrometer consisting of a free ion drift region and a new ion reflector, the motion of the same m/z ions is quasi-single oscillation of the same period. Therefore, the flight-times of the same m/z ions are focused to a constant even if the initial kinetic energy of the emitted ions are scattered.

The TOF mass separation system was designed to permit easy switching between "Reflector type" ($V_R > V_0$) and "Linear type" ($V_R = 0$).

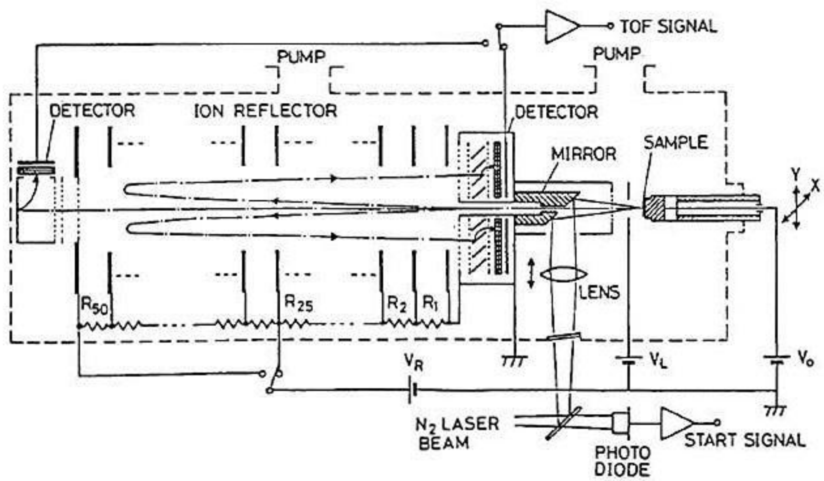


Fig. 1 Construction of the Laser Desorption TOF Mass Analyzer.

-- Detector --

Micro channel plate (MCP) or secondary electron multiplier (SEM) is usually used to detect ions, electrons or photons. Ions of larger m/z generally have low velocities in TOF-MS. So the detection sensitivity of MCP has a tendency to decrease in higher mass regions.

Higher detection sensitivity for high mass ions was

Early Earth and South Africa Geology

Yoshio Okamoto

Geoscience-English lecture
29th Nov. 2016

Why South Africa?

As a Geological wonderland

Oldest rocks(3.5Ga<): Canada, Greenland, Western Australia:

most accessible locality!

⇒In Japan, no rock of this era.

Economic Ores: Gold, Diamond, Platinum etc.

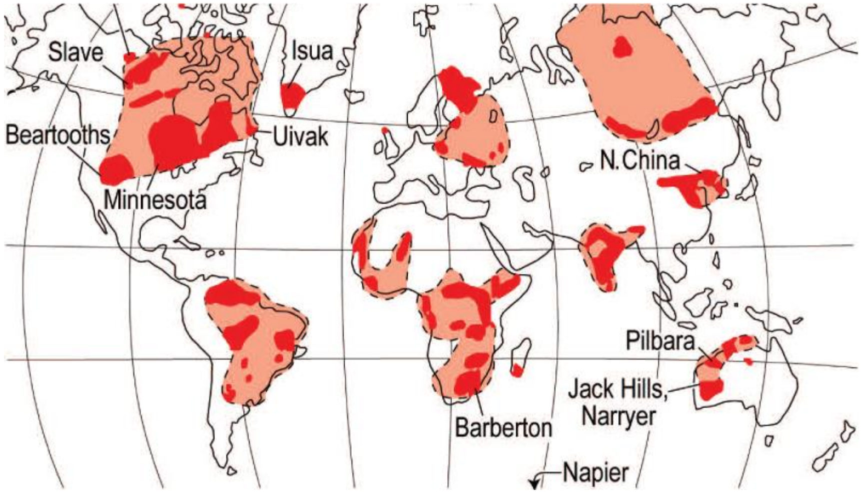
Gondwana homeland of continental drift

Oldest magma intrusion: "Bushveld igneous intrusion"

Meteor impacts Crater

Banded Iron Formation(BIF)

Ancient ice age remnants etc.



Global distribution of Archean rocks in modern continents.
Known (red), suspected (pink). Areas with rocks or zircons older than 3.6 billion years are labelled by name.
http://www.earthsciences.hku.hk/shmuseum/earth_evo_03_archean_intro.php

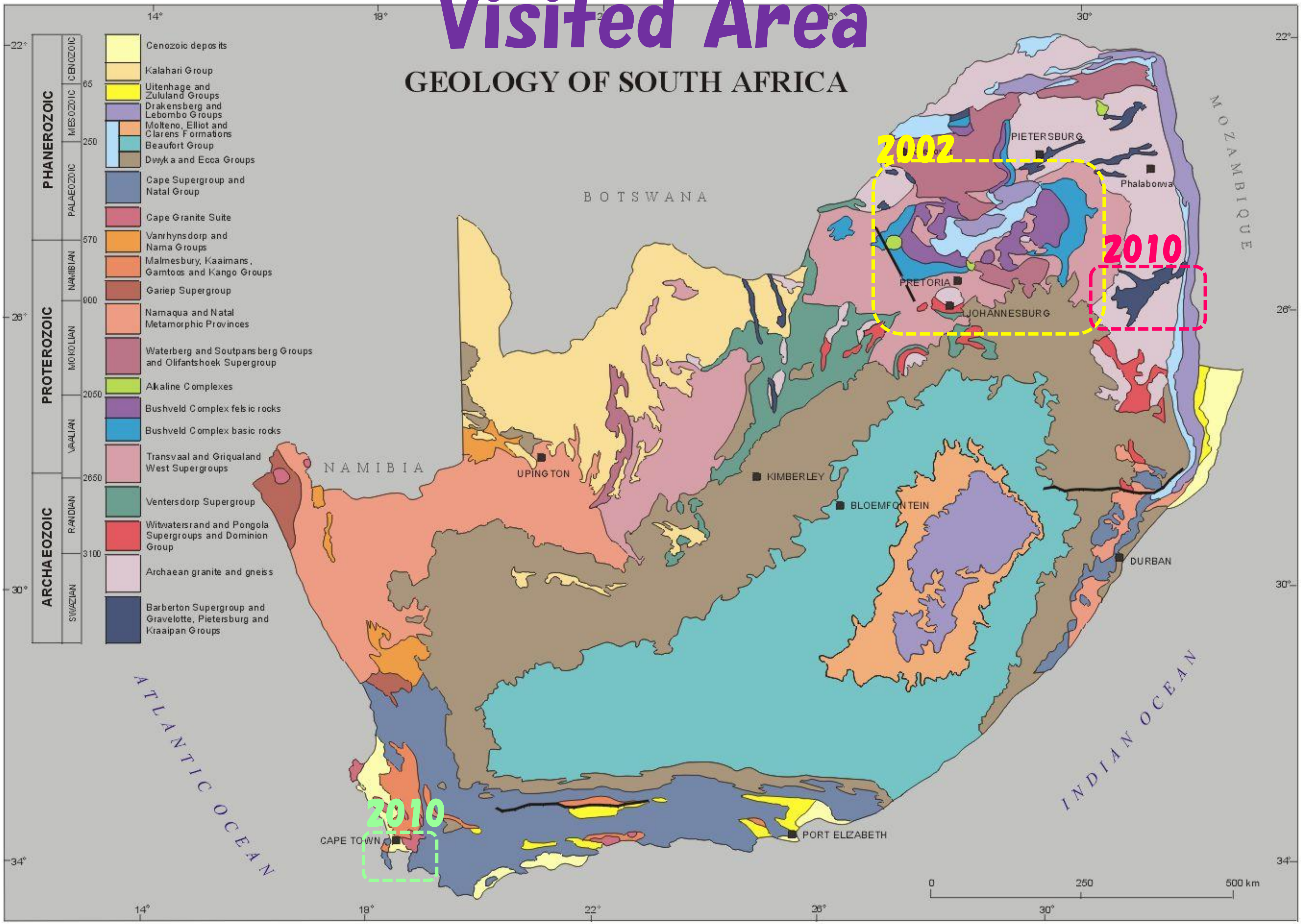
My Visits (Three-times)

IAGOD Geological Field Trip (Johannesburg to Pretoria): Aug. 2002: Big Five economic mines: Gold, Platinum, Chromium, Diamond, Iron, Coal

GeoSciEdVI Conference(Johannesburg) and field trip: Aug.-Sep. 2010: Barberton and Kruger National Park, Tswaing Meteor Impact Crater

IGC 35 Conference and Field trip: Aug-Sep. 2016: Robben Island, Cape of Good Hope, Table Mountain

Visited Area



COMPILED BY N. KEYSER

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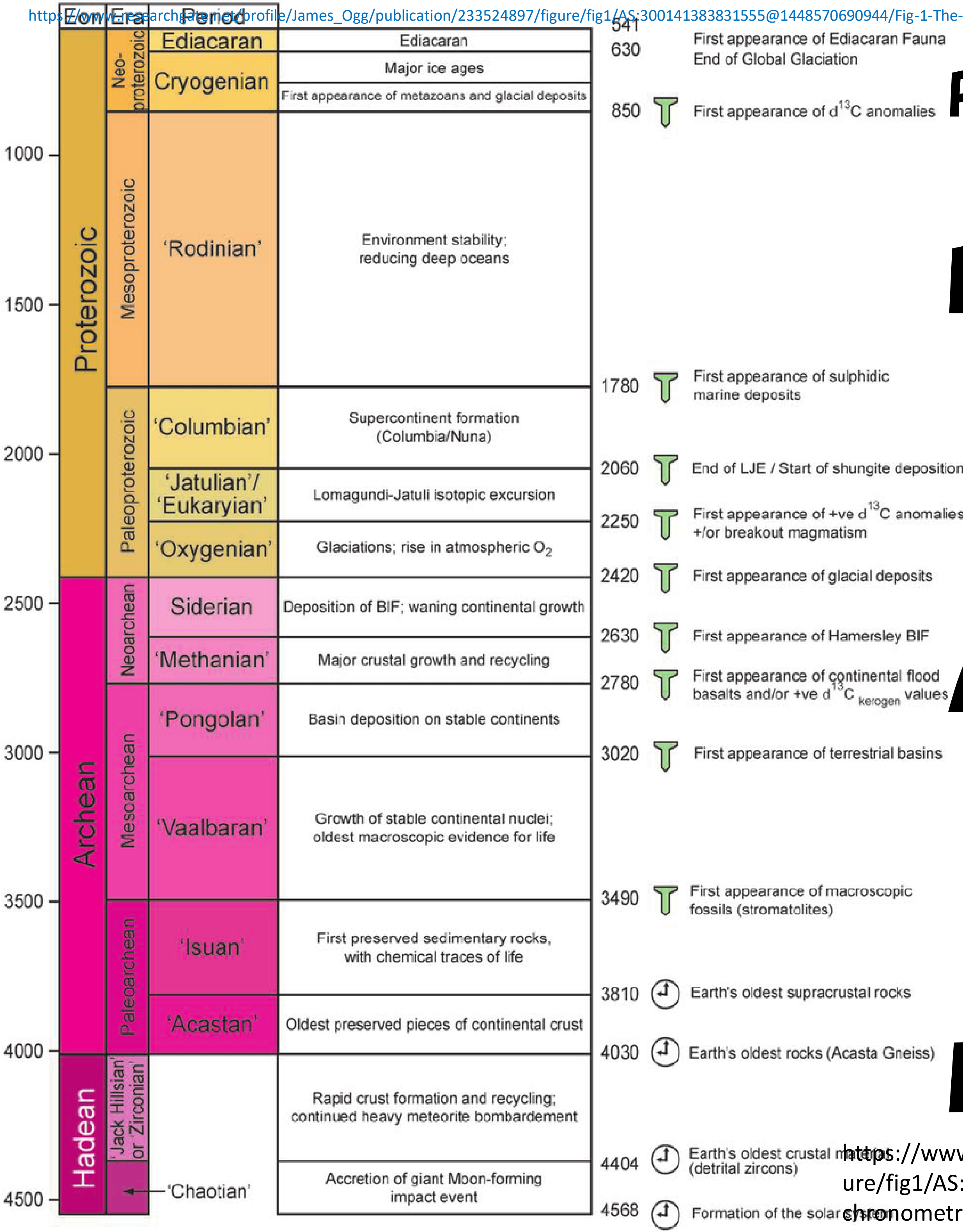
https://www.researchgate.net/profile/James_Ogg/publication/233524897/figure/fig1/AS:300141383831555@1448570690944/Fig-1-The-Precambrian-chronometric-scheme-used-for-Eon-Era-and-SystemPeriod.png

Pre-Cambrian Time scale



Proterozoic

Archean

Hadean

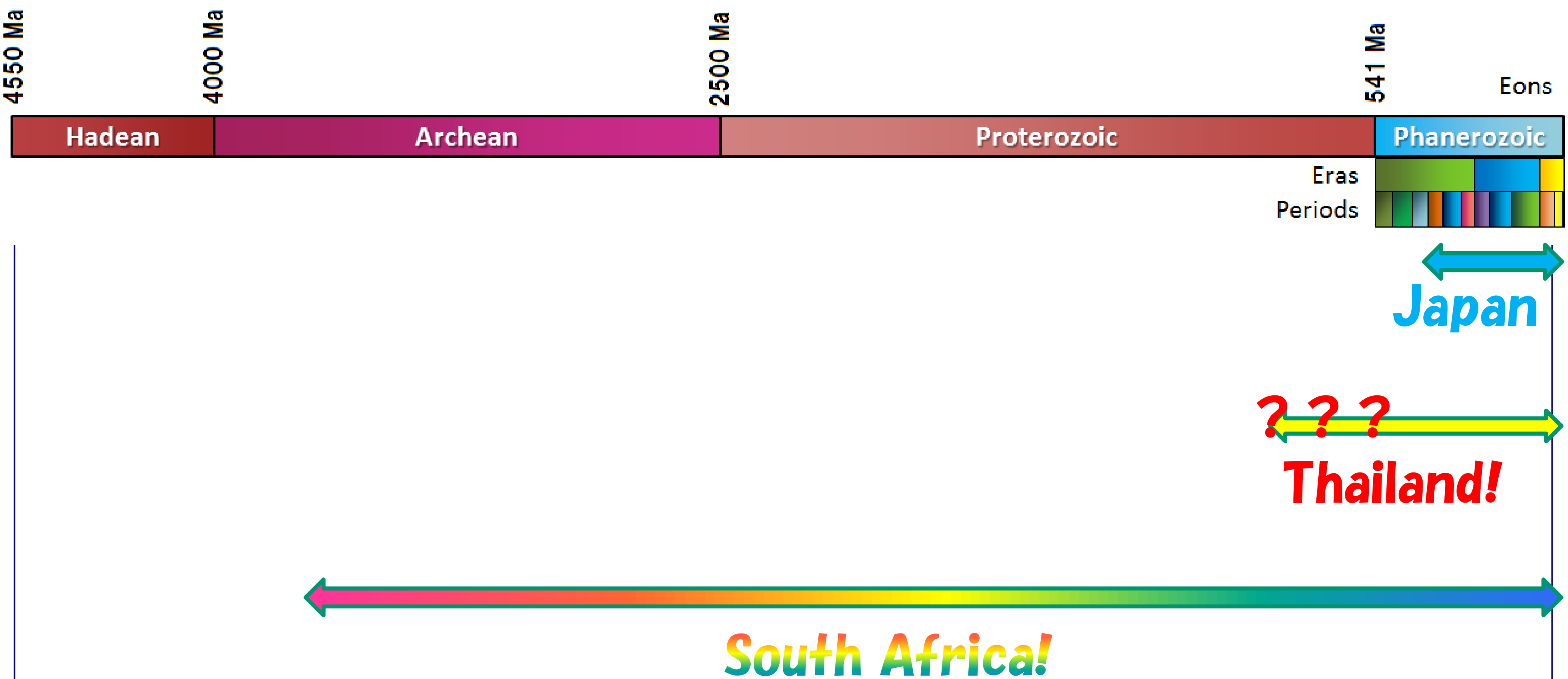
https://www.researchgate.net/profile/James_Ogg/publication/233524897/figure/fig1/AS:300141383831555@1448570690944/Fig-1-The-Precambrian-chronometric-scheme-used-for-Eon-Era-and-SystemPeriod.png

Absolute years

Gy = Ga = Billion years ago =
1000000000 years
My = Ma = Million years ago =
1000000 years

3.0Ga = 3000Ma = 3000000000years
Birth of Earth = 4.6 Ga = 4600 Ma=
4600000000 years

Thailand, Japan vs. South Africa on Geological Time scale



Why recently is the early earth so revealed.

After 1990's: A radiometric dating tool is developed:

"SHRIMP, **S**ensitive **h**igh-**r**esolution **i**on **m**icro**p**robe"

->20μm Zircon Pb/U, Pb/Pb

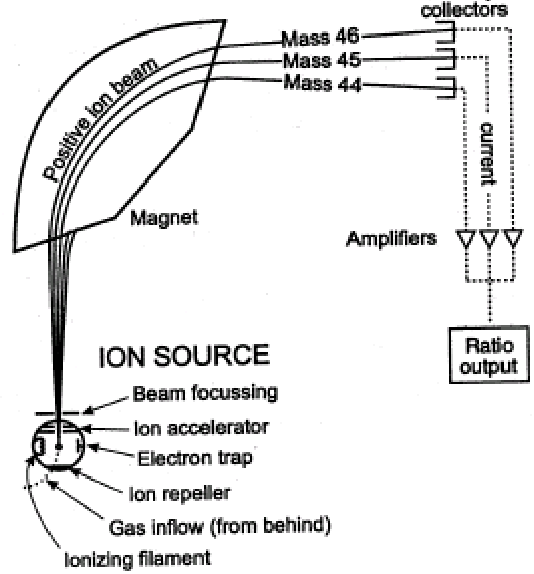
Also isotope ratio geochemical techniques are advanced:

^{146}Sm–^{142}Nd: ^{182}Hf–^{182}W: $^{142}Nd/^{144}Nd$, $^{182}W/^{184}W$ ->

use for evolution of early earth crust and mantle system

<Applying Mass Spectrometry>

A new window is opened for the early earth!

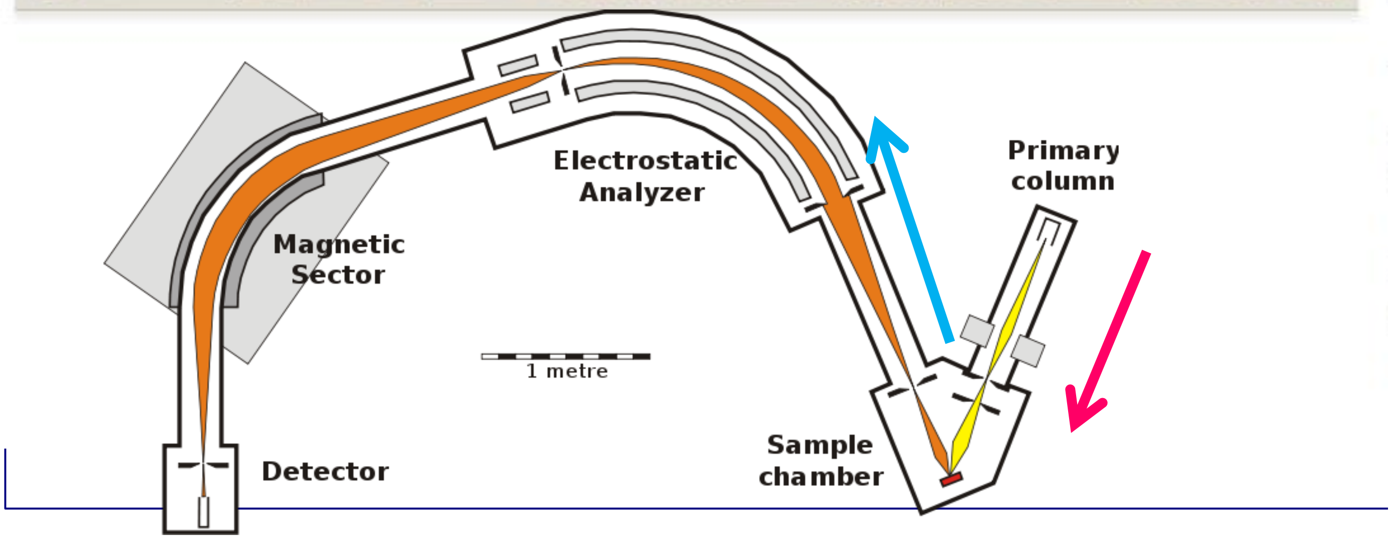


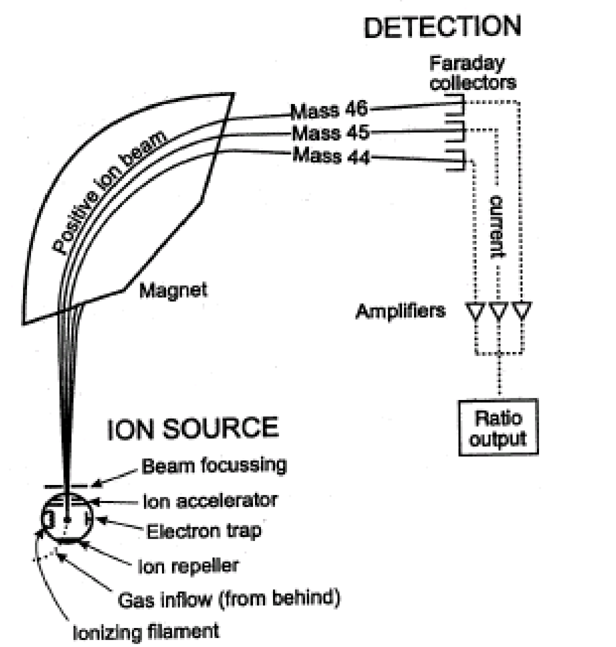
Stanford SCHOOL OF EARTH, ENERGY & ENVIRONMENTAL SCIENCES | USGS science for a changing world

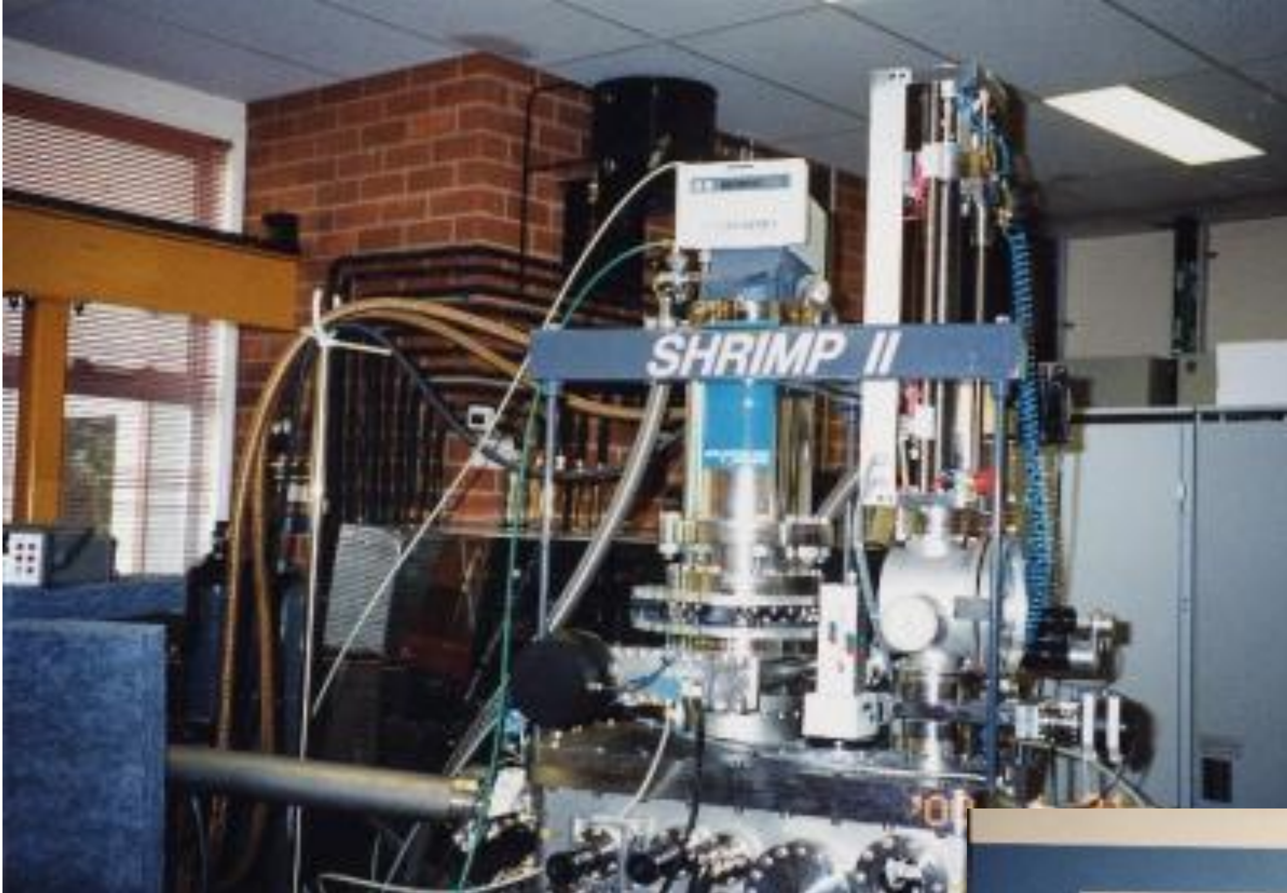
SHRIMP-RG Lab

Sensitive High Resolution Ion Microprobe - Reverse Geometry

The SHRIMP-RG is at Stanford University as a result of a partnership between the U.S. Geological Survey and Stanford School of Earth, Energy & Environmental Sciences. The laboratory has been jointly operational since 1998, supporting scientists and students from the USGS, Stanford, and external visitors from around the world who

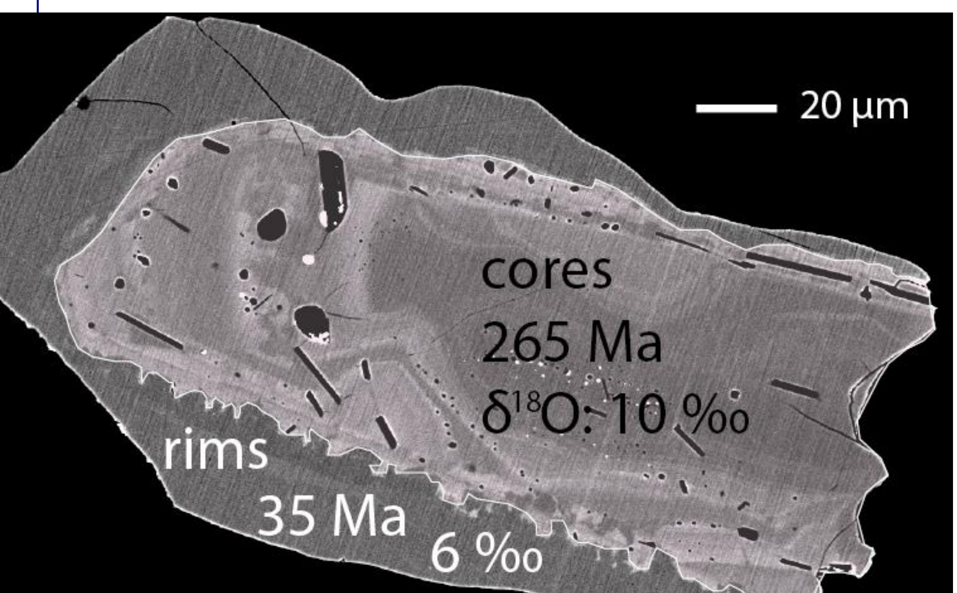






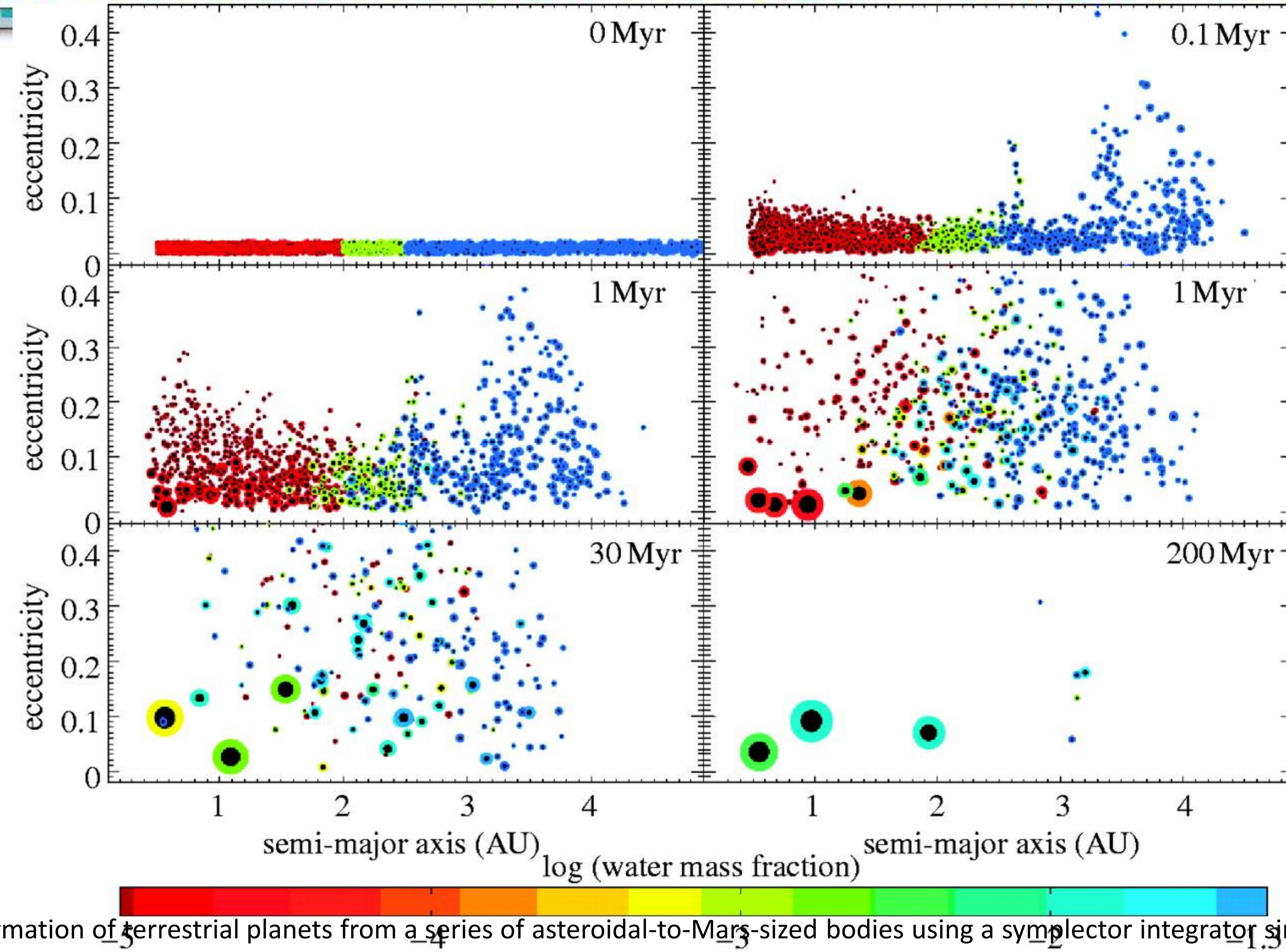
Photos by Prof. Fujioka

SHIRIMP II
at ANU (Australian National University) Geoscience Lab.



http://rses.anu.edu.au/highlights/view.php?article=

Example of the formation of terrestrial planets from a series of asteroidal-to-Mars-sized bodies using a symplector integrator simulation as described in the text.



Example of the formation of terrestrial planets from a series of asteroidal-to-Mars-sized bodies using a symplector integrator simulation as described in the text. Six snapshots in time show the eccentricity versus semi-major axis of 1885 objects that collide, coalesce and grow under the perturbing influence of Jupiter and of their own growing gravitational fields. The size of each body is proportional to its linear diameter as it grows, and the amount of iron it contains is shown in black. Colours allow the eye to track mixing across regions of the solar system, and can also be considered a rough indication of the amount of water assumed present in these objects at the beginning, and in the bodies as they collide and grow, with the water mass fraction scale shown at the bottom. The final system is not precisely our own terrestrial planet system, but similar, and outcomes vary dramatically as boundary conditions are changed. From Raymond et al. (2006).

Jonathan I Lunine Phil. Trans. R. Soc. B 2006;361:1721-1731

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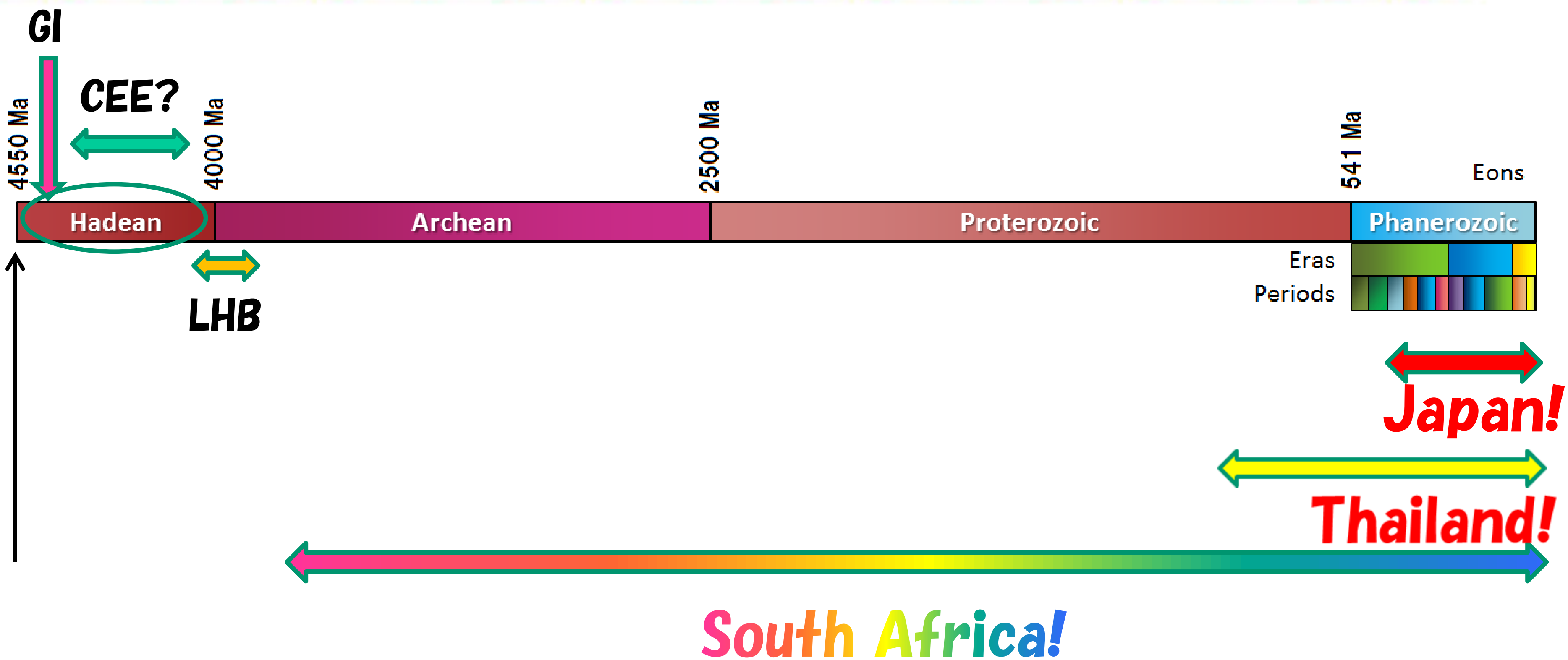
http://rstb.royalsocietypublishing.org/content/361/1474/1721

Early Earth (Part 1) Hadean eon



Forming of Earth 4.6Ga

Giant Impact (the birth of Moon) 4.5Ga

Cool Early Earth 4.4-4.0 Ga

Late Heavy Bombardment (LHB) 3.9 Ga

W.K.Hartmann (right) and Donald R. Davis(left)

as a founder of "Giant Impact Hypothesis"; the most plausible theory of the origin of the moon.

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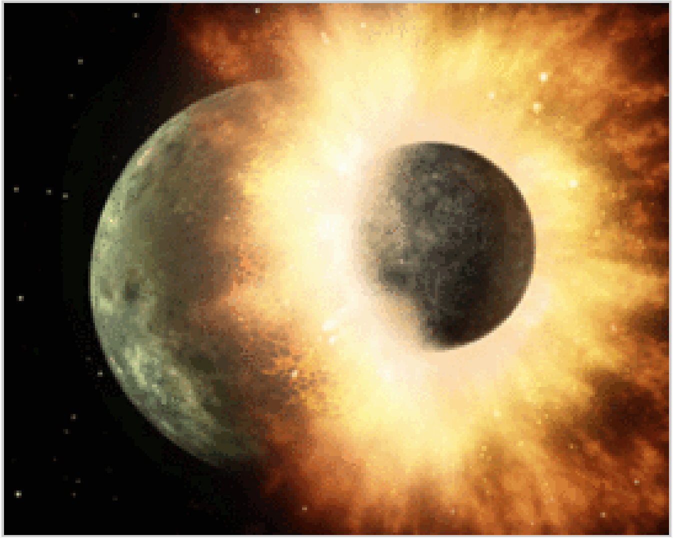
Giant impact hypothesis

From Wikipedia, the free encyclopedia

"Big splash" redirects here. For other uses, see Big Splash (disambiguation).

The **giant impact hypothesis** states that the Moon was formed out of the debris left over from a collision between the Earth and a body the size of Mars, approximately 4.5 Gya (four and a half billion years ago). The colliding body is sometimes called **Theia**, for the mythical Greek Titan who was the mother of Selene, the goddess of the Moon.[1][2]



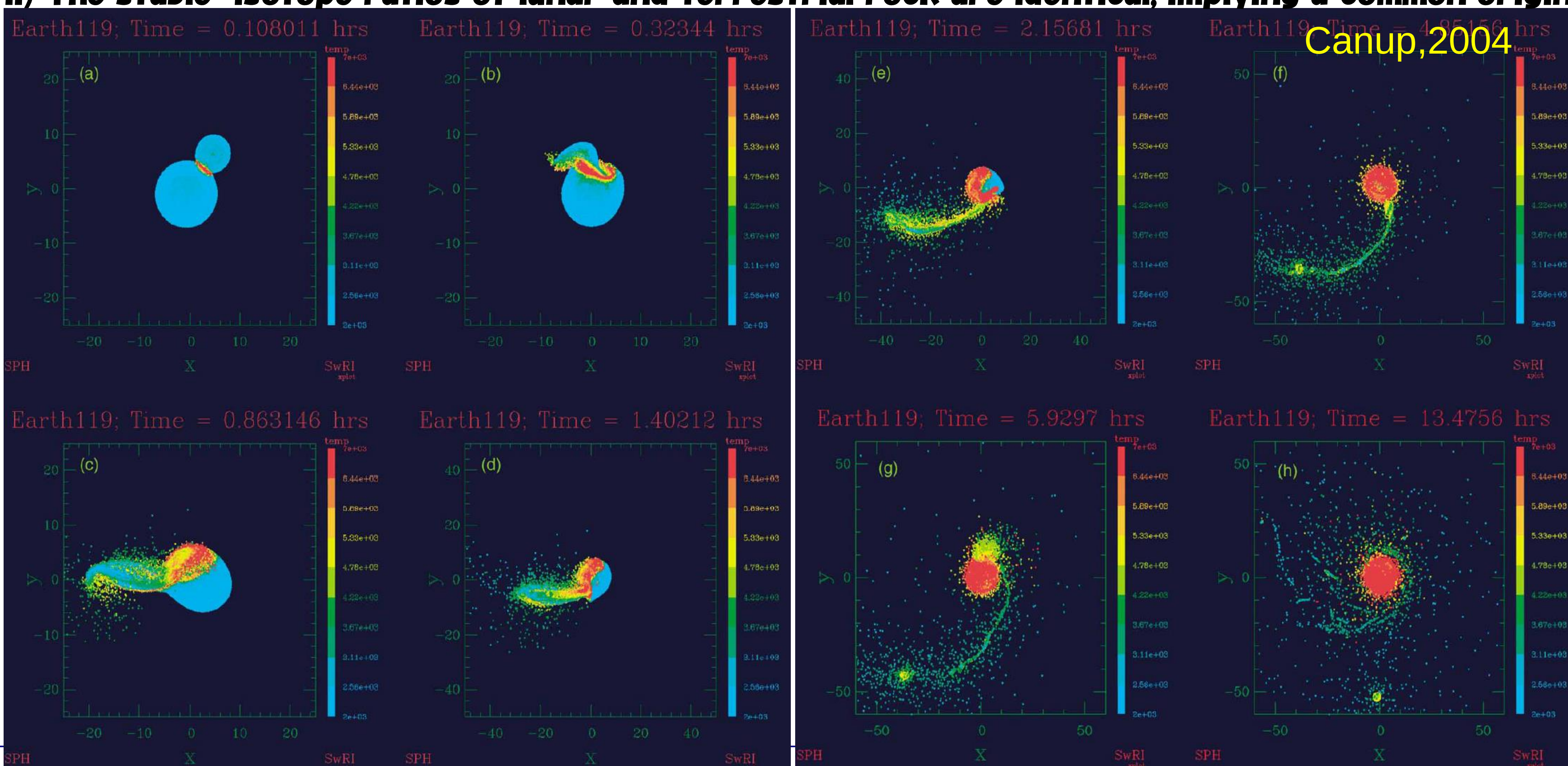
Artist's depiction of a collision between two planetary bodies. Such an impact between the Earth and a Mars-sized object likely formed the Moon.

The giant impact hypothesis is the currently-favoured scientific hypothesis for the formation of the Moon.[3] Supporting evidence includes: the Earth's spin and Moon's orbit having similar orientations,[4] Moon samples indicating the surface of the Moon was once molten, the Moon's relatively small iron core, lower density compared to the Earth, evidence of similar collisions in other star systems (that result in debris disks), and that giant collisions are consistent with the leading theories of the formation of the solar system. Finally, the stable isotope ratios of lunar and terrestrial rock are identical, implying a common origin.[5]

There remain several questions concerning the best current models of the giant impact hypothesis, however. The energy of such a giant impact is predicted to heat Earth to produce a global 'ocean' of magma; yet there is no evidence of the resultant planetary differentiation of the heavier material sinking into Earth's mantle. At present, there is no self-consistent model that starts with the giant impact event and follows the evolution of the debris into a single moon. Other remaining questions include when the Moon lost its share of volatile elements and why Venus, which also experienced giant impacts during its formation, does not host a similar moon.

Supporting evidence of GIT(wiki)

i) Earth's spin and the Moon's orbit have similar orientations.
ii) Moon samples indicate that the Moon once had a molten surface.
iii) The Moon has a relatively small iron core.
iv) The Moon has a lower density than Earth.
v) Evidence exists of similar collisions in other star systems (that result in debris disks).
vi) Giant collisions are consistent with the leading theories of the formation of the solar system.
vii) The stable-isotope ratios of lunar and terrestrial rock are identical, implying a common origin



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Giant impact hypothesis

From Wikipedia, the free encyclopedia

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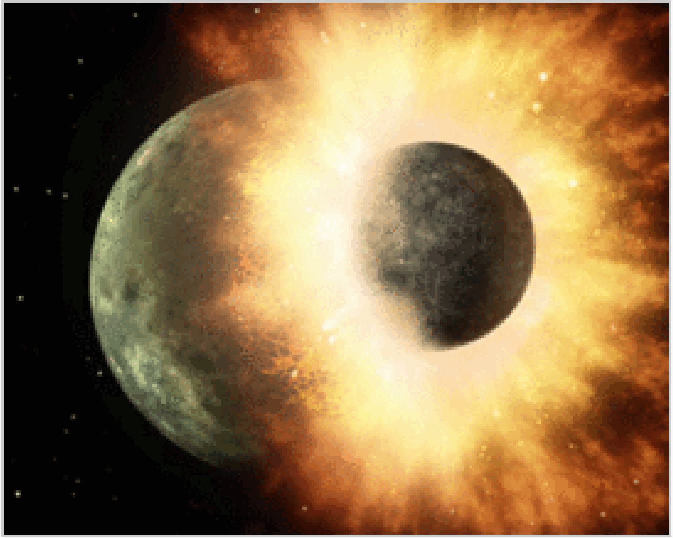

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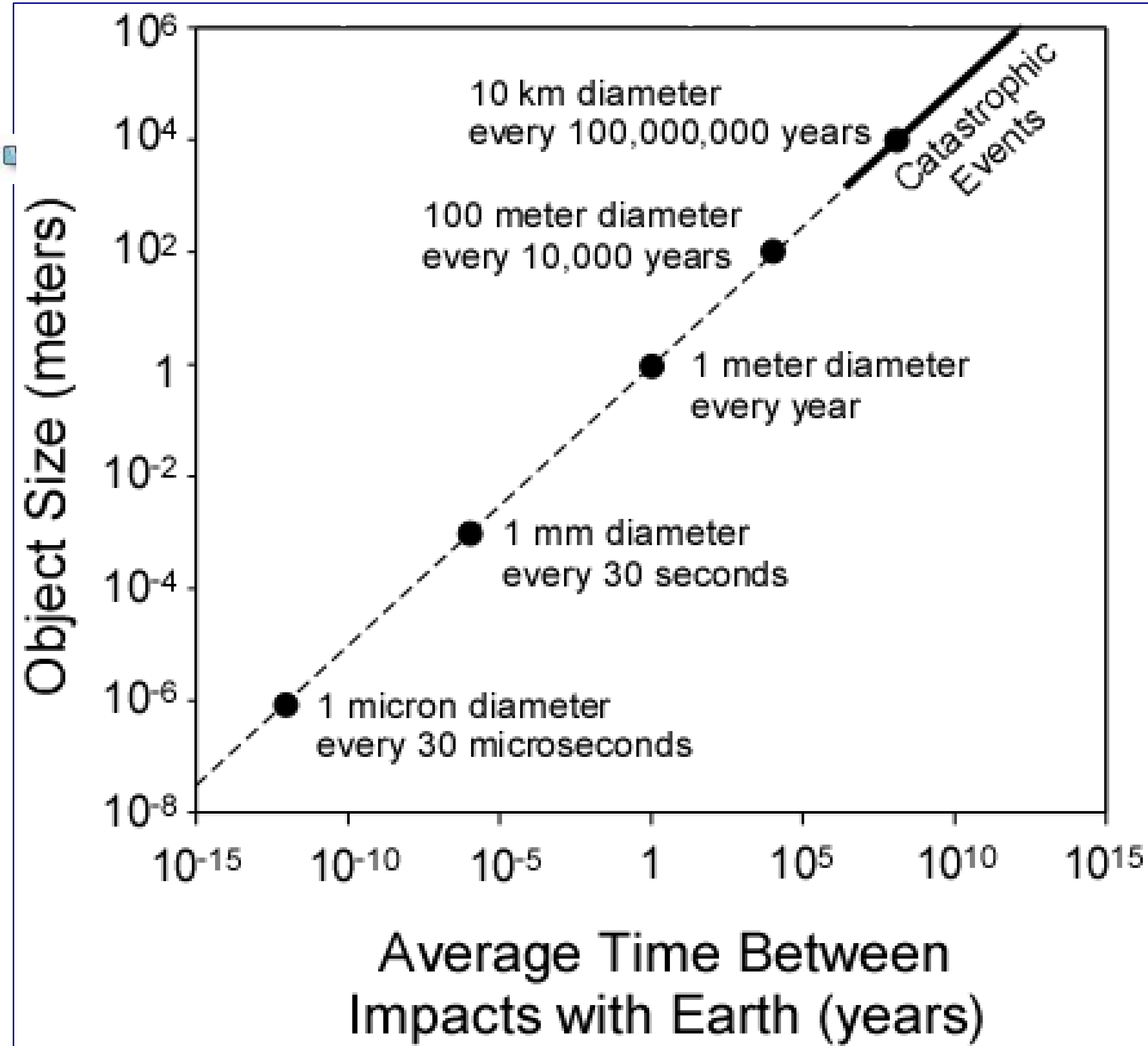
Celebrating 40 Years of Scientific Discovery

米国惑星科学研究所創始者
W.K.Hartmann氏



http://www.tulane.edu/~sanelson/images/impactrecurrence.gif

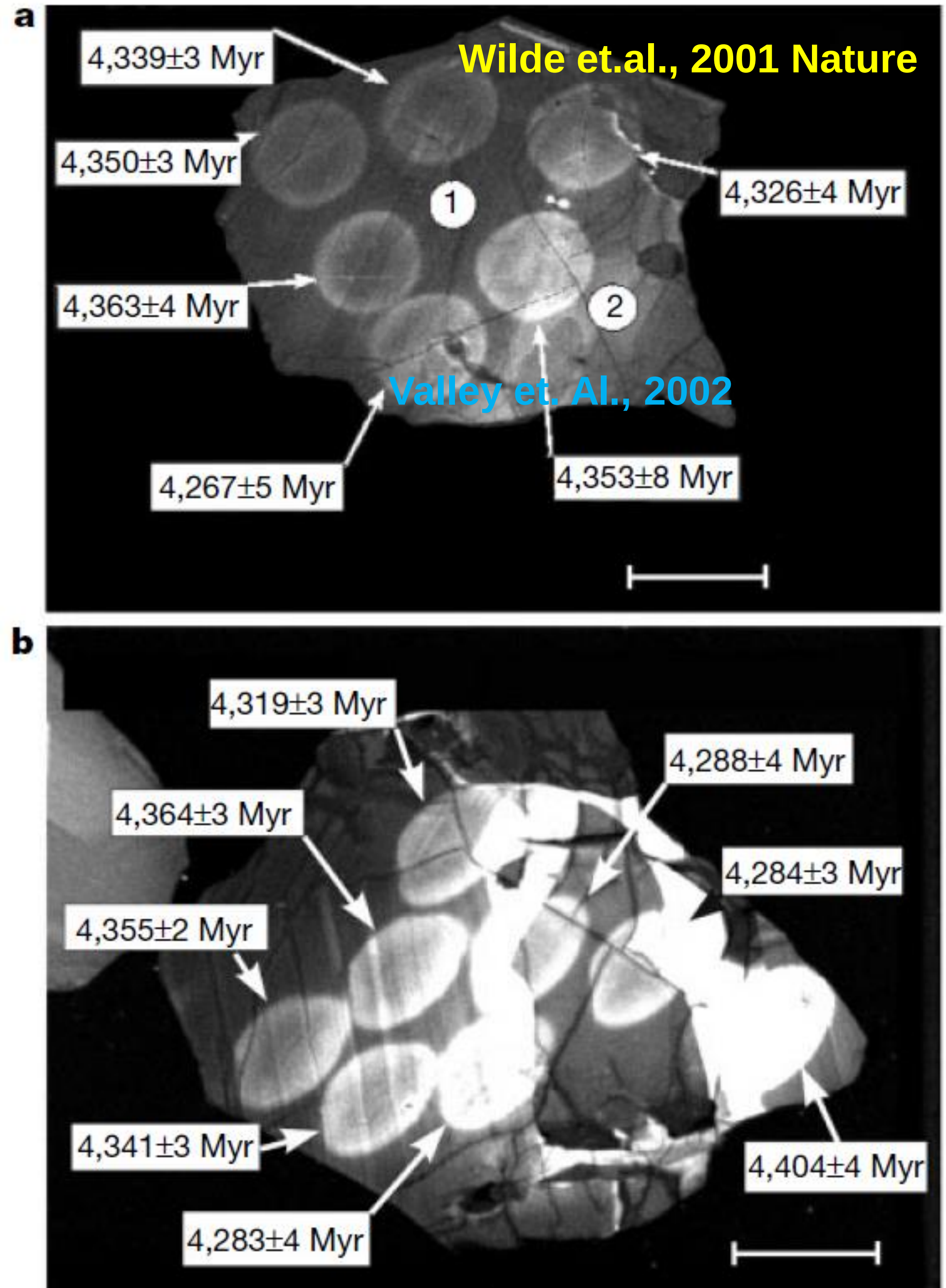
4.4Ga Zircon by SHRIMPII

Oldest mineral
Granitic rocks

Why Zircon?

Resist against weathering
U, Pb rich

Linewever & Norman, 2008



A cool early Earth

John W. Valley*
William H. Peck*
Elizabeth M. King*
Department of Geology and Geophysics, University of Wisconsin, Madison, Wisconsin 53706, USA
Simon A. Wilde
School of Applied Geology, Curtin University of Technology, GPO Box U1987, Perth, Australia

Sterilizing Impacts and life "Panspermia Hypothesis"

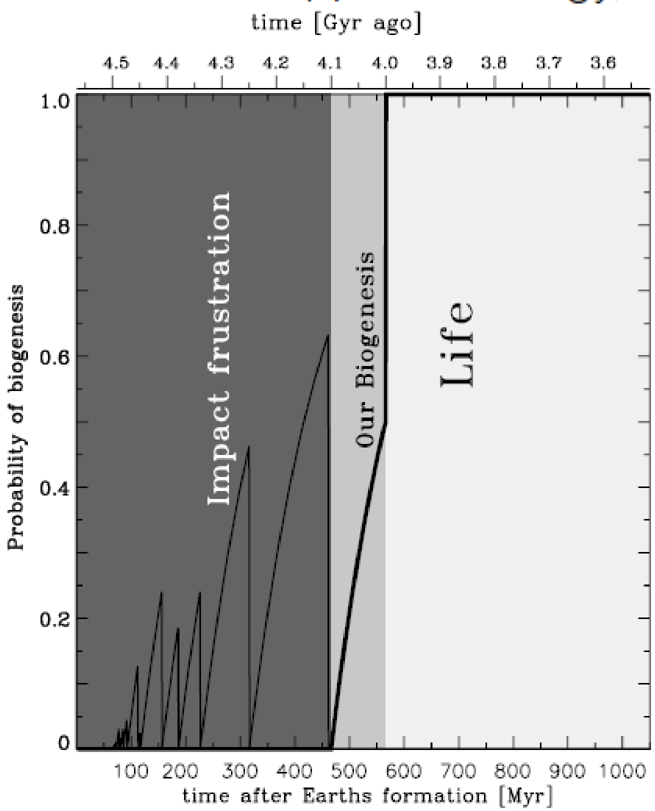


Fig. 2. After the sterilizing impact that formed the Moon about 90±20 Myr after the formation of the solar system (Halliday 2008), a heavy but decreasing and stochastic bombardment lasted for a few hundred million years probably frustrated the origin of life on Earth. Eventually, the molecular evolution that led to life as we know it, was able to squeeze through the thermal bottlenecks produced by impacts (however see Abraomov & Mojzsis 2008a,b). Figure from Davies & Lineweaver 2005.

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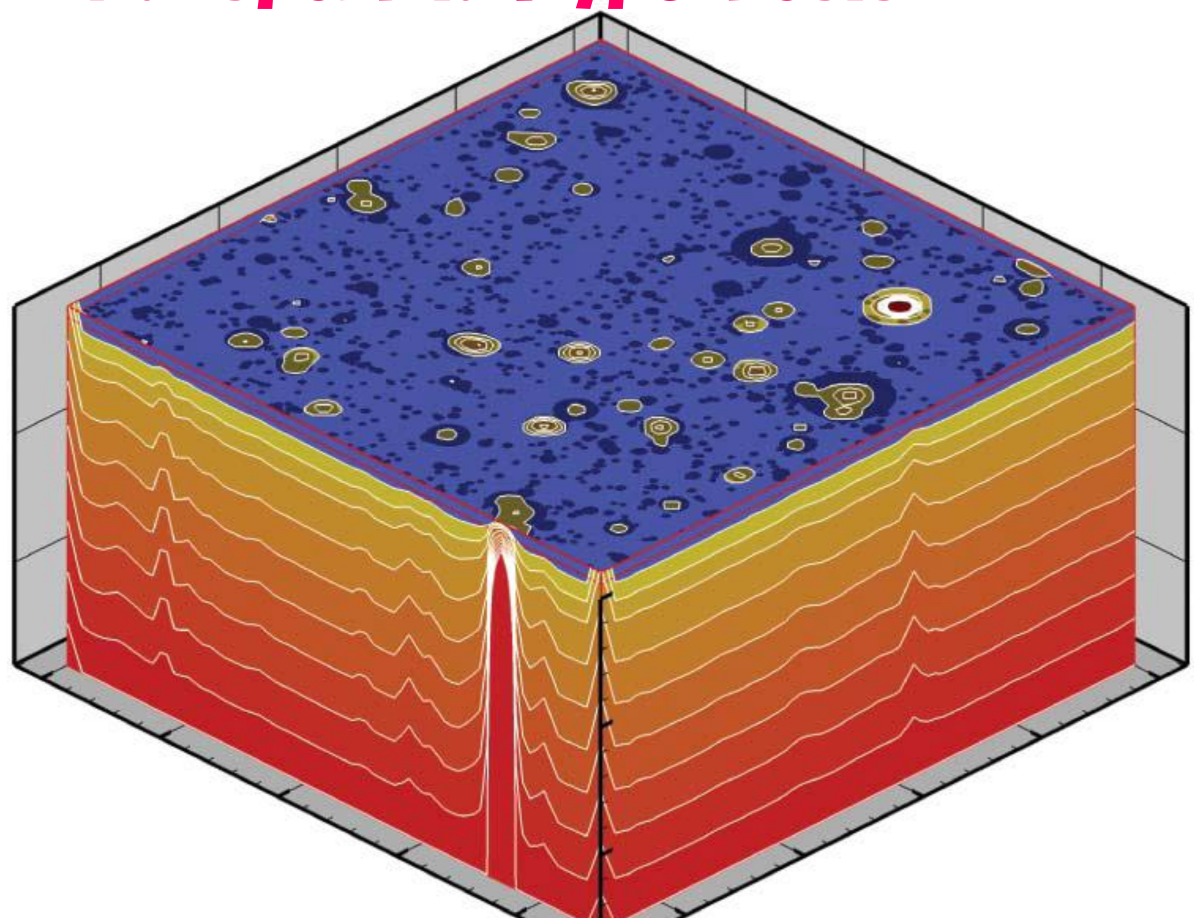


Hadean Earth (4.0 Ga)

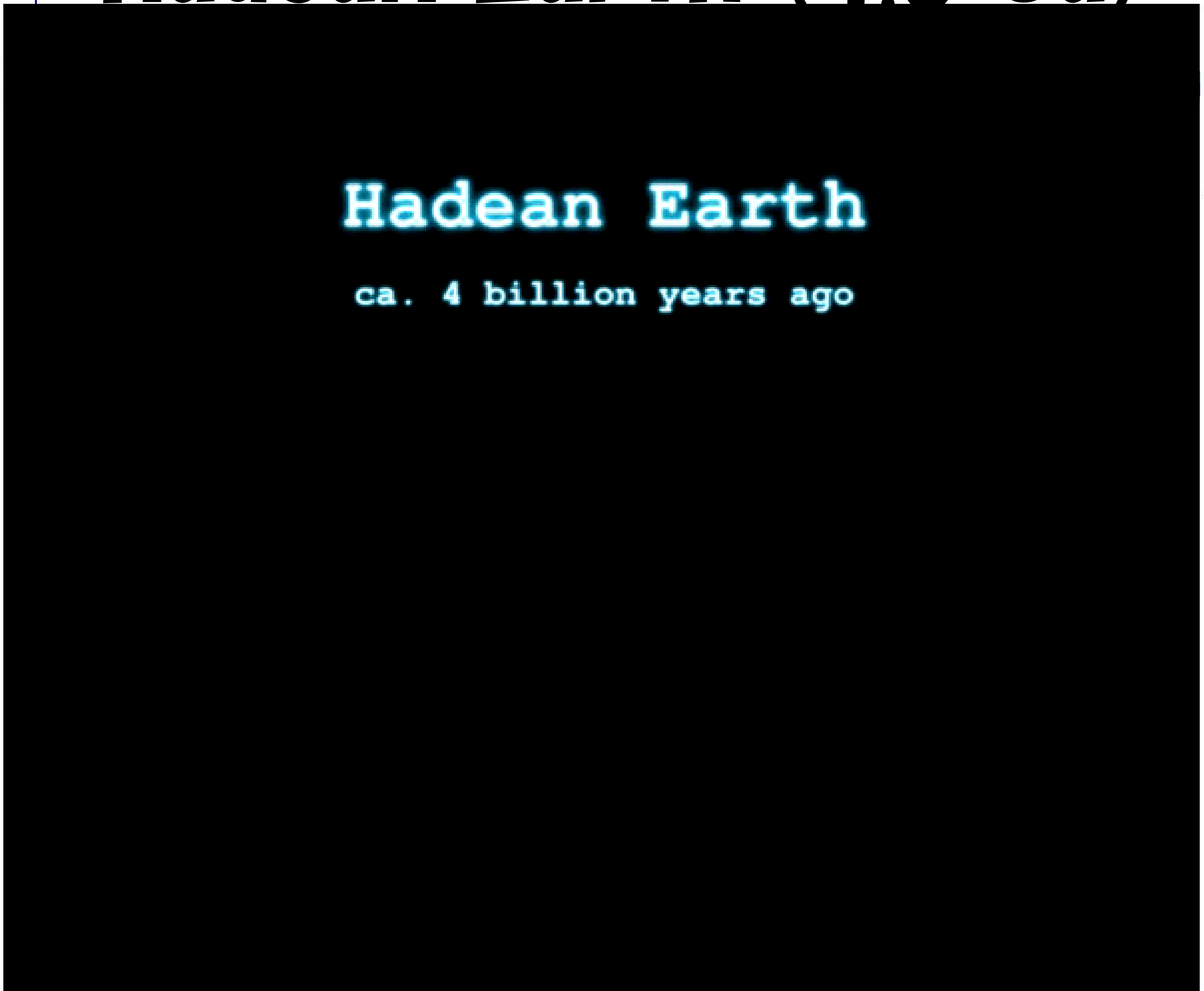
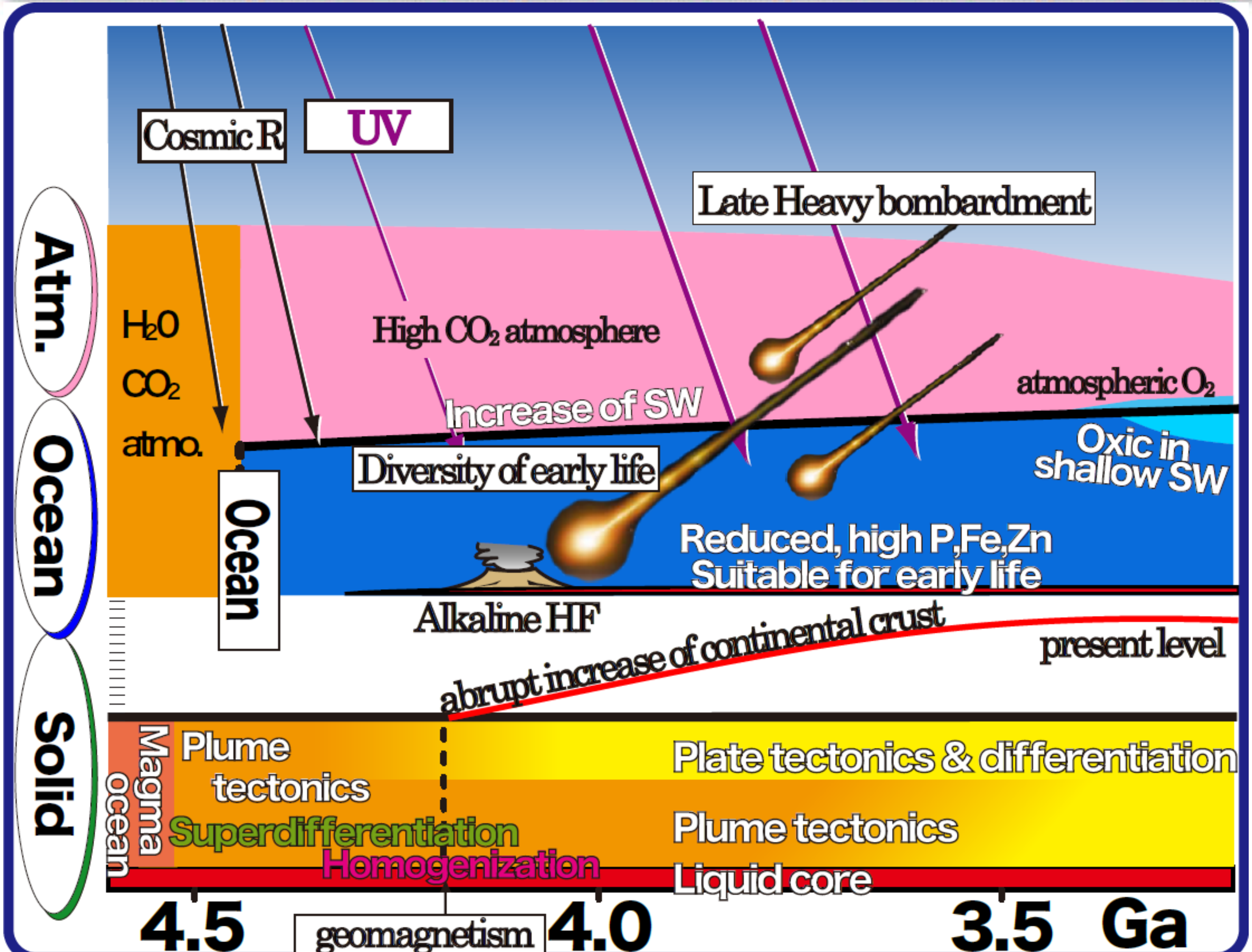


Figure 1. An artistic conception of the early Earth-Moon system. The Earth is pictured as surface pummeled by large impacts, resulting in extrusion of impact-generated deep-seated magma onto the surface. At the same time, distal portion of the surface could have retained liquid water. The Moon is pictured as a dry, heavily cratered body. The Moon is far less geologically active than the Earth and its older surface and rocks have been used to calibrate our bombardment.

Dr. Simone Marchi kindly allow me to use this gif-images.

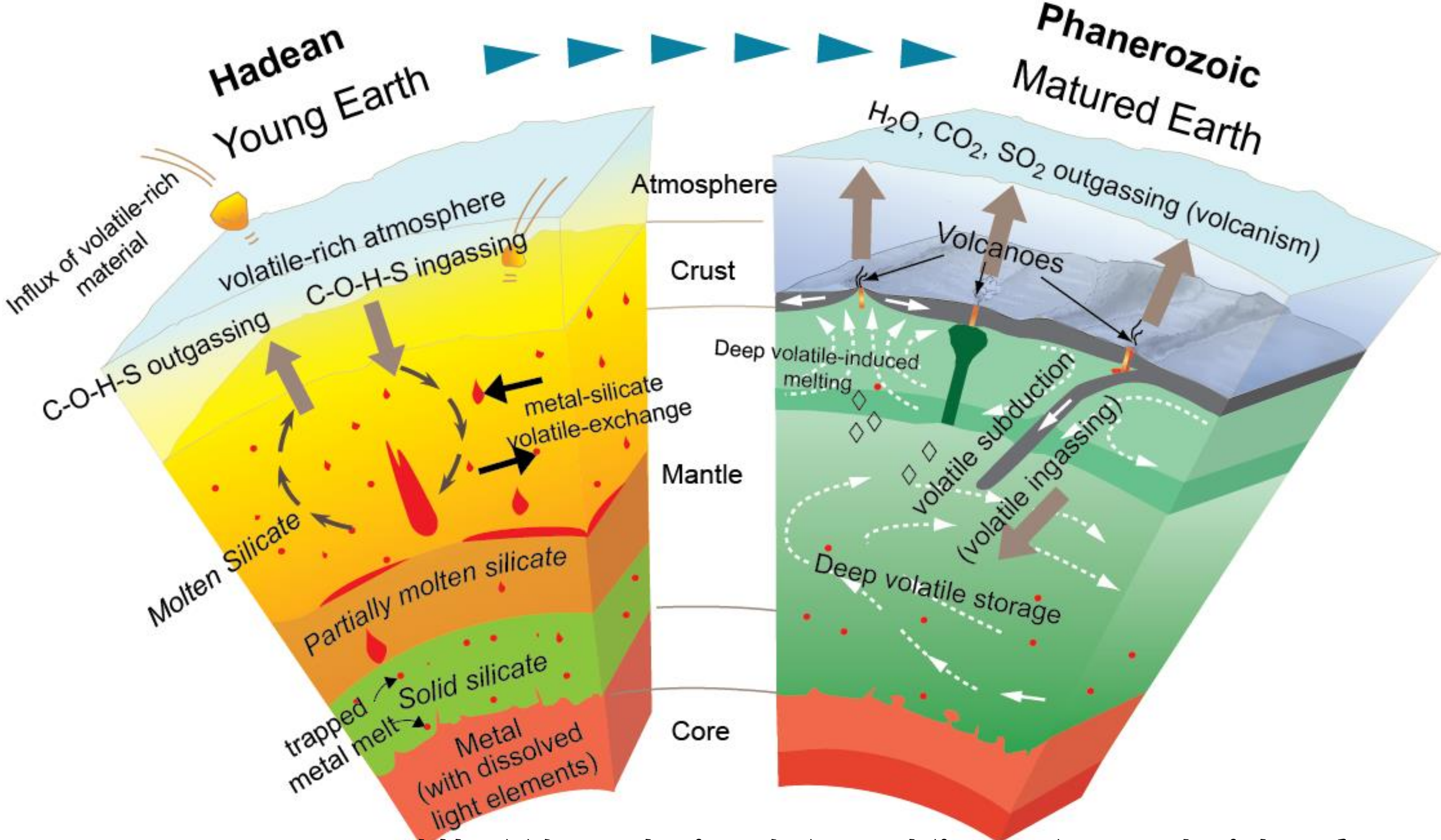
http://www.boulder.swri.edu/~marchi/



A.Prof. Komiya (Tokyo Univ.) kindly provides me this image.

https://www.jsps.go.jp/j-grantsinaid/12_kiban/ichiran_26/j-data/h26_j3213_komiya.pdf

Formation and evolution of earth



http://dasgupta.rice.edu/expert/images/research_picture_1.png

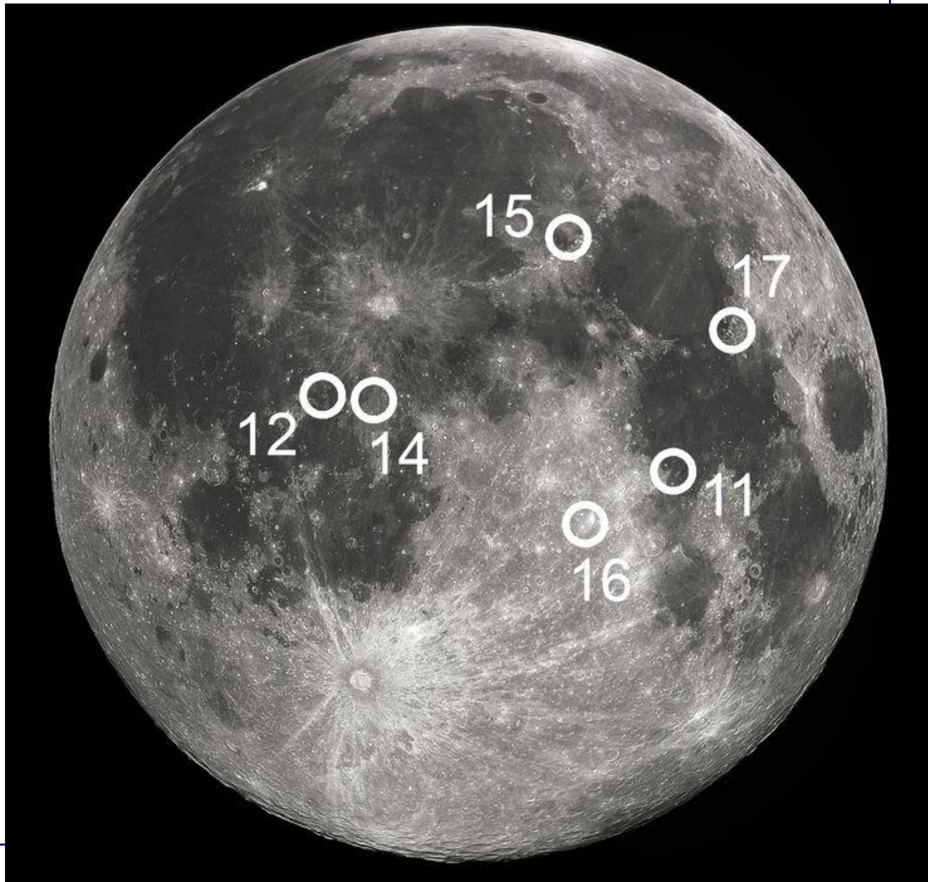
Late Heavy Bombardment (LHB)

<Evidence>

Moonrocks:Apollo mission

The ages of **impact melts** collected at **these sites clustered between about 3.8 and 4.1 Ga.** The apparent clustering of ages of these led to postulation that the ages record an intense bombardment of the Moon. They called it the 'lunar cataclysm' and proposed that it represented a dramatic increase in the rate of bombardment of the Moon around 3.9 Ga.

http://public.media.smithsonianmag.com/legacy_blog/age-histogram.jpg



“クレータ年代学”

Crater Chronology：principle

- **Basic idea by W. K. Hartmann in 1960's**
- **The principle is quite simple!**

->Heavy cratering surface is old.

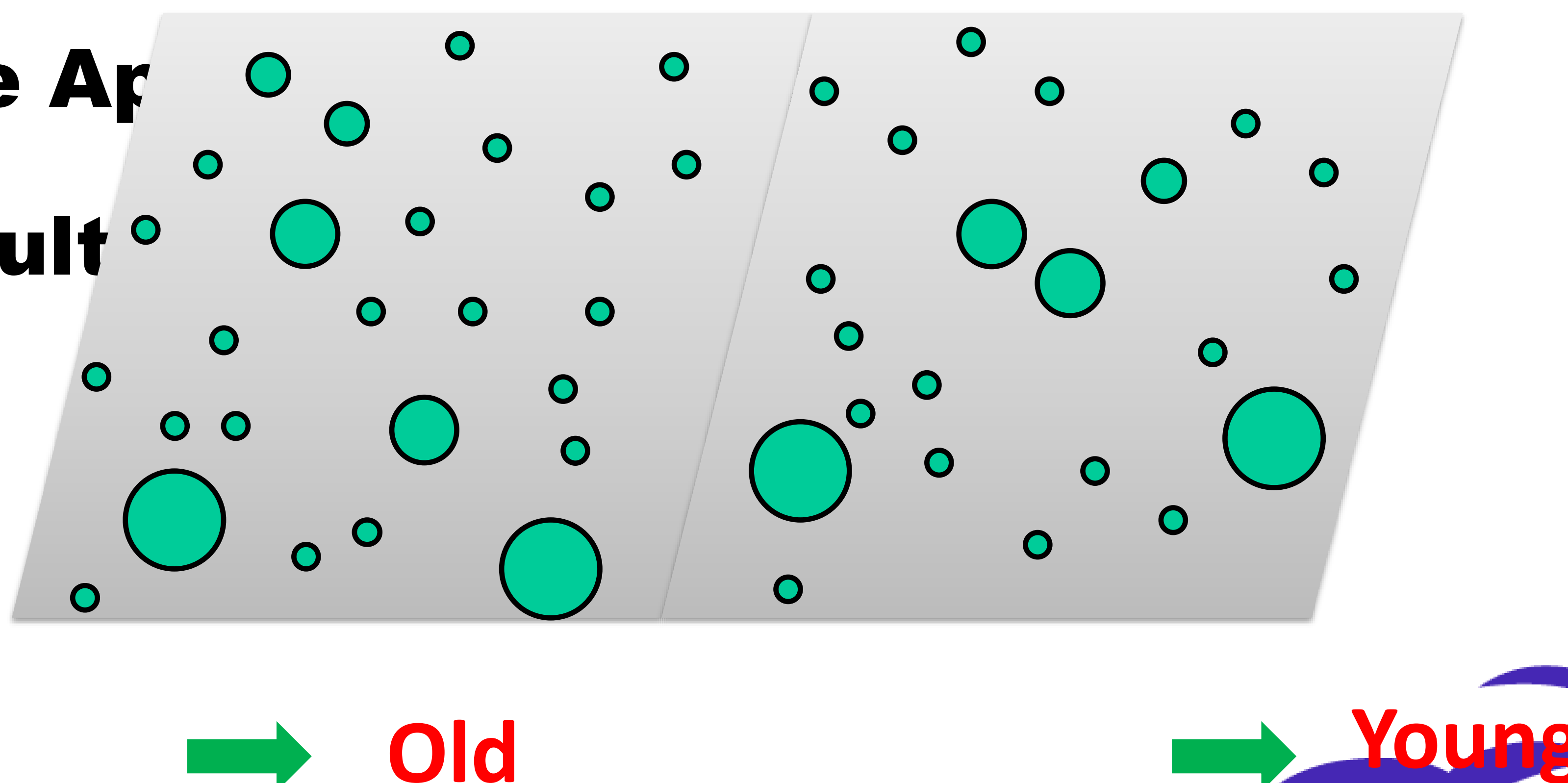
http://sservi.nasa.gov/articles/video-the-lunar-crater-chronol

What is Crater-Chronology?

William K.Hartmann (PSI) first developed isochrones diagram for the Moon.

- **The Ap**

  result



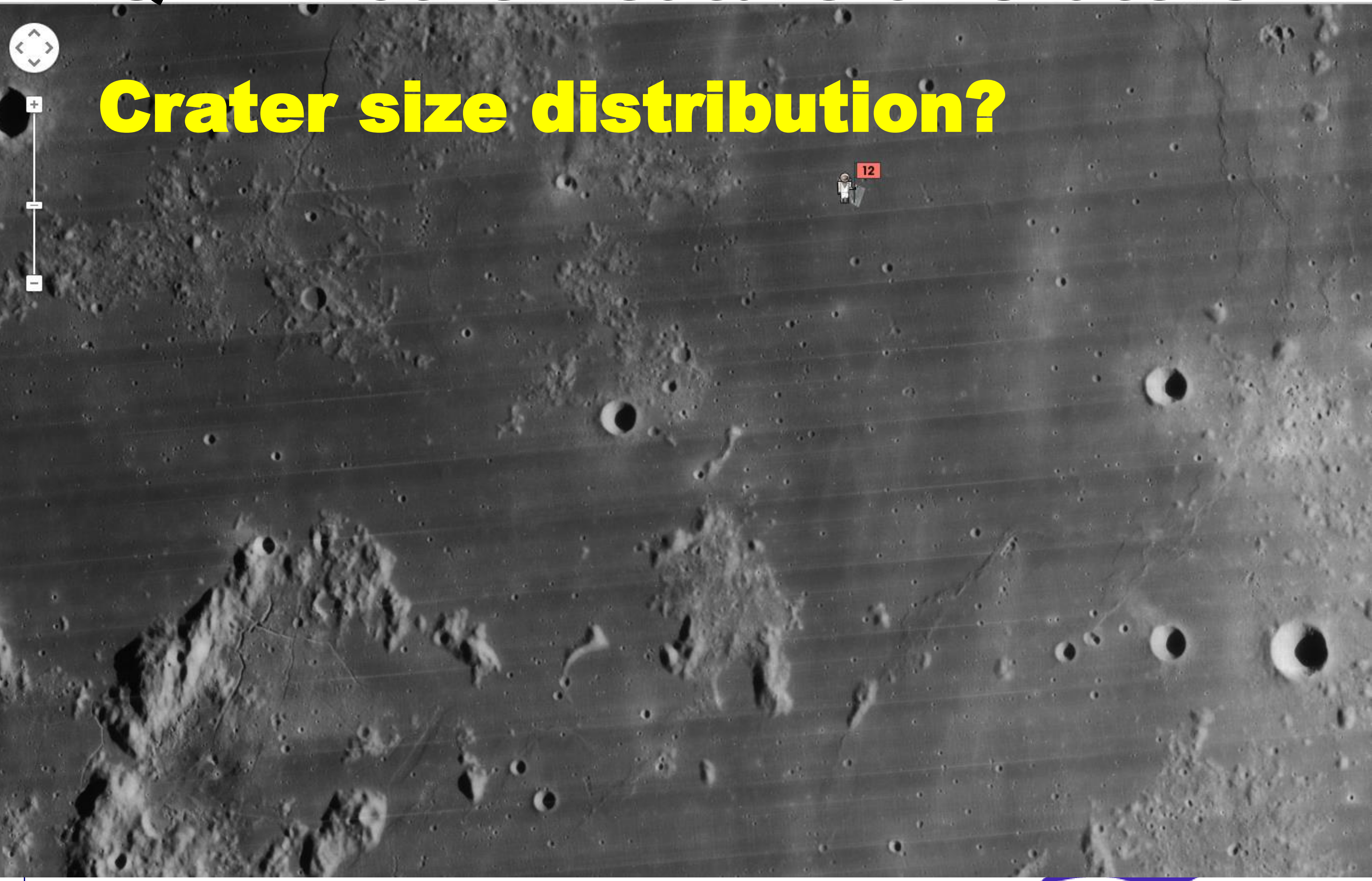
Confirmation of “Crater counts”

After some simplified assumptions, he completed an Isochrones chart for the Moon in 1960’s. From it, he estimated the surface age of “Luna maria” as 3.6 Giga years.“月の海が36億年を示す”

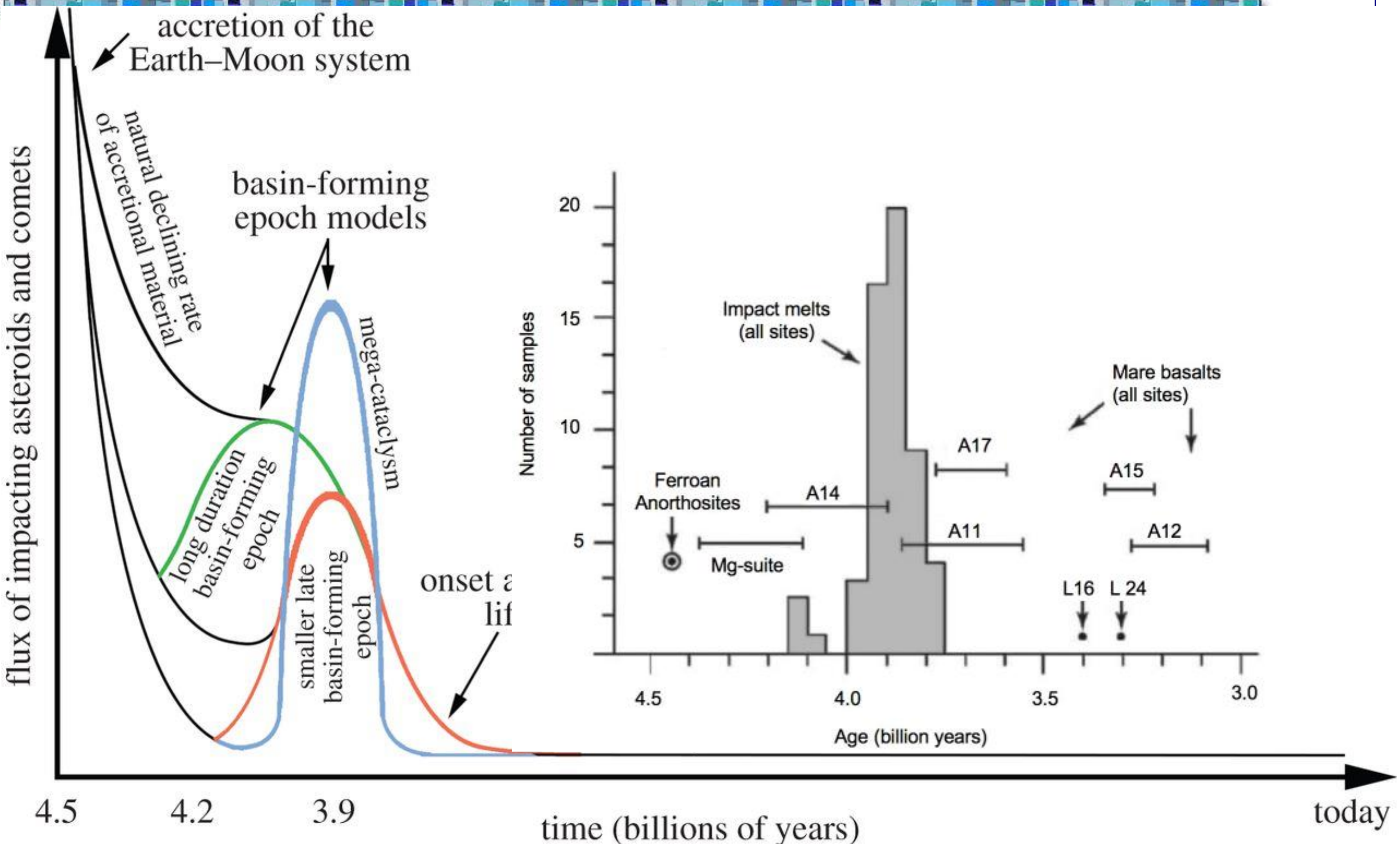
Five years after, the Apollo mission brought back many moon rock samples and confirmed the reliability of this method by measuring the radiometric ages of these rocks.

Q1. Another feature of Craters?

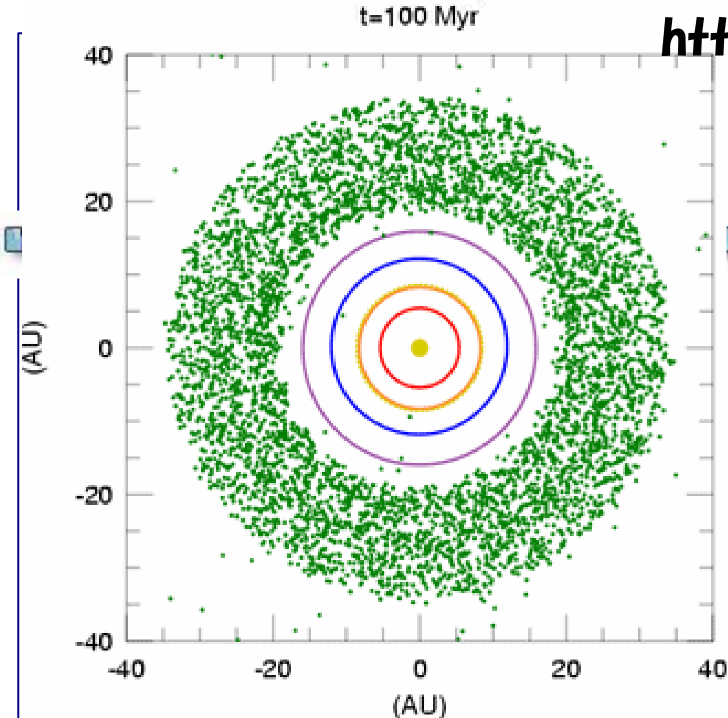
Crater size distribution?



Late Heavy Bombardment part2.



http://rsta.royalsocietypublishing.org/content/372/2024/20130315



(From Gomes, et al., 2005, Nature, v. 435, p. 466-469.)

http://www.psrd.hawaii.edu/Aug06/cataclysmDynamics.html

Simulation : "Nice model"
R. Gomes et.al., Nature2005
A migration of the giant planets

In this dynamical simulation of the late heavy bombardment, the Sun is in the center, the colored circular rings represent the orbits of the four giant planets, and the green dots represent the disk of planetesimals between 15.5 AU and 34 AU.

Each panel represents the state of the planetary system at a different time, starting at t=100 million years. Saturn and Jupiter migrate slowly, reaching 2:1 resonance. This scatters Neptune and Uranus. Their extreme migrations scatter planetesimals in a short time interval--a cataclysm.

The four panels below correspond to four different snapshots taken from the simulations. From left to right: The beginning of planetary migration (100 Myr), just before the beginning of the scattering (879 Myr), just after scattering has started (882 Myr), and 200 Myr later, when only 3% of the initial mass of the disk is left and the planets have achieved their final orbits.

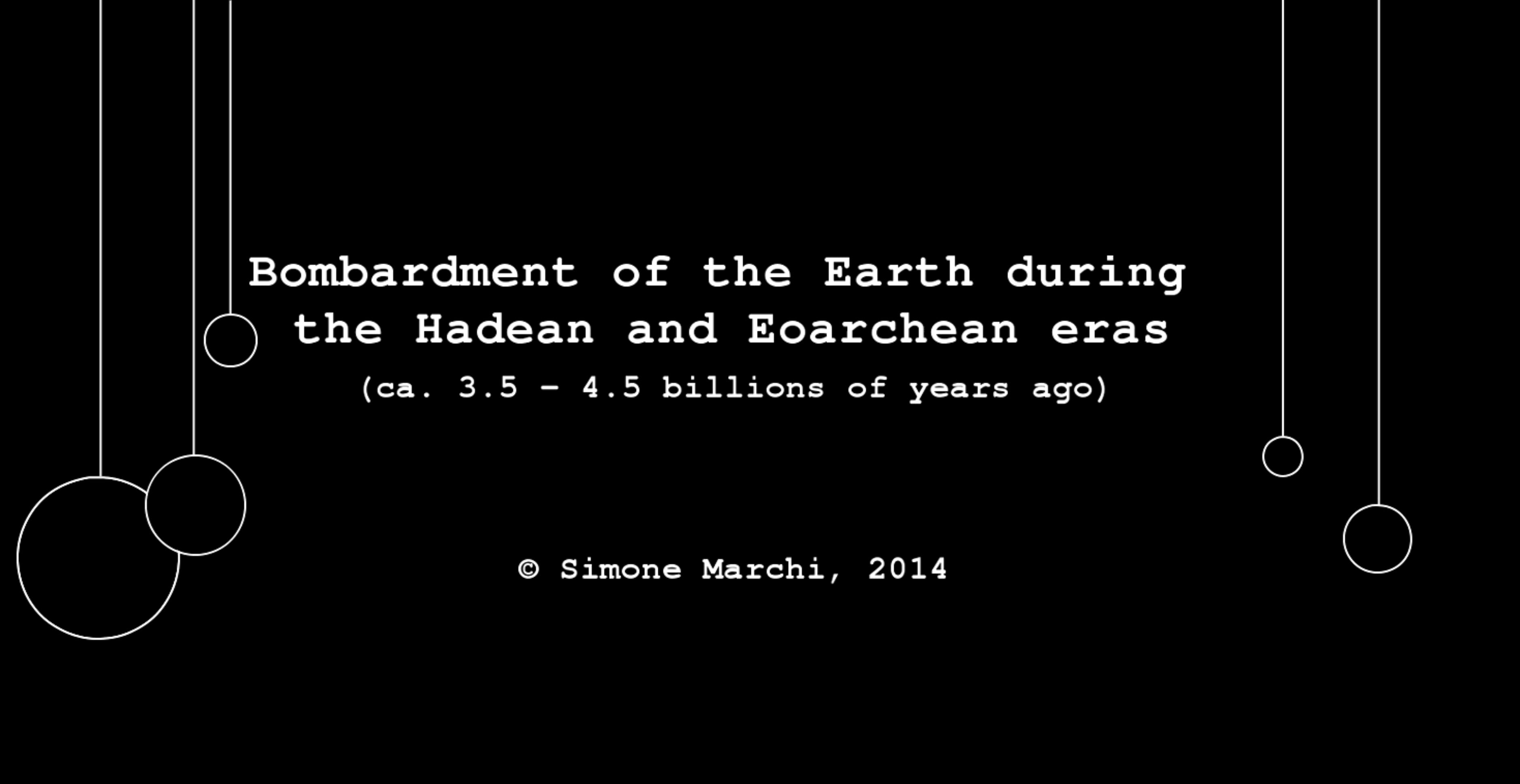
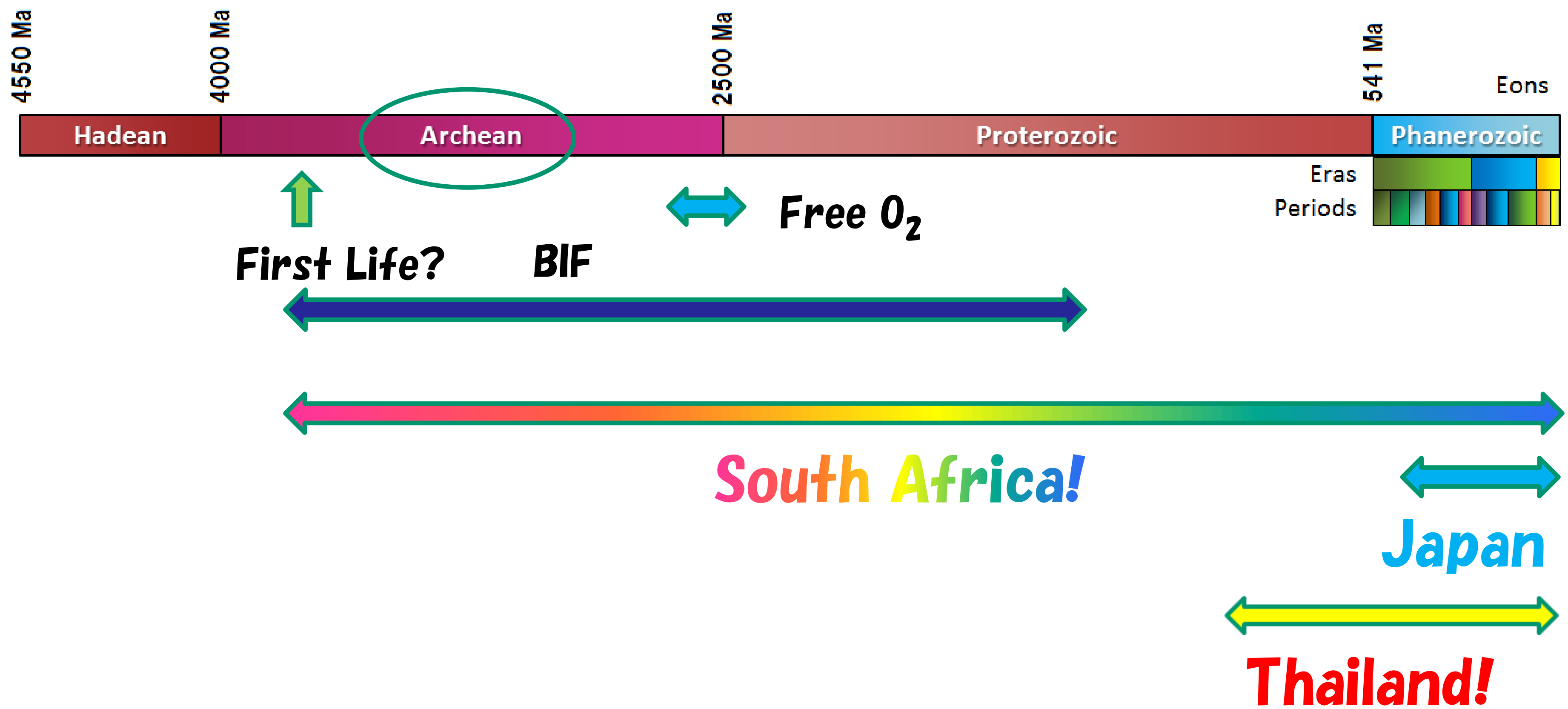


Figure 2. An animation showing the effects of bombardment on the early Earth. Each circle represents the area highly processed by an impact. The diameters of the circles correspond to the final size of the craters for impactors smaller than 100 km in diameter, while for larger impactors it corresponds to the size of the region buried by impact-generated melt, as described in the text. Color coding indicates the timing of the impacts. The smallest impactors considered have a diameter of 15 km.

http://www.boulder.swri.edu/~marchi/

Early Earth (Part 2) Archean eon

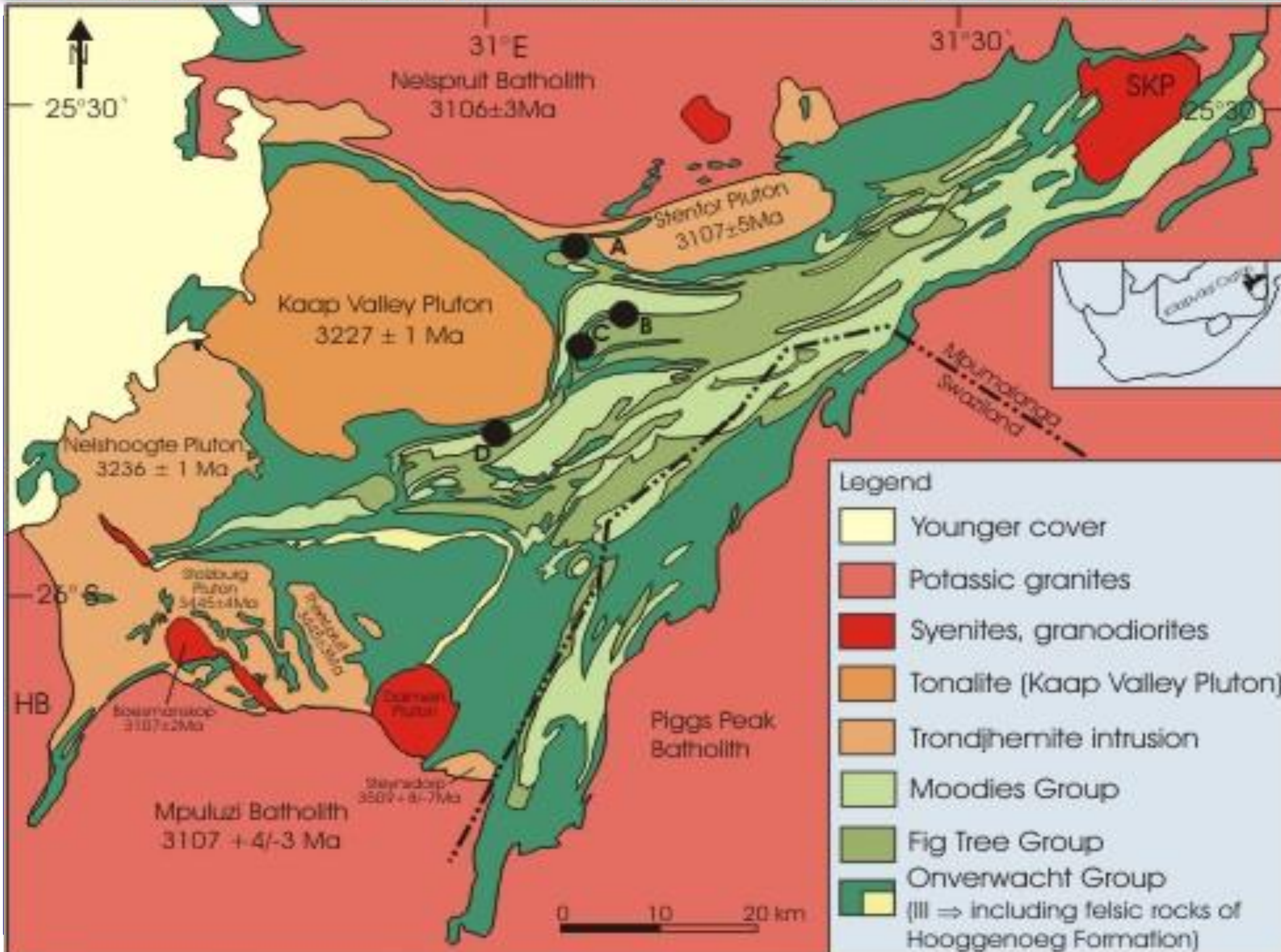


First life? 3.7-3.5 Ga

Banded Iron Formation (BIF) 3.8 to 1.9 Ga

Free Oxygen 2.5-2.4 Ga

Barberton Geological Map



Barberton Field Trip (2010)

Oldest Craton (> 3.6Ga)

Komatiite (Mg20% Ultra Mafic, 3.5Ga)

1600℃ (High Temp. Magma) →Spinifex Texture

Pillow Lava： evidence of Oldest Oceanic Crust

Oldest Sedimentary Rocks bearing no metamorphism (3.4-3.2Ga)

Sand-Mud **Tidal Rythmite**

Chart (**BIF**)

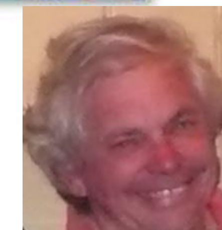
Bio mats (Javaux, Nature 2010)

Spherules of A large Impact (>30Km)

Oldest Gold Ore

Members

Members

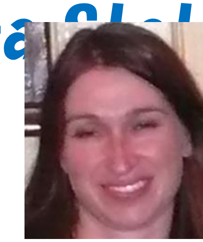


- Dexter Perkins : Professor, Dept. Of Geology and Geological Engineering, Univ. of North Dakota

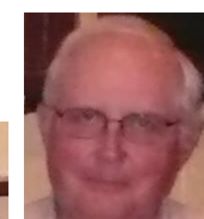
- Cathy Manduca : Director, Science Education Resource Center – Carleton College

- Karl Wirth : Associate Professor, Geology Depa nt Macalester College St. Paul, Minnesota

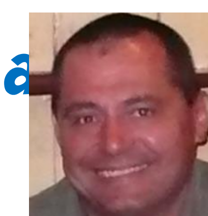
- Donald P. Schwert : Professor of Geology, Center for Science & Mathematics Education, North Dakota e University



- Florence le Hebel : Université Lyon 2



- Jim Nicholls, Retired : Department of Geology a Geophysics, University of Calgary



- Dr.Dion Brandt : Geological Consultant (Driver and lea

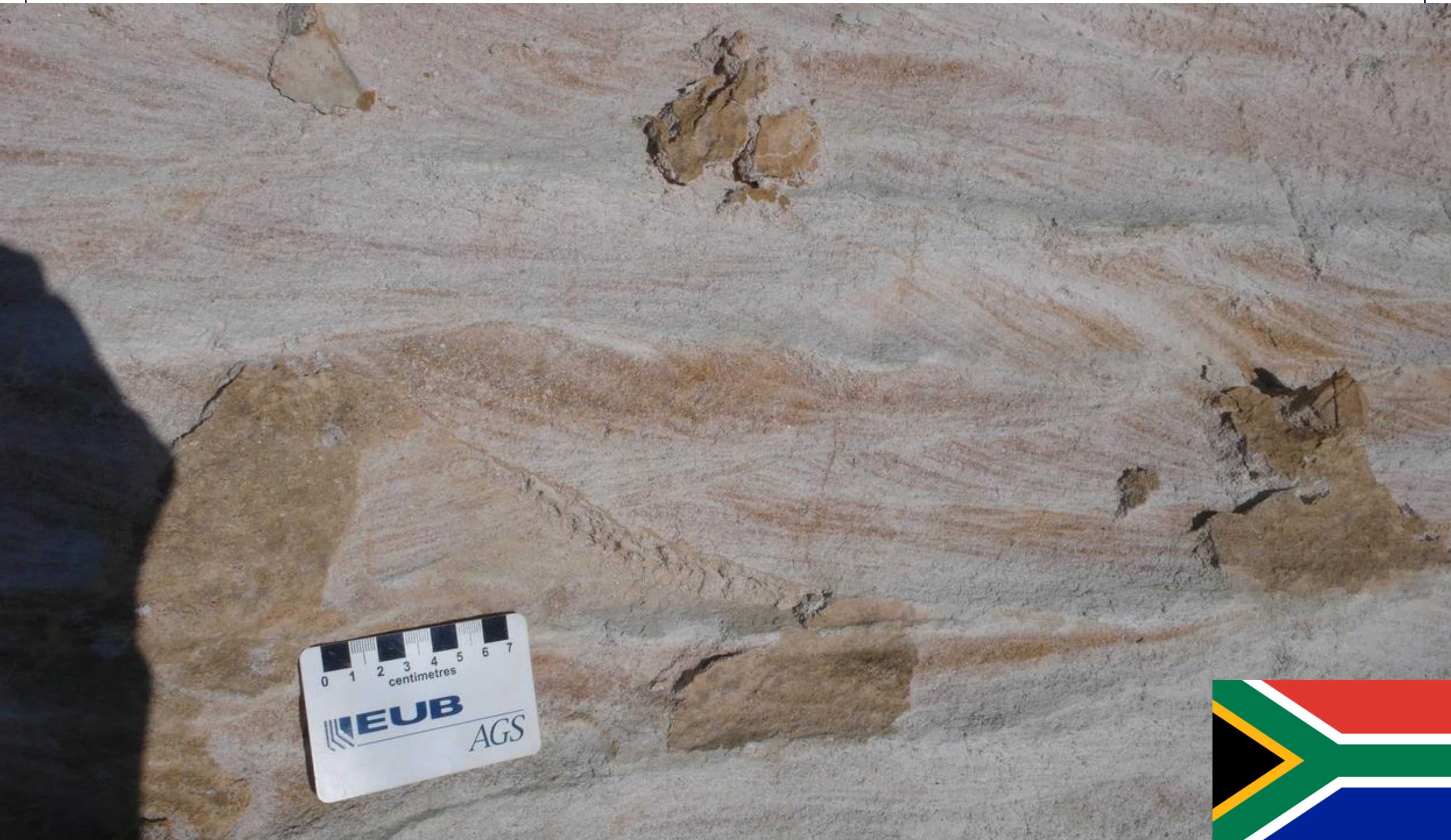
- And Me (USA 4, Canada 1, French 1, SA 1, Japan)

Barberton

Moodies Group (3.2Gy) shallow marine tidal Rhythmites

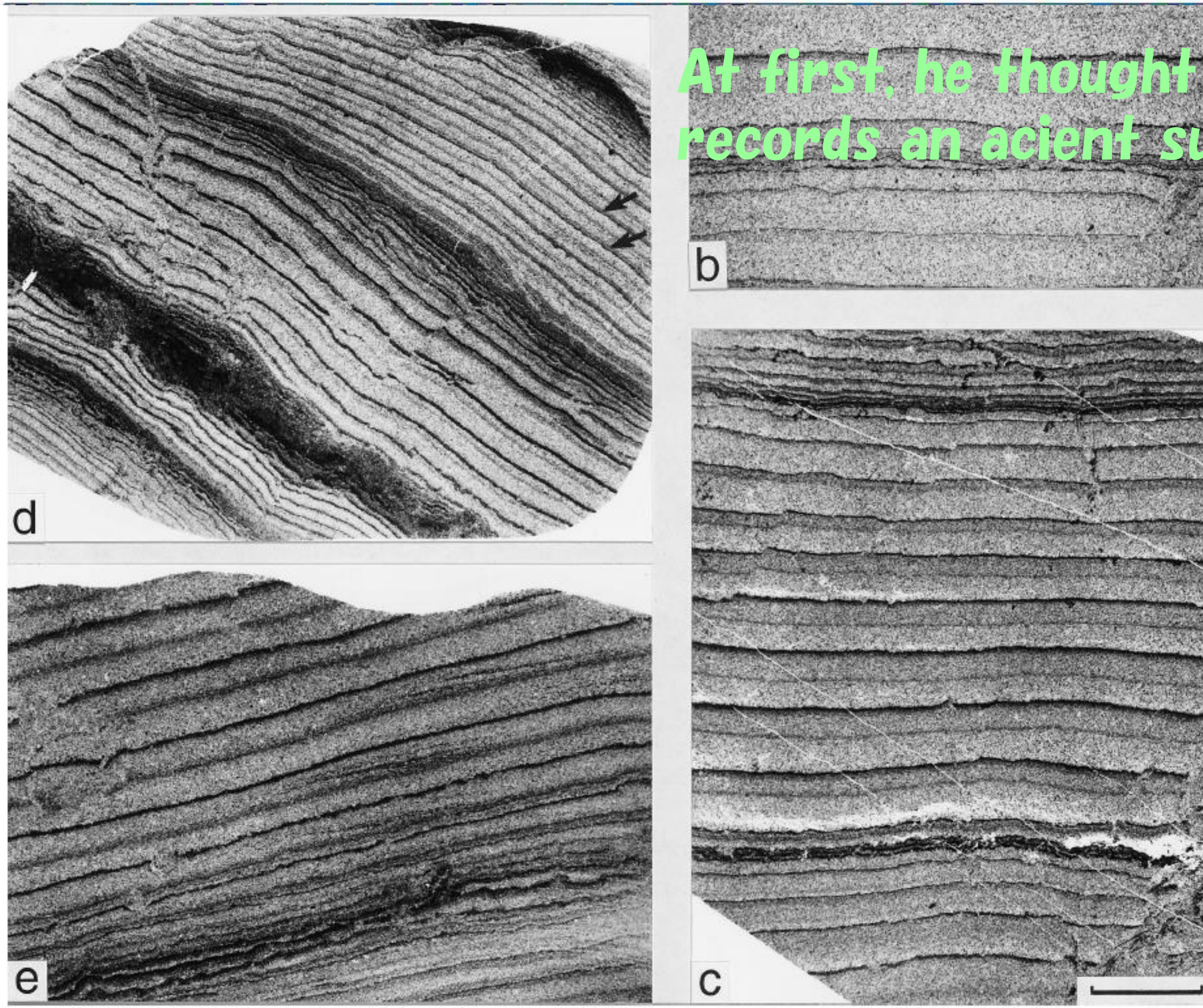
South Africa 2010

At Barberton

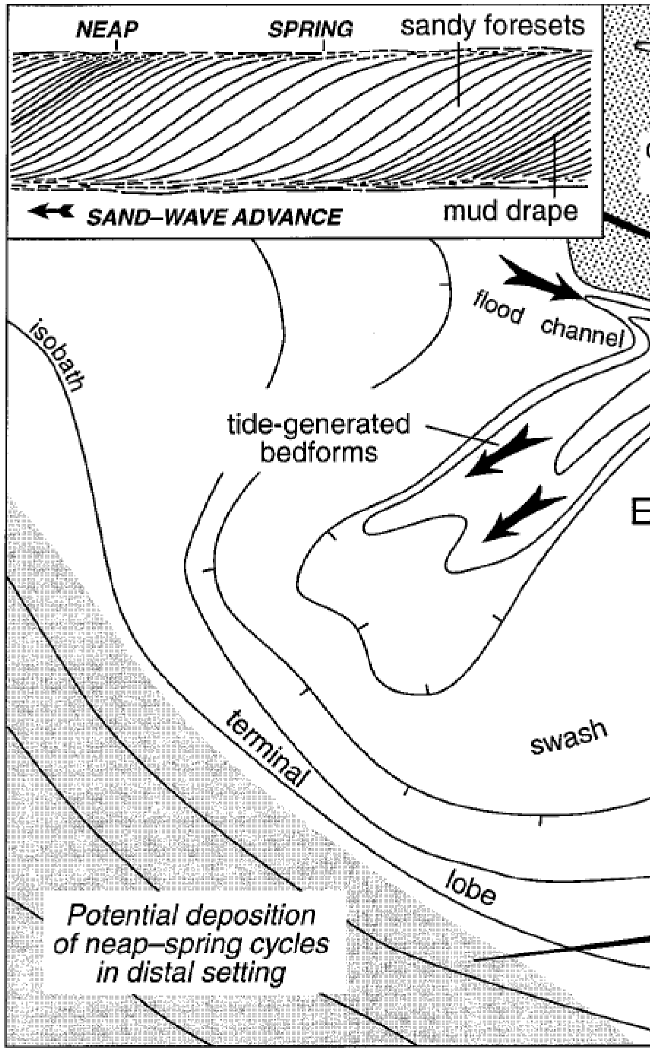


Williams 2000: Australia 0.6Ga

At first, he thought the lamina records an acient sunspot cycle



Williams 2000: Australia 0.6Ga



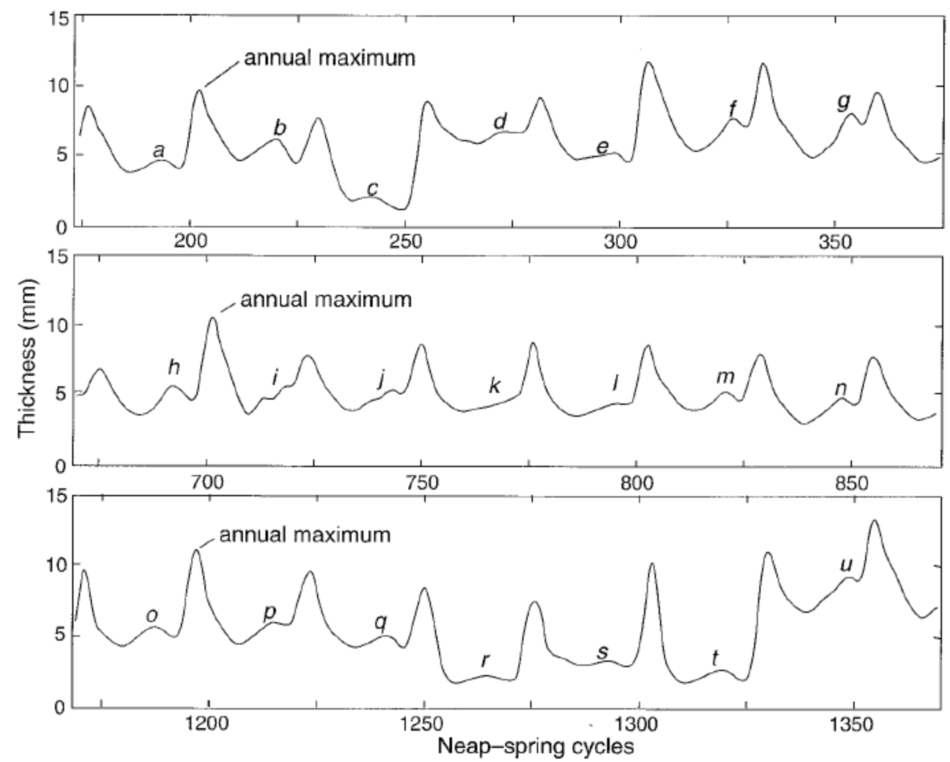


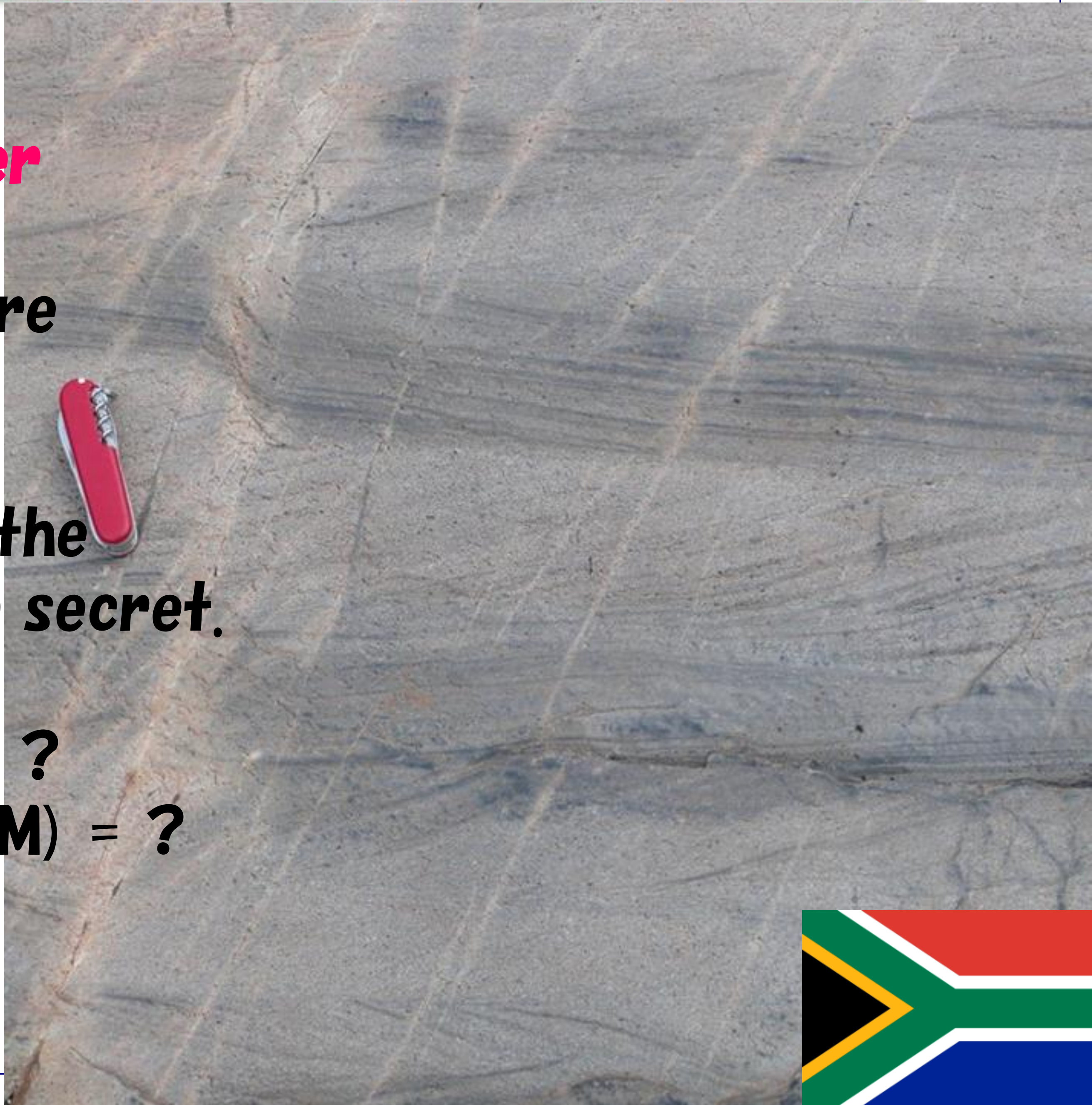
Figure 5. Envisaged environment of deposition for the E
a hypothetical ebb tidal delta adapted from *Imperato et al.* [1
tidal inlet, where fine-grained sediment is entrained by ebb t
via the main ebb channel to deeper water offshore. There tl
cycles of thin, graded laminae mostly of sand and silt (show
the neap-spring cycles become progressively more abbreviat
into marine shelf mud. Where protected from wave acti
deposition and preservation of long rhythmite records. Ti
inset) are confined to proximal, nearshore tidal channels. M
the permission of the International Union of Geological S

Figure 9. Three extracts from the Elatina paleotidal record of neap-spring cycle thickness (smoothed by a five-point filter weighted 1, 4, 6, 4, 1; neap-spring cycle number increases up the stratigraphic succession), showing 24 first-order peaks that are equated with the nontidal annual or seasonal maximum in sea level. The plots span the three intervals where the second-order peaks (peaks a–u), which are interpreted as reflecting the semiannual paleotidal cycle, show minimal height (peaks c–e, j–l, and q–t); the symmetry of the annual peaks tends to be greatest at these places. Over the 60-year record, a period of 19.5 ± 0.5 years is revealed by variation in the height of the semiannual peaks (see Figure 13a), as measured from the base of the preceding trough to the top of the peak or to the midpoint between rare twin peaks (peaks i and j). Neap-spring cycle thickness shows a gradual decrease for cycles 1200–1325 and abrupt increases at cycles 250 and 1325; these nonperiodic changes evidently reflect sedimentary processes on the tidal delta such as a gradual blocking of the main ebb channel followed by channel avulsion.

Verify the Giant Impact Theory

In the Archean eon, Moon was more closer to earth.
So, these periods were shorter than today.
How to examine?
The tidal records in the sediments reveal the secret.

length of day (LOD)= ?
Length of month (LOM) = ?



Moodies Group(3.2Gy)Analysis of tidal rhythmites

1) Rapid moon rotation: 18days

2) Unknown: length of day and month

3) Circular orbit of Moon

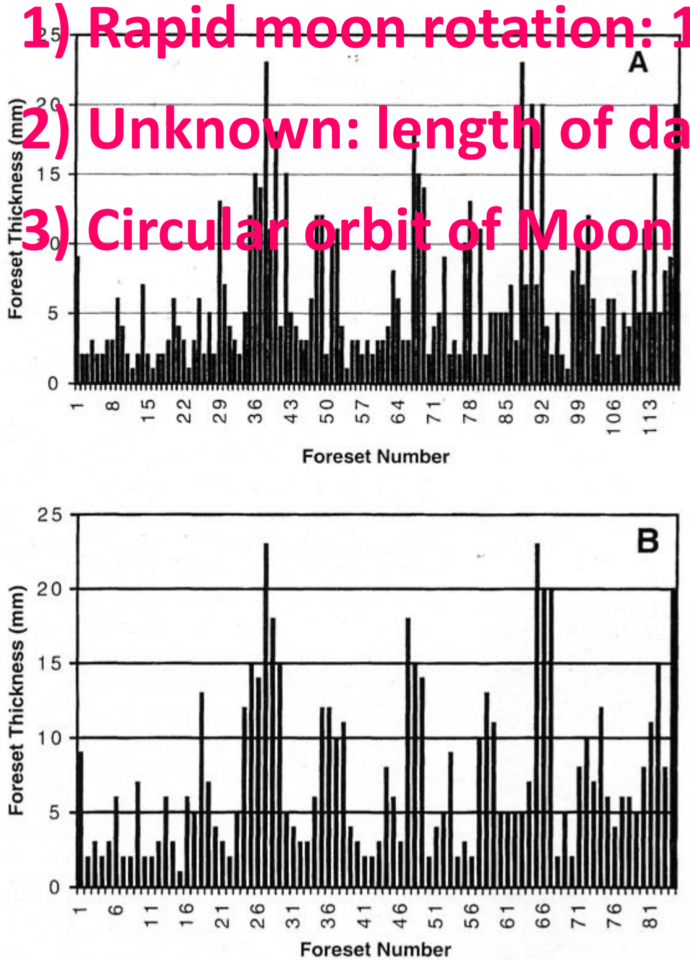


Figure 3. A: Traverse 2—all data. Histogram of sandstone foreset bundle thicknesses plotted against foreset number for traverse two through cross-bed set shown in Figure 2. Note variation in thickness of sandstone foresets and common presence of thick-thin pairs of foresets. B: Traverse 2—subordinates removed. Histogram of inferred dominant-tide foreset bundle thicknesses plotted against foreset number for traverse two through cross-bed set shown in Figure 2. Inferred subordinate flood-tide laminations were removed visually from data sets. Note that interpreted neap-spring-neap cycles are 9–10 days long and that alternate neap-spring-neap cycles are thicker and thinner, respectively.

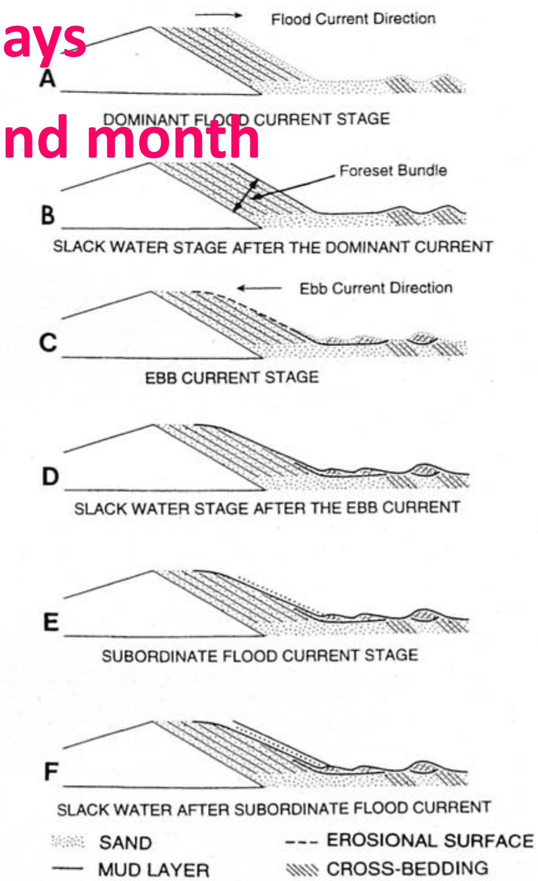


Figure 4. Migration of sand wave in tidal system characterized by strong flood current and weak ebb current (modified after Visser, 1980). Note that most sand is deposited on lee face of sand wave during dominant flood stage (A), whereas only thin sand layer is deposited on lee face during subordinate flood stage (E). Dominant and subordinate flood currents are typical of semidiurnal tidal systems. During ebb stage, sand deposition takes place only in trough of sand wave and is preserved in form of intrasets within toesets of cross-bed set (C). During stillstand associated with turning of tide, clay accumulates on lee face and within trough of sand wave and is preserved as mudstone drapes (B, D, F).

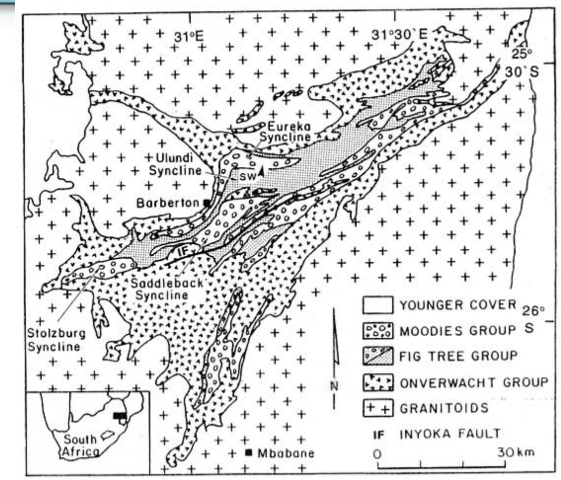
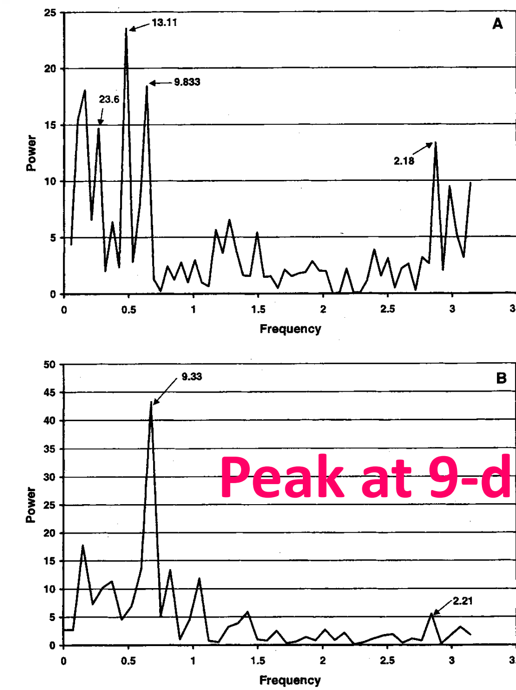


Figure 1. Simplified geological map of Barberton Greenstone Belt. Heavy arrowhead indicates location of sand-wave (sw) in Eureka syncline.

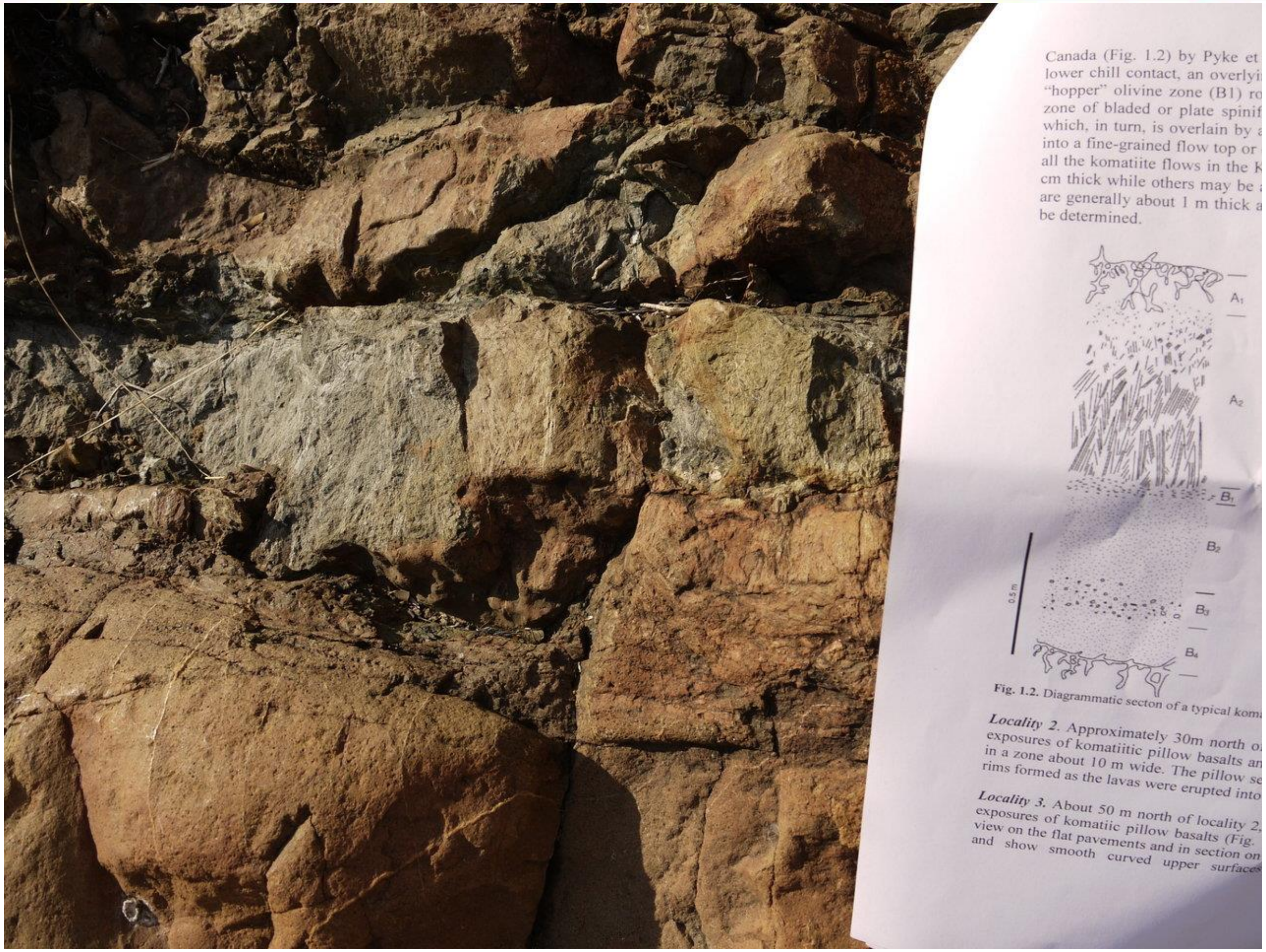


Peak at 9-days

Figure 5. A: Traverse two—all data. Power spectral plot of foreset bundle thicknesses measured along traverse two (see Fig. 3A). B: Traverse two—subordinates removed. Power spectral plots of dominant flood-tide foreset bundle thicknesses along traverse two (see Fig. 3B).

After Eriksson,2000

Komatiite: A first oceanic crust from a hot mantle!

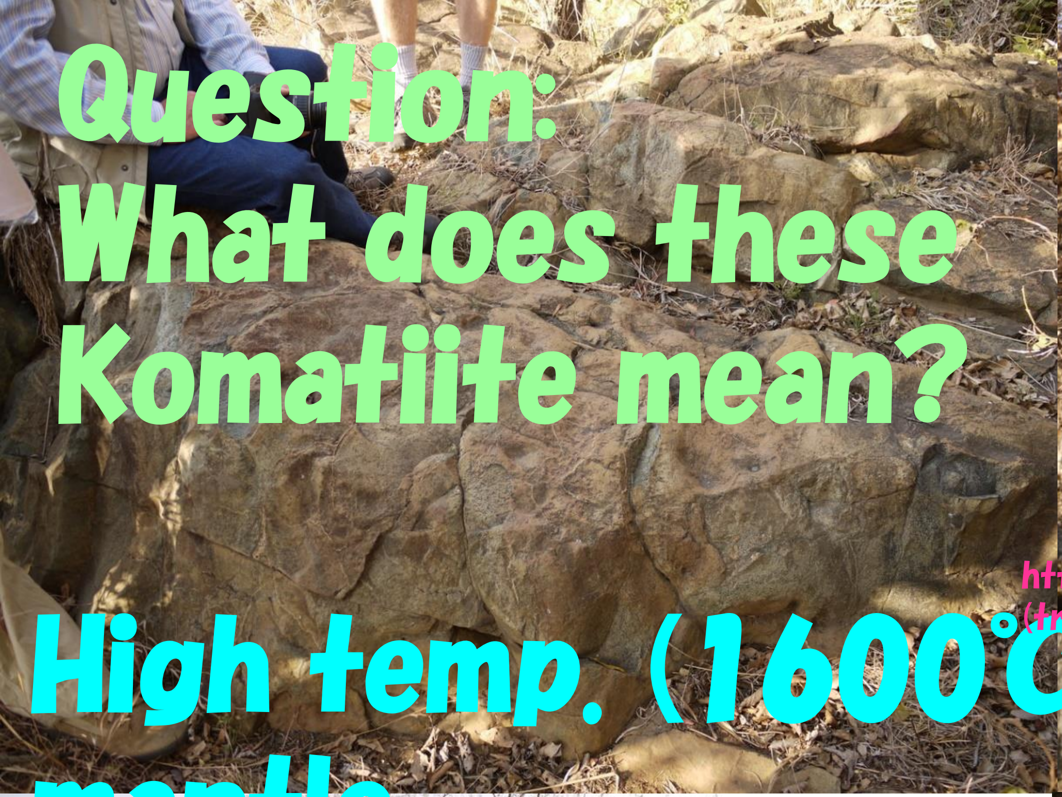


Dyke and Komati River


Komatiite!! Please see my sample!
EUB
AGS
centimetres
2 3 4 5 6 7
EUB

Komatiitc basalt: Pillow Lava

Question:
What does these Komatiite mean?



http://aginnovators.org.au/sites/default/files/Spinifex (triodia) grass in NT

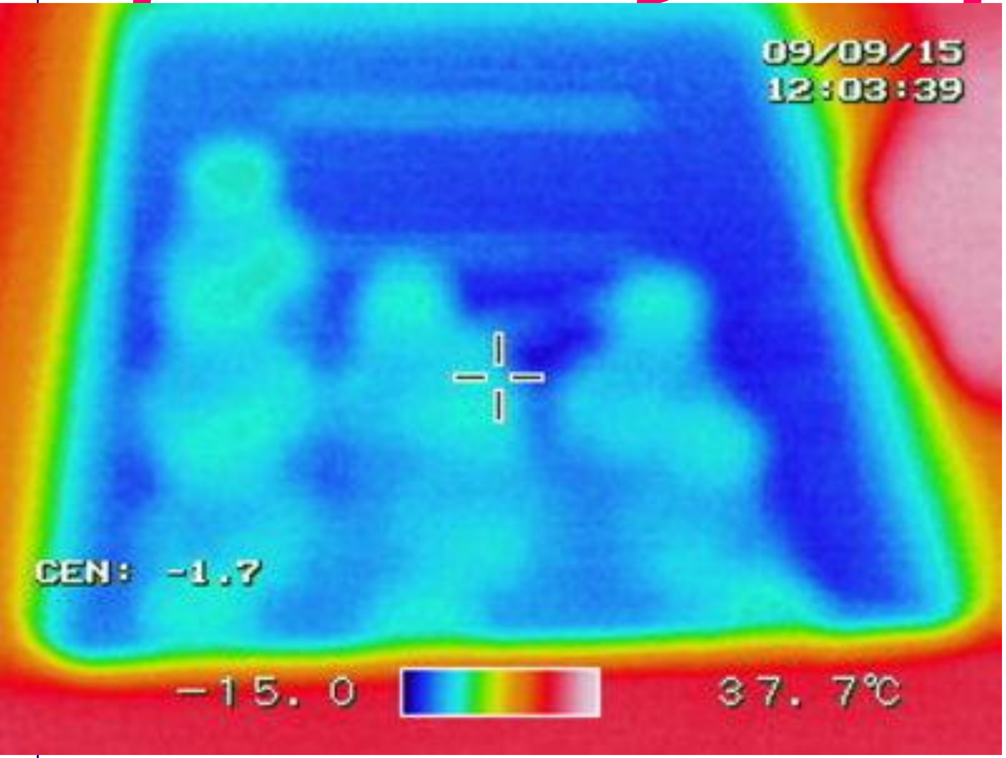
High temp. (1600℃) of early mantle

Super Cooling: Spinifex texture

First Oceanic Crust!

High temp. (1600℃) of early mantle

Super cooling -> Spinifex texture



Special thanks to
Prof. Konishi
(Osaka Kyoiku University)

After LHB a large impact still recorded on South Africa

LETTER

doi:10.1038/nature10982

Impact spherules as a record of an ancient heavy bombardment of Earth

B. C. Johnson[1] & H. J. Melosh[1,2]

Nature 2012

Impact craters are the most obvious indication of asteroid impacts, but craters on Earth are quickly obscured or destroyed by surface weathering and tectonic processes[1]. Earth's impact history is inferred therefore either from estimates of the present-day impactor flux as determined by observations of near-Earth asteroids, or from the Moon's incomplete impact chronology[2–4]. Asteroids hitting Earth typically vaporize a mass of target rock comparable to the projectile's mass. As this vapour expands in a large plume or fireball, it cools and condenses into molten droplets called spherules[5]. For asteroids larger than about ten kilometres in diameter, these spherules are deposited in a global layer. Spherule layers preserved in the geologic record accordingly provide information about an impact even when the source crater cannot be found[1]. Here we report estimates of the sizes and impact velocities of the asteroids [illegible]at cre[illegible]ed global sphe[illegible]ule [illegible]ayers. Th[illegible] impact chronolo[illegible] [illegible] [illegible]at the im[illegible] flux [illegible] sign[illegible]ly higher 3.5 billion years ago than it is n[illegible]w. This conclusio[illegible] co[illegible]sistent with a gradual decline of the impactor flux after the Late [illegible] Bombardme[illegible]

[illegible] have been [illegible] the pr[illegible]ss of spherule formation in the hope that the properties of an impacting body could b[illegible] determined from ob[illegible]vations of th[illegible] [illegible]sulting [illegible] laye[illegible] These [illegible]

locations. In the Supplementary Information, we derive an equation that relates impactor size to spherule layer thickness:

$$D_{\mathrm{imp}} = 17(t_r/\xi)^{(1/3)} \quad (1)$$

where D_{imp} is the impactor diameter in kilometres and ξ is an efficiency factor that conservatively ranges from 0.5 to 2 for typical asteroidal impact velocities on Earth. Additionally, t_r is the layer's reduced thickness in centimetres, defined as $t_r = 2f_{sp}t$ where t is the measured layer thickness and f_{sp} is the volume fraction of spherules in the layer.

We test the accuracy of equation (1) by comparing the impactor size estimated using spherule layer thickness with the impactor size determined by other methods. The Cretaceous–Palaeogene boundary layer is found at numerous sites globally and has a thickness of around 3 mm [illegible] consists of about half spherules by volume[9] [illegible] the entire range [illegible] nd D [illegible] 9.0 [illegible] is cons[illegible] the size of the Chicxulub impactor (10 ± 4 km) as determined by iridium fluence and similar estimates from the size of the Chicxulub impact structure[10,11]. Our impactor size estimates for two other spherule layers, S2 and S3 (Table 1), are also consistent with the estimate, 3–7 times larger than the Chicxulub impactor, which is also based on total iridium fluence[12].

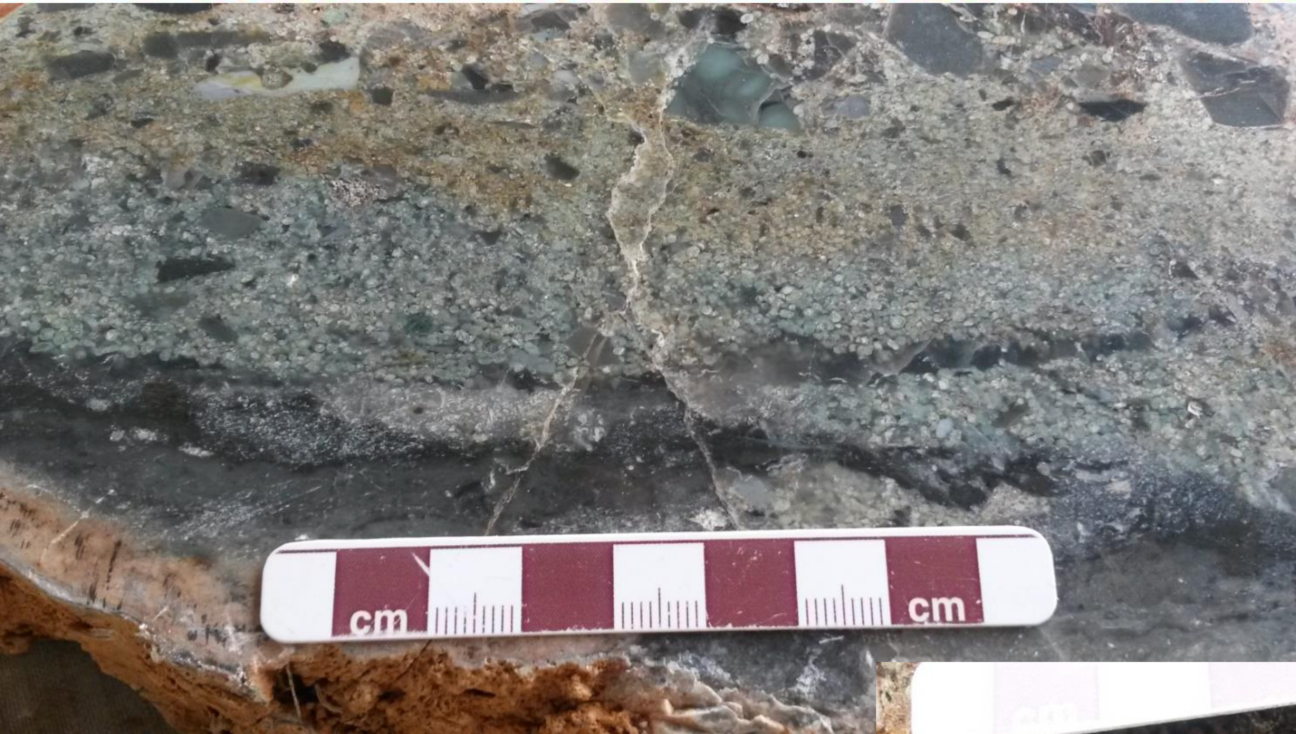
The estimat[illegible] of i[illegible] sizes [illegible] equati[illegible] (1) ar[illegible] only valid if th[illegible] [illegible] of the global

Asteroid ϕ ~ 50km: crater size ~ 400km

Hit a continent

(now South Africa and Australia)

A Spherule sample at Barberton, South Africa (3.5-3.2Ga)



Pictures by Tony Ferrar
Dr. Dion' s friend
He sent me these pictures.

.Sample from Fig Tree G (3.4 Ga
Barberton)

First life? Famous Schopf's paper 1993

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THE UNIVERSITY OF
WESTERN
AUSTRALIA

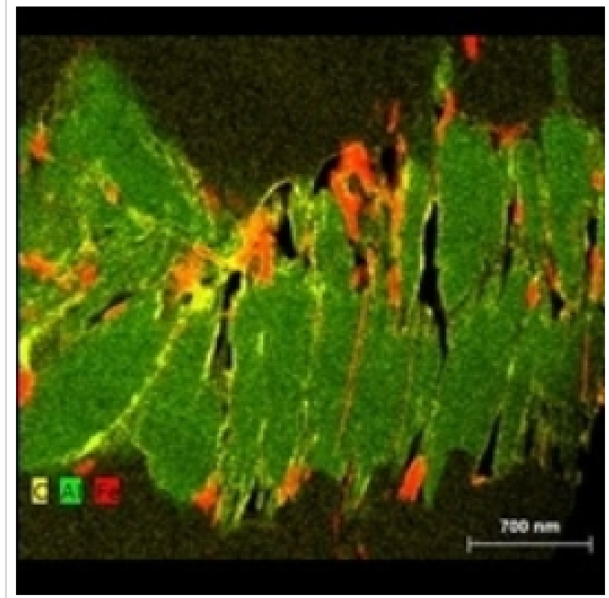
University News

Oldest fossils controversy resolved

Monday, 20 April 2015

New analysis of world-famous 3.46 billion-year-old rocks by researchers from The University of Western Australia is set to finally resolve a long-running evolutionary controversy.

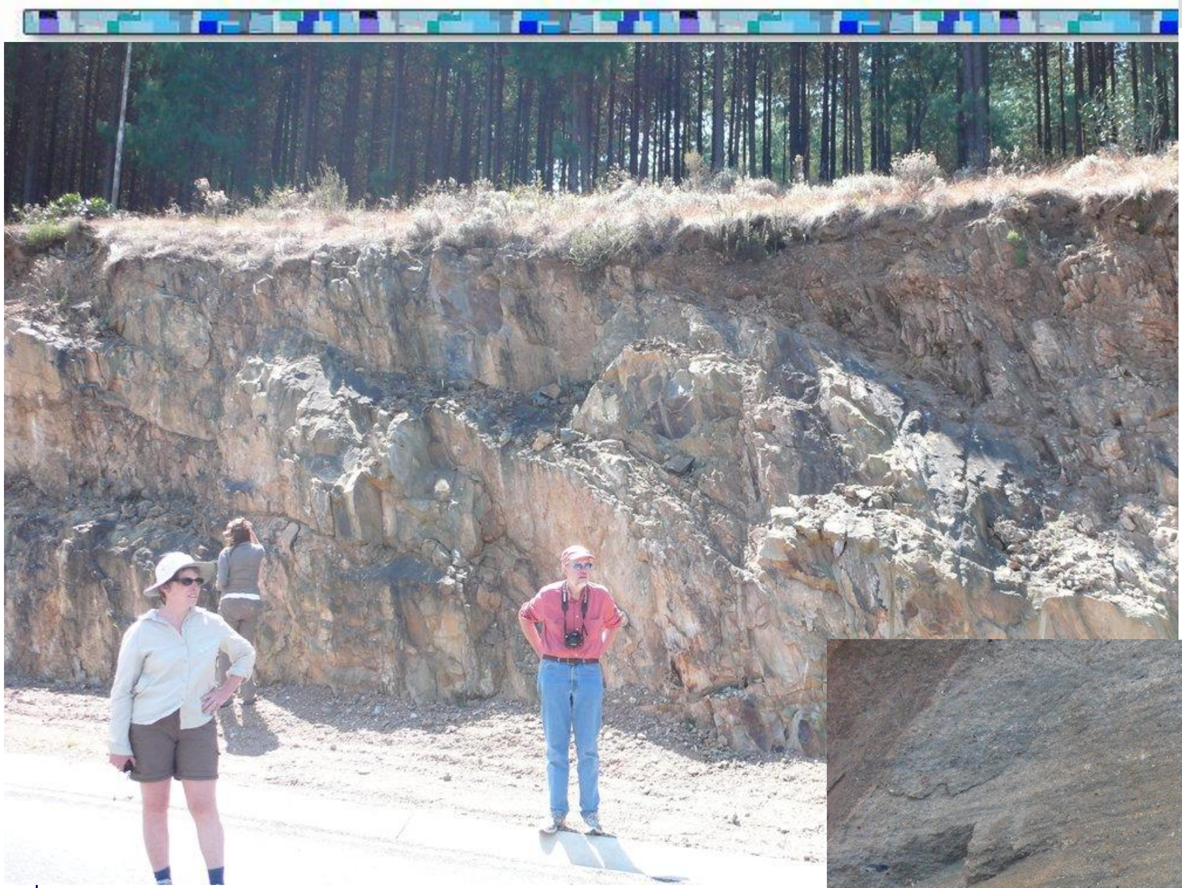
The new research, published this week in *Proceedings of the National Academy of Sciences USA*, shows that structures once thought to be Earth's oldest microfossils do not compare with younger fossil candidates but have, instead, the character of peculiarly shaped minerals.

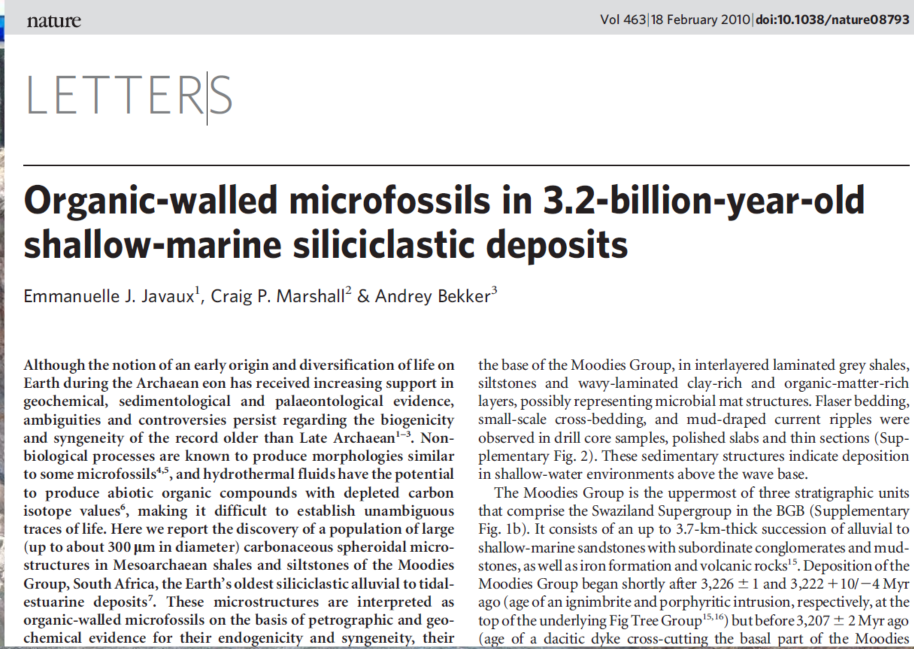


In 1993, US scientist Bill Schopf described tiny (c. 0.5-20 micrometres wide), carbon-rich filaments within the 3.46 billion-year-old Apex chert from the Pilbara region of Western Australia, which he likened to certain forms of bacteria, including cyanobacteria. (Chert is fine-grained, silica-rich sedimentary rock.)

These 'Apex chert microfossils' soon became enshrined in textbooks, museums displays, popular science books and online reference guides as the earliest evidence for life on Earth. In 1996, these structures were even used to test and help refute the case against 'microfossils' in the Martian meteorite ALH 84001.

A Bio-mat sample at Barberton, South Africa (3.2 Ga)




nature Vol 463 | 18 February 2010 | doi:10.1038/nature08793

LETTERS

Organic-walled microfossils in 3.2-billion-year-old shallow-marine siliciclastic deposits

Emmanuelle J. Javaux[1], Craig P. Marshall[2] & Andrey Bekker[3]

Although the notion of an early origin and diversification of life on Earth during the Archaean eon has received increasing support in geochemical, sedimentological and palaeontological evidence, ambiguities and controversies persist regarding the biogenicity and syngeneity of the record older than Late Archaean[1–3]. Non-biological processes are known to produce morphologies similar to some microfossils[4,5], and hydrothermal fluids have the potential to produce abiotic organic compounds with depleted carbon isotope values[6], making it difficult to establish unambiguous traces of life. Here we report the discovery of a population of large (up to about 300 μm in diameter) carbonaceous spheroidal microstructures in Mesoarchaean shales and siltstones of the Moodies Group, South Africa, the Earth's oldest siliciclastic alluvial to tidal-estuarine deposits[7]. These microstructures are interpreted as organic-walled microfossils on the basis of petrographic and geochemical evidence for their endogenicity and syngeneity, their

the base of the Moodies Group, in interlayered laminated grey shales, siltstones and wavy-laminated clay-rich and organic-matter-rich layers, possibly representing microbial mat structures. Flaser bedding, small-scale cross-bedding, and mud-draped current ripples were observed in drill core samples, polished slabs and thin sections (Supplementary Fig. 2). These sedimentary structures indicate deposition in shallow-water environments above the wave base.

The Moodies Group is the uppermost of three stratigraphic units that comprise the Swaziland Supergroup in the BGB (Supplementary Fig. 1b). It consists of an up to 3.7-km-thick succession of alluvial to shallow-marine sandstones with subordinate conglomerates and mudstones, as well as iron formation and volcanic rocks[15]. Deposition of the Moodies Group began shortly after 3,226 ± 1 and 3,222 +10/−4 Myr ago (age of an ignimbrite and porphyritic intrusion, respectively, at the top of the underlying Fig Tree Group[15,16]) but before 3,207 ± 2 Myr ago (age of a dacitic dyke cross-cutting the basal part of the Moodies

Javaux et. al., Nature 2010

Banded iron Formation(Sample)

Oxygen in the Ocean
Photo-synthesis by Cyanobacteria

Coffee Brake, at the Kruger national park, South Africa

Coffee Brake, at the Kruger national park, South Africa

One scene, at the Kruger national park, South Africa

- We enjoyed the game drive in the Kruger National Park
- Our driver opened the both side doors to view and made us to take picture easily---.
- Unfortunately we came across a patrol car, we got stopped.
- Two young black police men walked to our car, One police man said to our driver Dr. Dion, " You commit a traffic violation. The rule prohibit driving car with the door open. Opening the door is very dangerous. Because the wild animals running into the car! ".
- Then we all asked to the police "Please forgive our violation. Could you just let him off this one time?"
- Of course their answer was "NO!" . Our driver had ticketed.
- However, at that time I was deeply moved this scenery! -----.

Question:
Why was I deeply moved at that time?

Questions

What does the Komatiite mean?

At the Kruger N.P: Why was I deeply moved?

At the platinum mine: Why Is Japan the most important country as a customer?

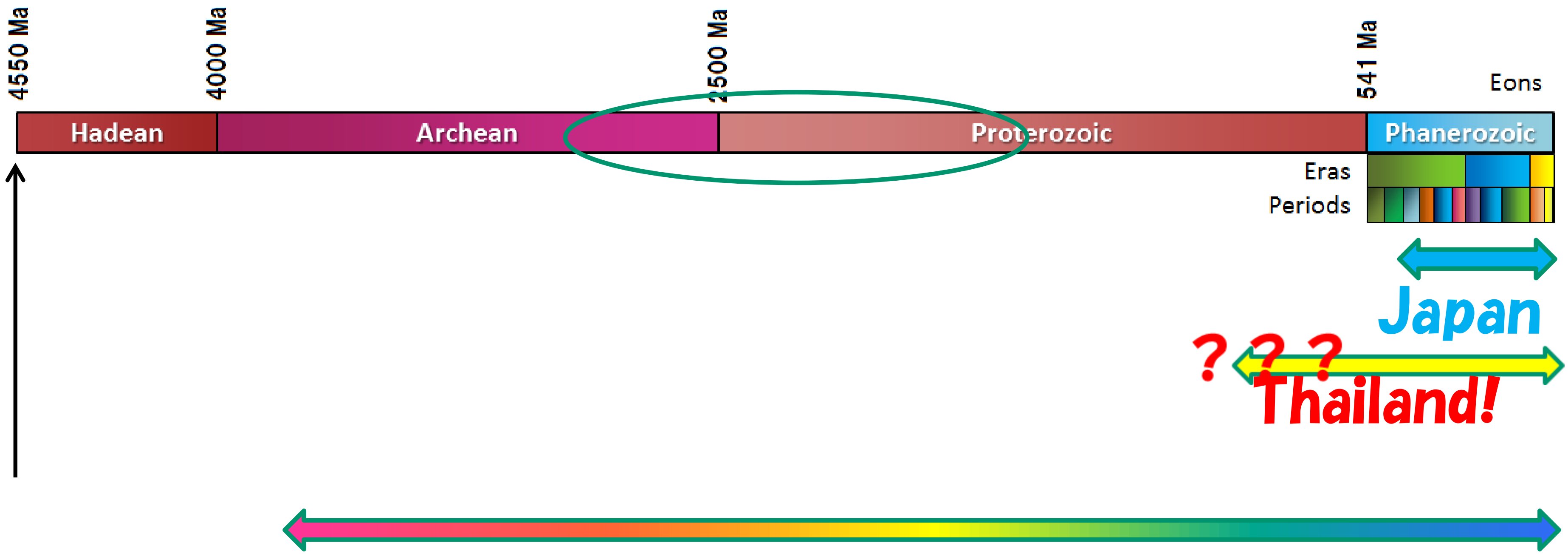
Why are chromium layers so large and extended?

At the Gold mine: Why does the gold ore include pyrite(fool's gold).

At the Impact Crate: At first how was the crater formed?

Why do I show this photo?

Early Earth (Part 3) Archean to Proterozoic



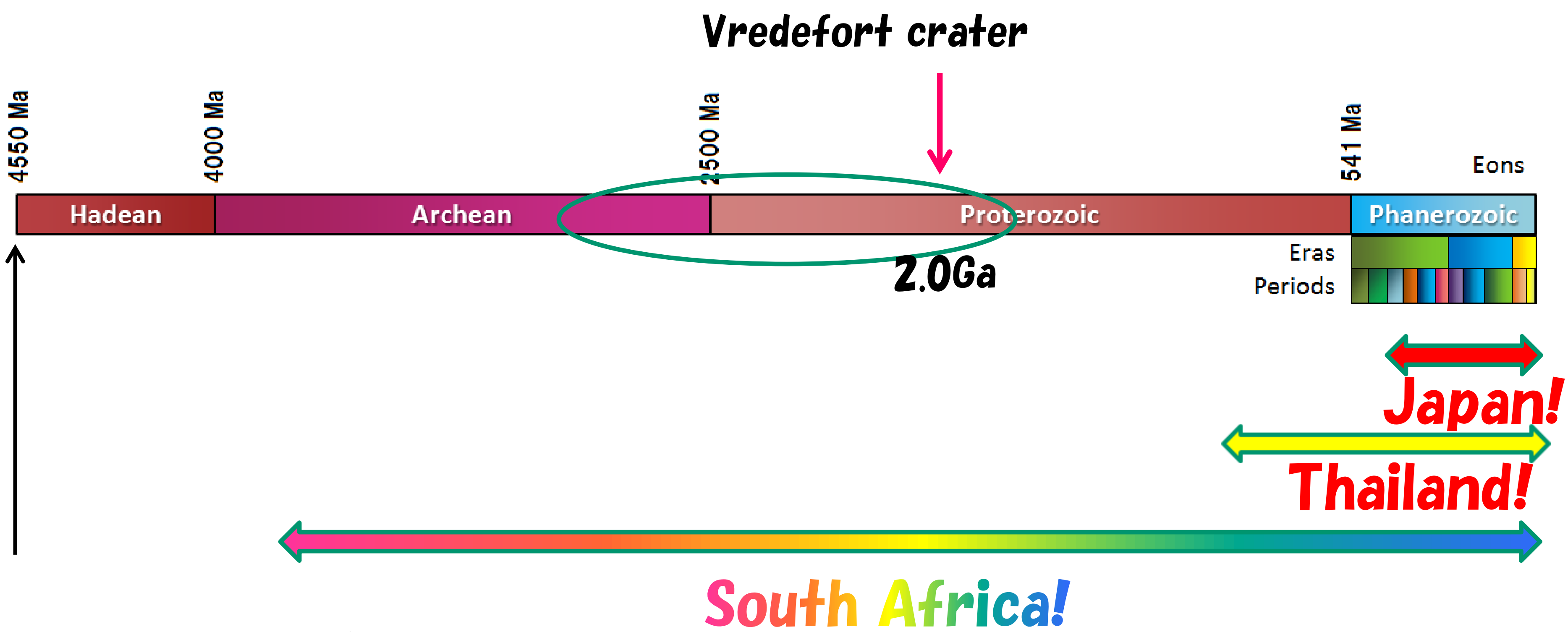
Gold deposit 3.0Ga South Africa!

Chromium and Platinum: Bushveld Intrusion 4.5Ga

Diamond 4.4-4.0 Ga

Coal 0.35 Ga

Early Earth (Part 3) Archean to Proterozoic



Gold deposit 3.0Ga

Chromium and Platinum: Bushveld Igneous Complex (BIC) 2.0Ga

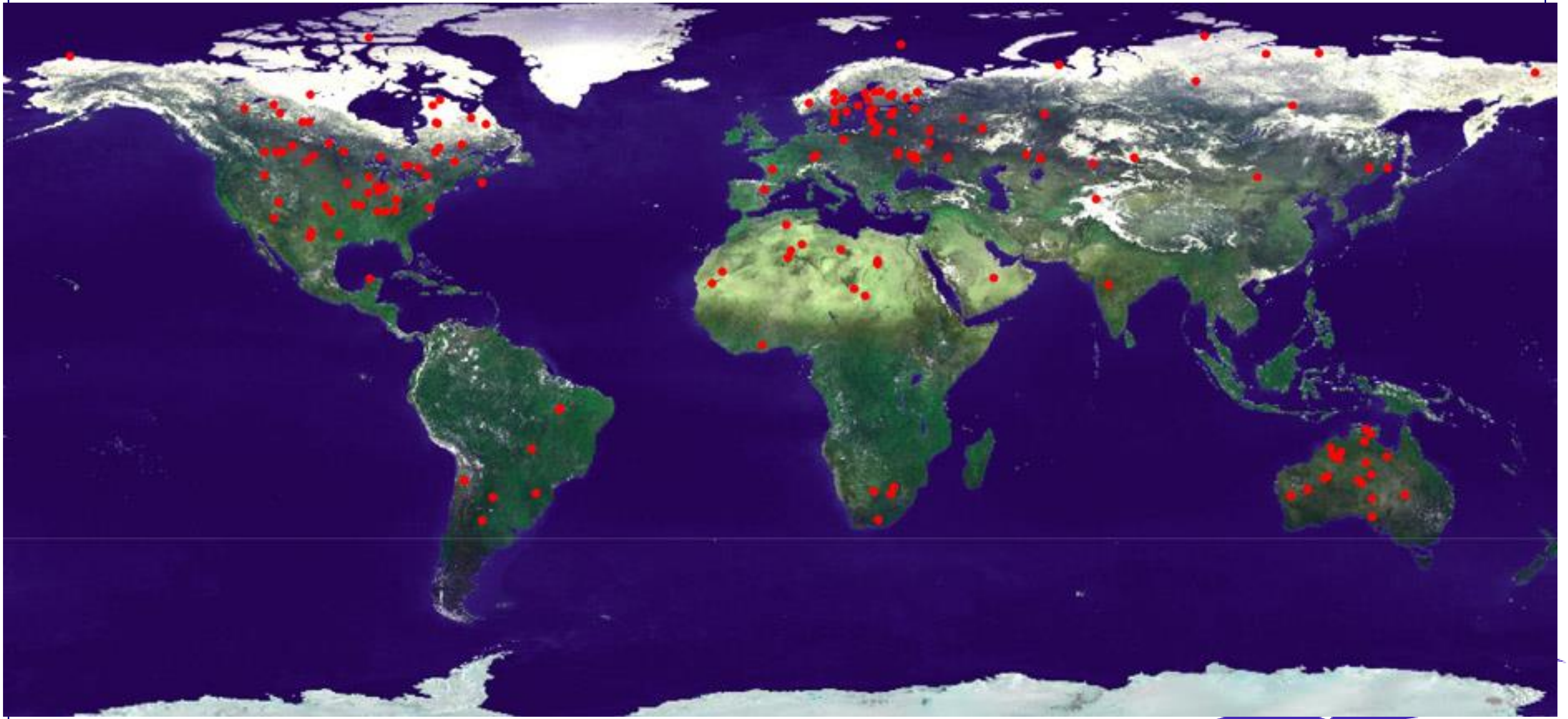
Vredefort impact crater 2.0Ga

Diamond Kimberlite 1.2-0.1 Ga

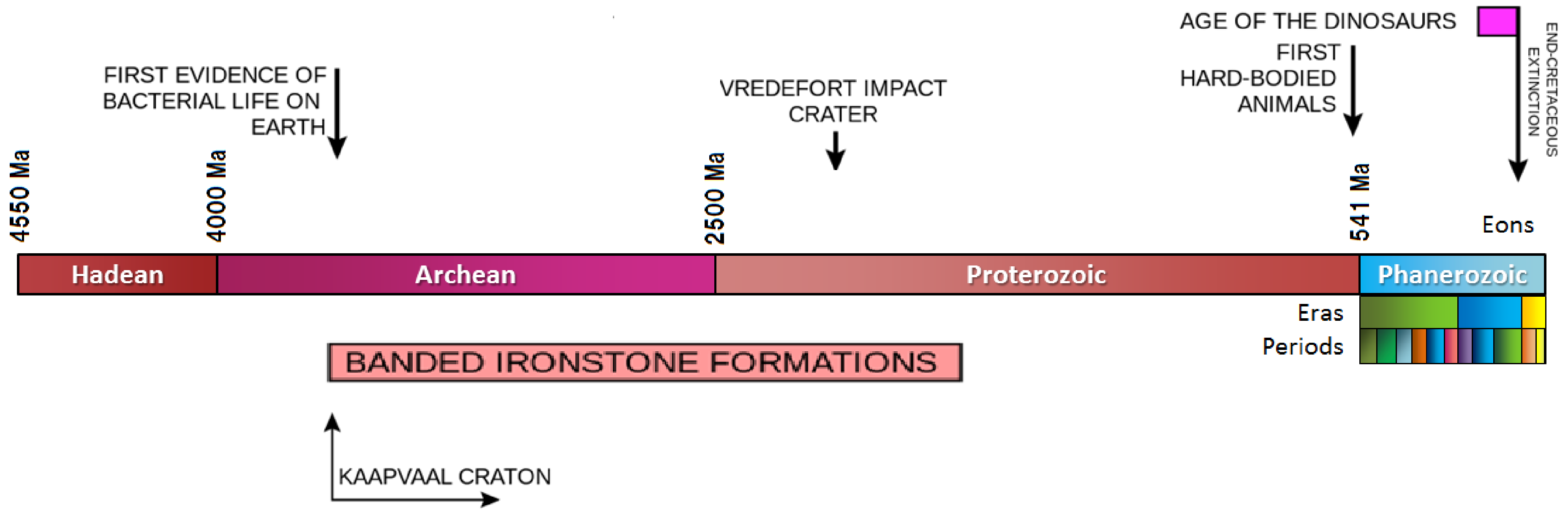
(Coal 0.25 Ga)

Impact Crater and Ore Deposits

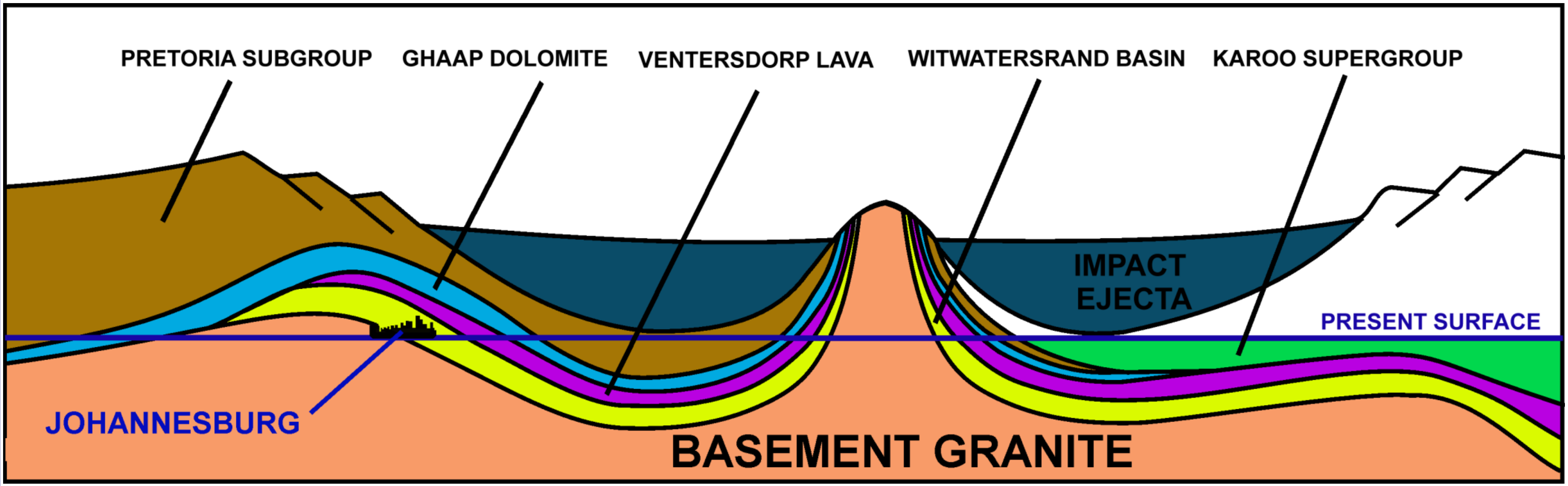
http://www.lpi.usra.edu/science/kring/epo_web/impact_cratering/World_Craters_web/worldcraters_maps.jpg



From wiki



A timeline of the earth's history indicating when the Vredefort crater was formed in relation to some of the other important South African geological events. W indicates when the Witwatersrand Supergroup was laid down, C the Cape Supergroup, and K the Karoo Supergroup. The graph also indicates the period during which banded ironstone formations were formed on earth, indicative of an oxygen-free atmosphere. The Earth's crust was wholly or partially molten during the Hadean Eon. One of the first microcontinents to form was the Kaapvaal Craton, which is exposed at the center of the Vredefort Dome, and again north of Johannesburg.



A schematic diagram of a NE (left) to SW (right) cross-section through the 2020 million year old Vredefort impact crater and how it distorted the contemporary geological structures. The present erosion level is shown. Johannesburg is located where the Witwatersrand Basin (the yellow layer) is exposed at the "present surface" line, just inside the crater rim, on the left. Not to scale.

300 km wide crater

Gold from Wikipedia

The gold in the Witwatersrand Basin area was deposited in Archean river deltas having been washed down from surrounding gold-rich greenstone belts to the north and west. Rhenium-osmium isotope studies indicate that the gold in those mineral deposits came from unusual 3000 million year old mantle-derived intrusions known as komatiite, present in the greenstone belts.

South Africa accounted for 15% of the world's gold production in 2002 and 12% in 2005, though the nation had produced as much as 30% of world output as recently as 1993. Despite declining production, South Africa's gold exports were valued at $3.8 billion USD in 2005. The US Geological Survey estimated in that as of 2002, South Africa held about 50% of the world's gold resources, and 38% of reserves.

Tau Tona Gold Mine (Video)

It is one of the most efficient mines in South Africa and remains in continuous operation even during periods when the price of gold is low. Since its construction, two secondary shafts have been added bringing the mine to its current depth. The mine today has some 800 km (500 mi) of tunnels and employs around 5,600 miners. The mine is a dangerous place to work, with an average of five miners dying in accidents each year. The mine is so deep that temperatures in the mine can rise to life-threatening levels. Air conditioning equipment is used to cool the mine from 55 °C (131 °F) down to a more tolerable 28 °C (82 °F). The rock face temperature currently reaches 60 °C (140 °F).

Movie please!!

Fool’ s Gold!!(Why Pyrite?)

Not gold(Au), but pyrite (FeS_2)
3.0 Ga reducing environment of earth surface.
No Oxygen atmosphere, now our surface is covered by iron-oxide, hematite or magnetite.

Diamonds (Video)

Ever since the Kimberley diamond strike of 1868, South Africa has been a world leader in diamond production. The primary South African sources of diamonds, including seven large diamond mines around the country, are controlled by the De Beers Consolidated Mines Company. In 2003, De Beers operations accounted for 94% of the nation's total diamond output of 11,900,000 carats (2.38 t). This figure includes both gem stones and industrial diamonds. Diamond production rose in 2005 to over 15,800,000 carats (3.16 t).

Platinum (Video)and palladium

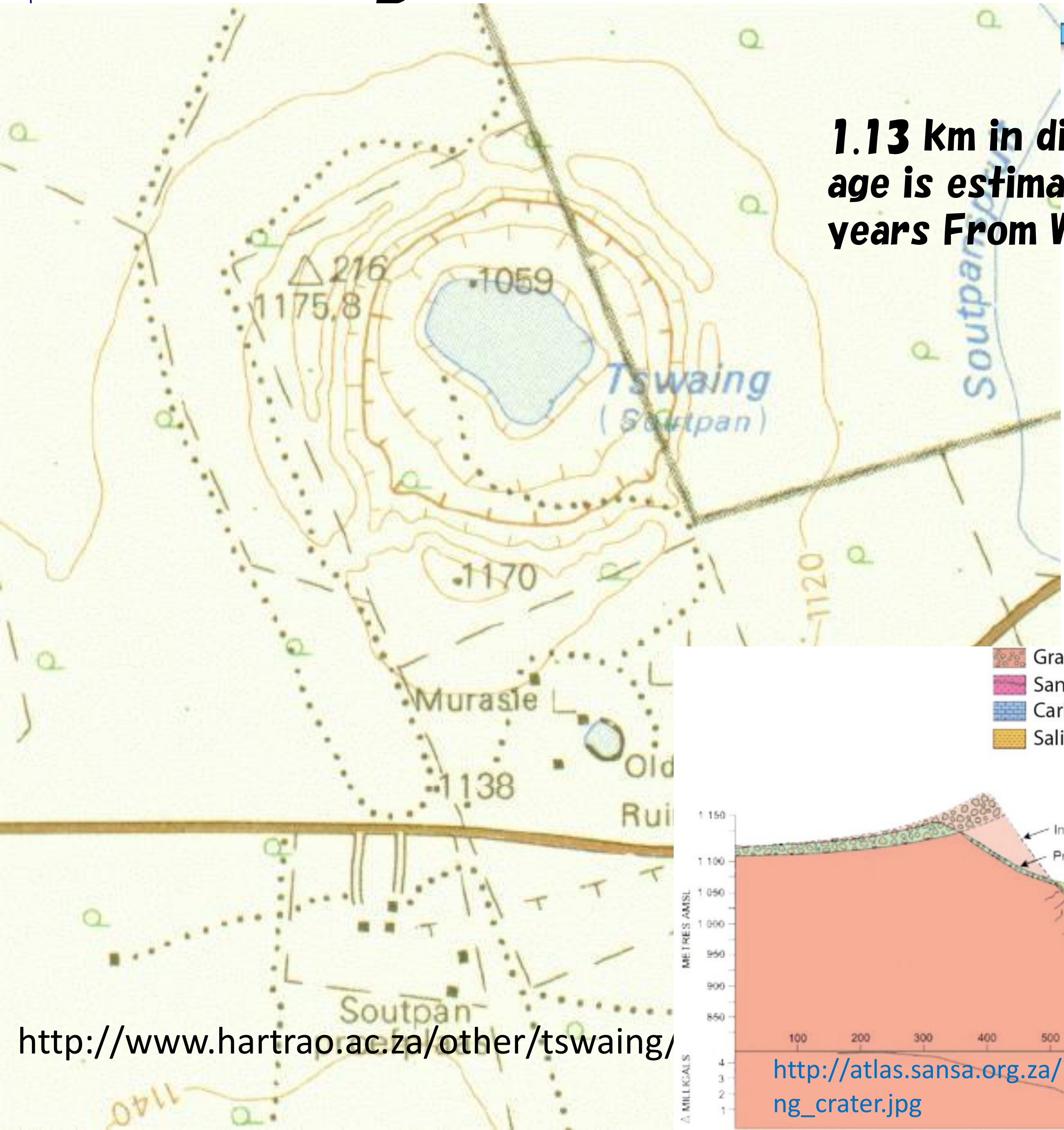
South Africa produces more platinum and similar metals than any other nation. In 2005, 78% of the world's platinum was produced in South Africa, along with 39% of the world's palladium. Over 163,000 kilograms (5,200,000 ozt) of platinum was produced in 2010, generating export revenues of $3.82 billion USD. Palladium is produced in two ways: recovery and mining production. Currently Russia and South Africa are the biggest palladium producers in the world.

Chromium (Video)

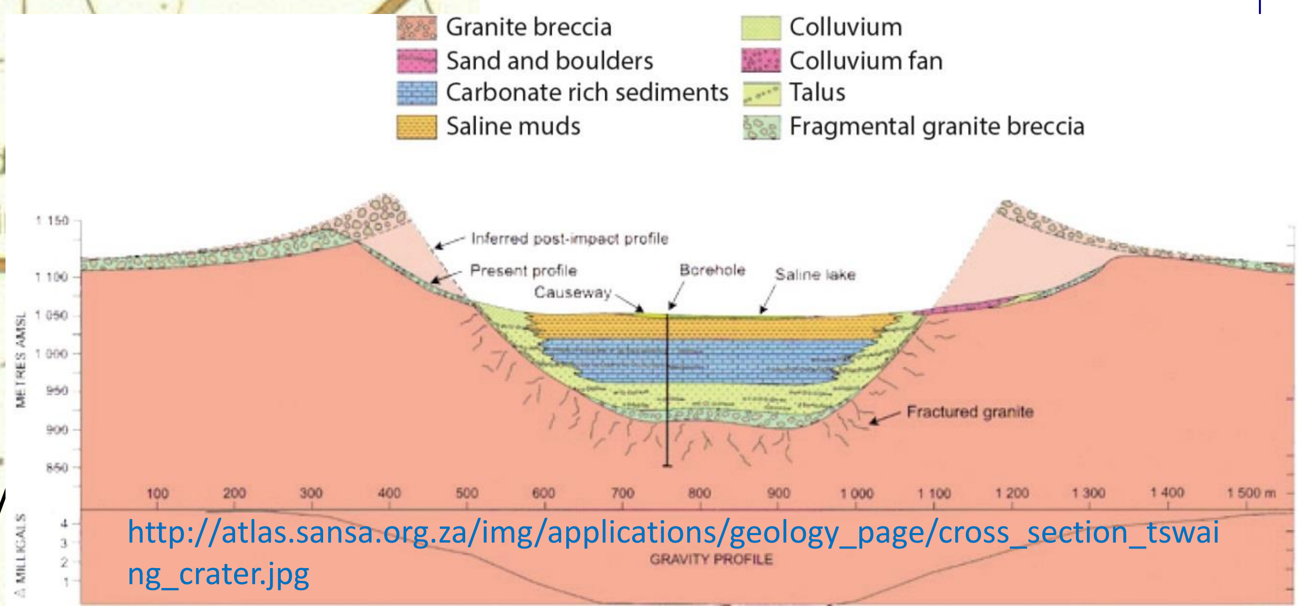
Chromium is another leading product of South Africa's mining industry. The metal, used in stainless steel and for a variety of industrial applications, is mined at 10 sites around the country. South Africa's production of chromium accounted for 100% of the world's total production in 2005, and consisted of 7,490,000 metric tons (7,370,000 long tons; 8,260,000 short tons) of material.

Tswaing Meteor Crater

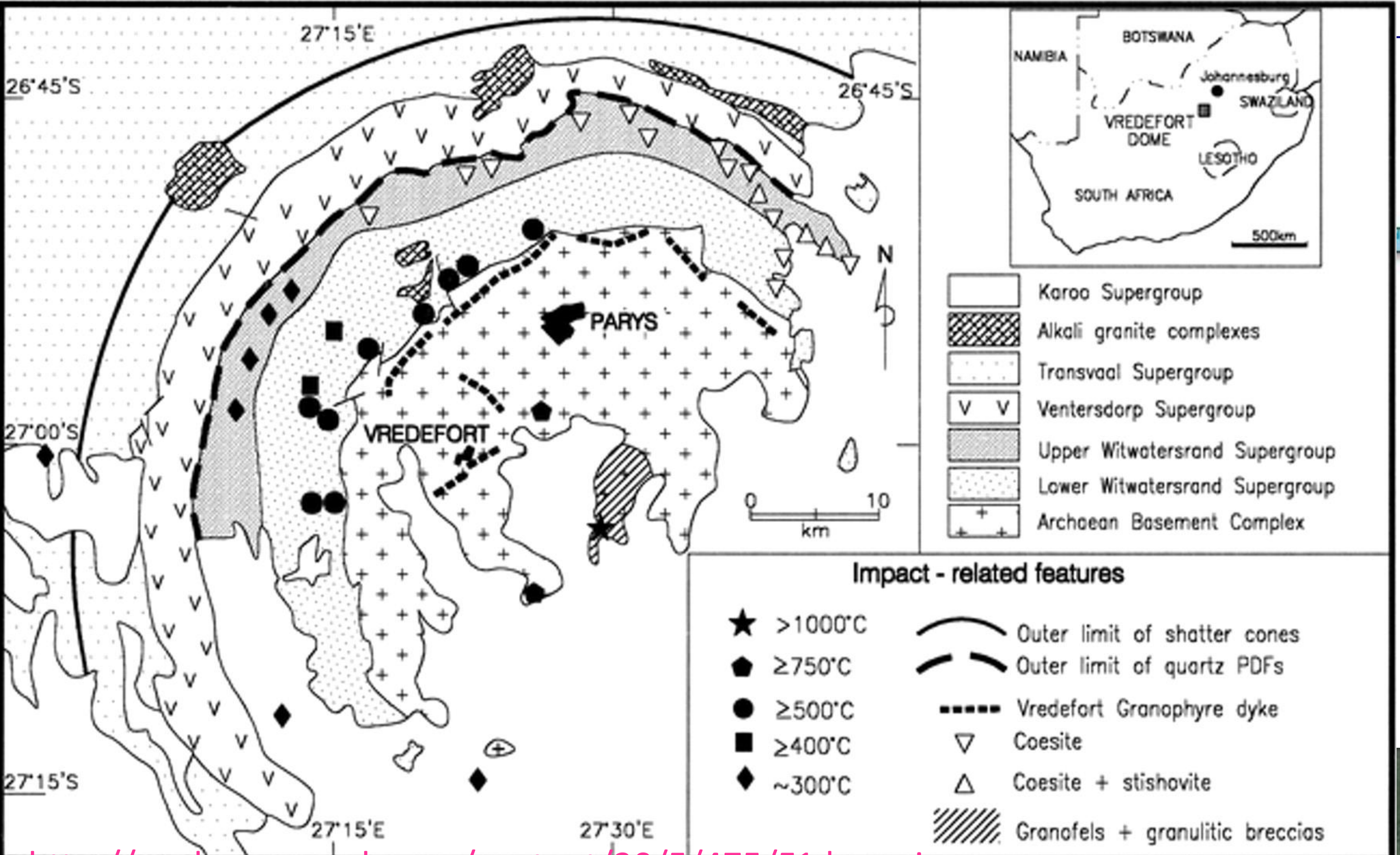
1.13 Km in diameter and 100 m deep and the age is estimated to be 220,000 ± 52,000 years From Wikipedia.



http://www.hartrao.ac.za/other/tswaing/



http://atlas.sansa.org.za/img/applications/geology_page/cross_section_tswaing_crater.jpg



http://geology.gsapubs.org/content/30/5/475/F1.large.jpg

Vredefort crater
more than 300 km across
2.023 billion years
(± 4 million years),

Photo by H.Nemoto (2010)

The Rainbow Country

-Peoples and cultures-

Yoshio Okamoto

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14th July 2011 at the English Reading Class

PSI entrance and Dr. Hartmann

Life origin?

Linewever & Norman, 2008

When and How life appeared
Magma ocean and dry up
Sterilizing Impacts and life
"Panspermia Hypothesis"
A cool early Earth (John W. Vall
April 2002: v. 30: no. 4: p. 351-

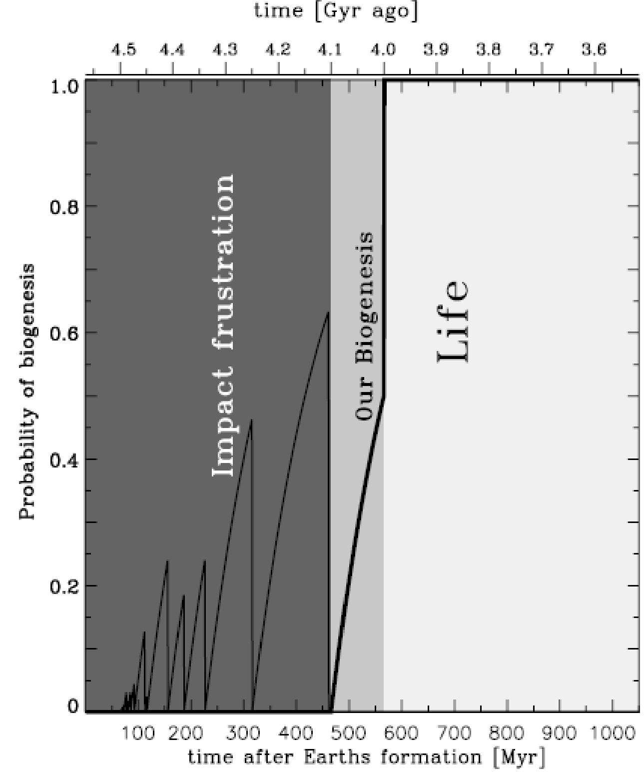
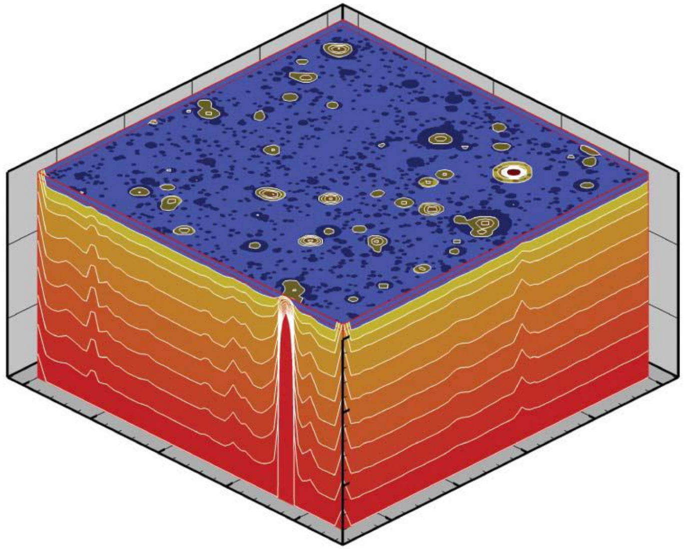
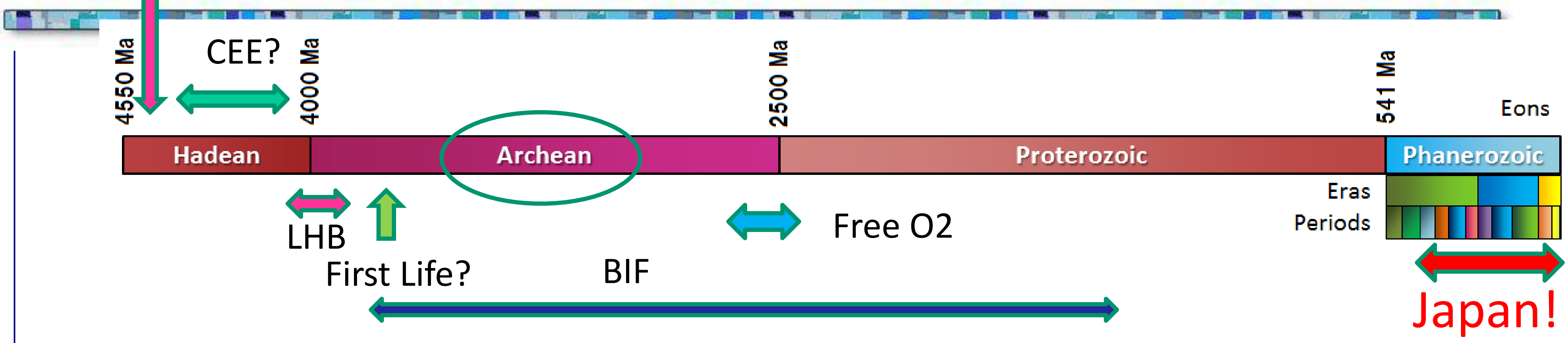


Fig. 2. After the sterilizing impact that formed the Moon about 90±20 Myr after the formation of the solar system (Halliday 2008), a heavy but decreasing and stochastic bombardment lasted for a few hundred million years probably frustrated the origin of life on Earth. Eventually, the molecular evolution that led to life as we know it, was able to squeeze through the thermal bottlenecks produced by impacts (however see Abraomov & Mojzsis 2008a,b). Figure from Davies & Lineweaver 2005.



Abramov & Mojzsis, 2009

Early Earth (Part 1) Hadean eon to 2.4 Ga



Forming of Earth 4.6Ga

Giant Impact (the birth of Moon) 4.5Ga

Cool Early Earth 4.4-4.0 Ga

Late Heavy Bombardment (LHB) 3.9 Ga