Time capsule

a mission into the geological time space

A slide set associated with publication:

Message in a stainless steel bottle thrown into deep geological time

by

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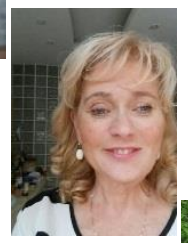

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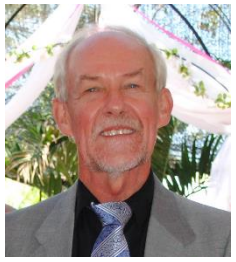


Simon A. Weil

Time capsule, the cap and the container

- Tube lenght = 600 mm
- Diameter (inside) =110 mm
- Stainless steel plate 4 mm thick
- Five containers (one presented)
- Design: Marek Lewandowski
- Management: Krzysztof Otto
- Production: Darek Łukasiewicz

Magnetic pillows separating the containers in action

Neodymium magnets rings are glued with the container using epoxy resin.
A weight of 0.7 kG is applied

Demonstration tube made of PCV; the upper container hangs over the lower one on the magnetic pillow

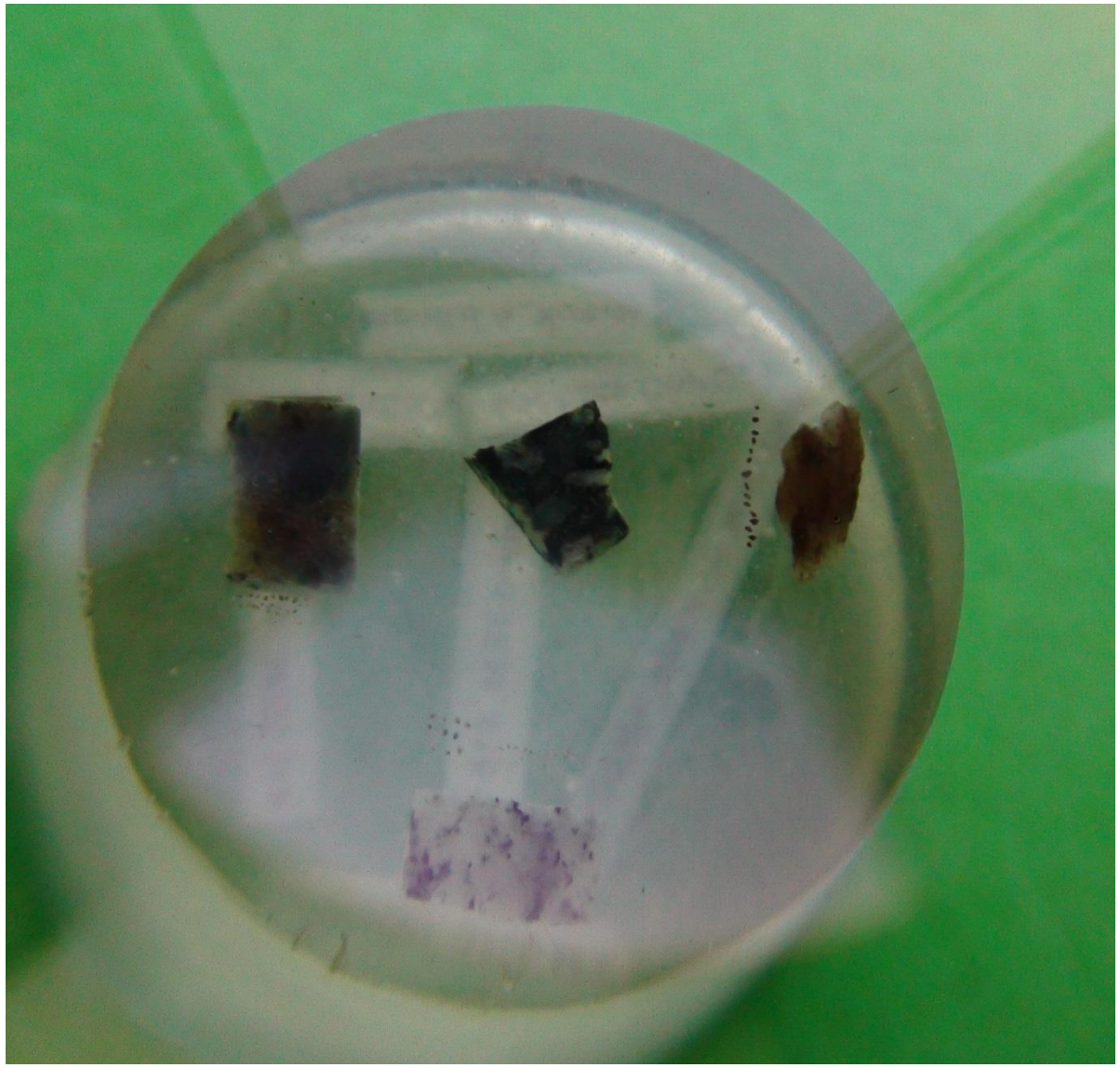
The Earth through time

Pultusk meteorite, estimated for an age of 4.5 Ga.
It represents very beginning of the solar system planet.
Coll. Marek Lewandowski and Magda Sidorczuk

Host rocks
(left side: Napier Complex, Antarctica; right side: Jack Hills, Western Australia and at the bottom: Nain Complex, Labrador) together with a reference material in the center (Lachlan Orogen) aligned in epoxy resin.

These rocks contain the mineral zircon
(visible as tiny grains next to the rock chips, see next slide) as old as 3.8 Ga (Antarctica), 3.7 Ga (Labrador) and 4.4 Ga (Jack Hills).

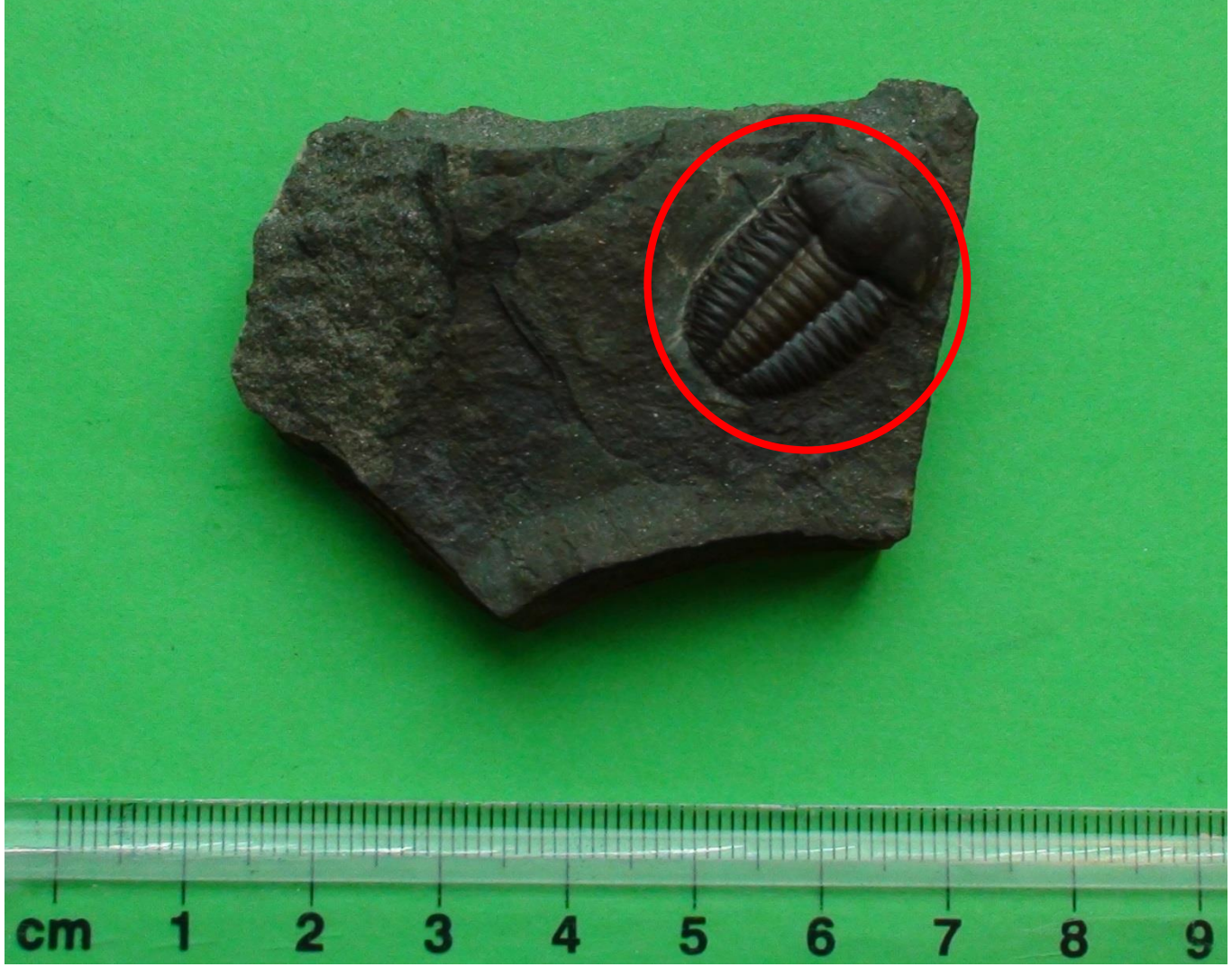
Coll. Monika A. Kusiak



Zircon grains next to their host rocks – a close up view through a magnifying glass

A gravel of the Iron Banded Formation (BIF), of estimated age ca. 2.2 Ga.
This rock proves the first appearance of oxygen in the ocean. Namibia, Orange River bank.
Coll. Marek Lewandowski

BIF gravel, containig substantial amount of a not fully oxidized iron, is attracted by a neodymium magnet

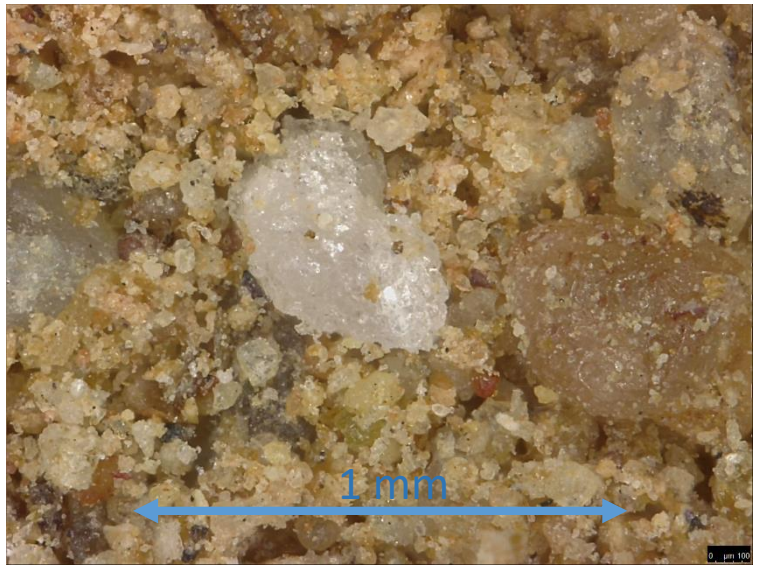


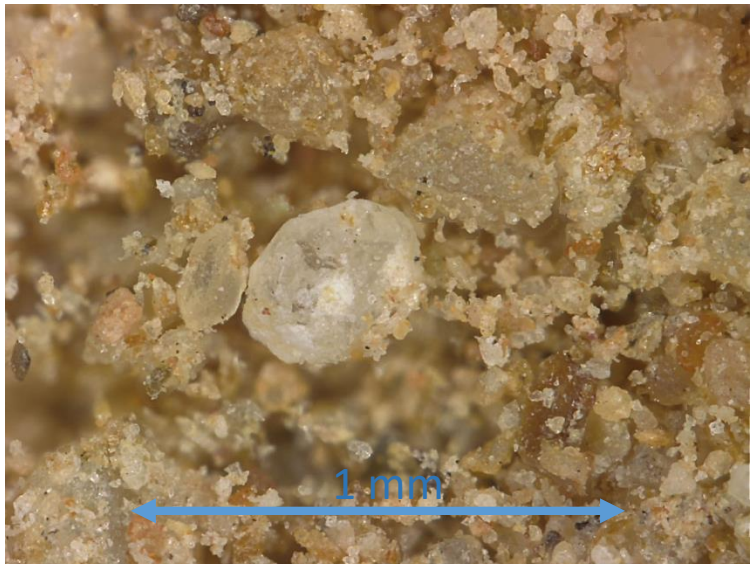
Elliosocephalus hoffi, (ca. 545 Ma, Cambrian, Barrandien, Czech Rep.)
This trilobites exemplifies explosion of biodiversity in Cambrian time
Sample was cut around the red circle (1” in diameter)
Coll. Tomasz Praszkier

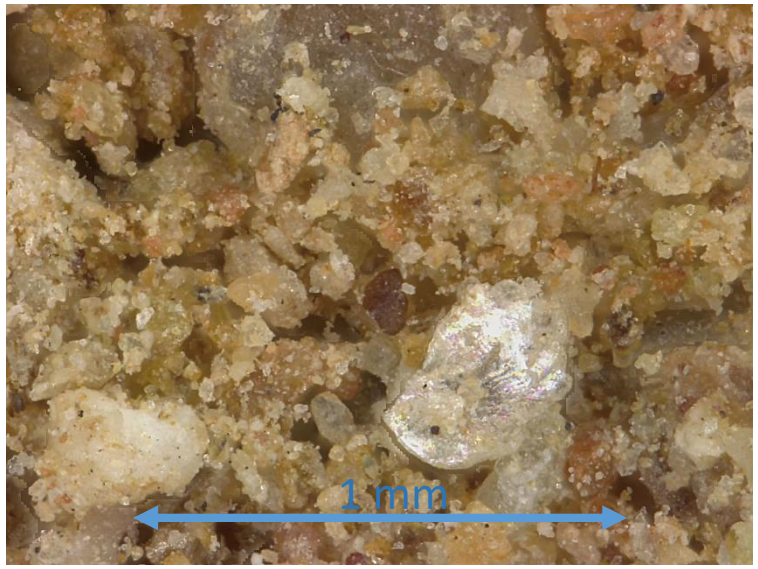
The Permian redbed sample, estimated age ca. 280 Ma (Velebit Mt., Croatia)
The rocks deposited during the mass extinction period, sampled for paleomagnetic purpose (see inlet)
Coll. Marek Lewandowski

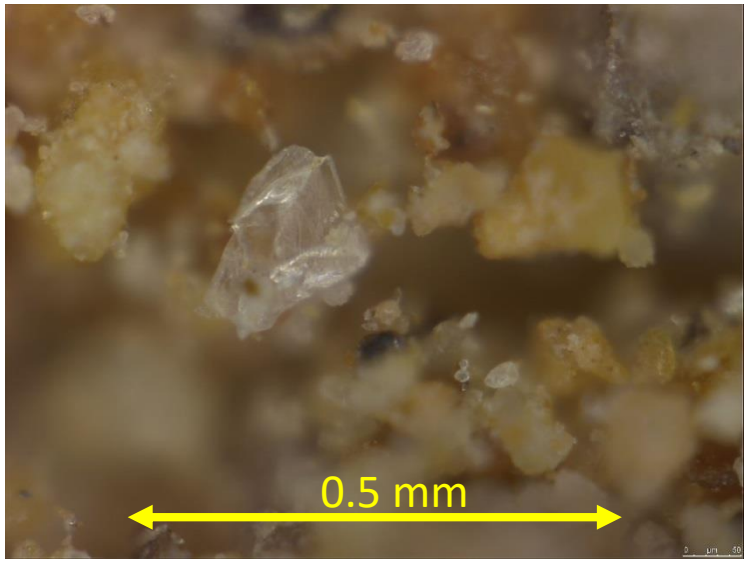
Late Jurassic *Perisphinctes*, estimated age ca. 150 Ma (Poland)
This ammonite documents biological revival in Mesozoic era
Coll. Marek Lewandowski

Diamond bearing sand (Quatenary deposits, Orange River bank, Namibia)
Includes, among other components, pieces of the kimberlite rock (centre, dark-gray crumb) and a BIF gravel
Coll. Marek Lewandowski and Magda Sidorczuk



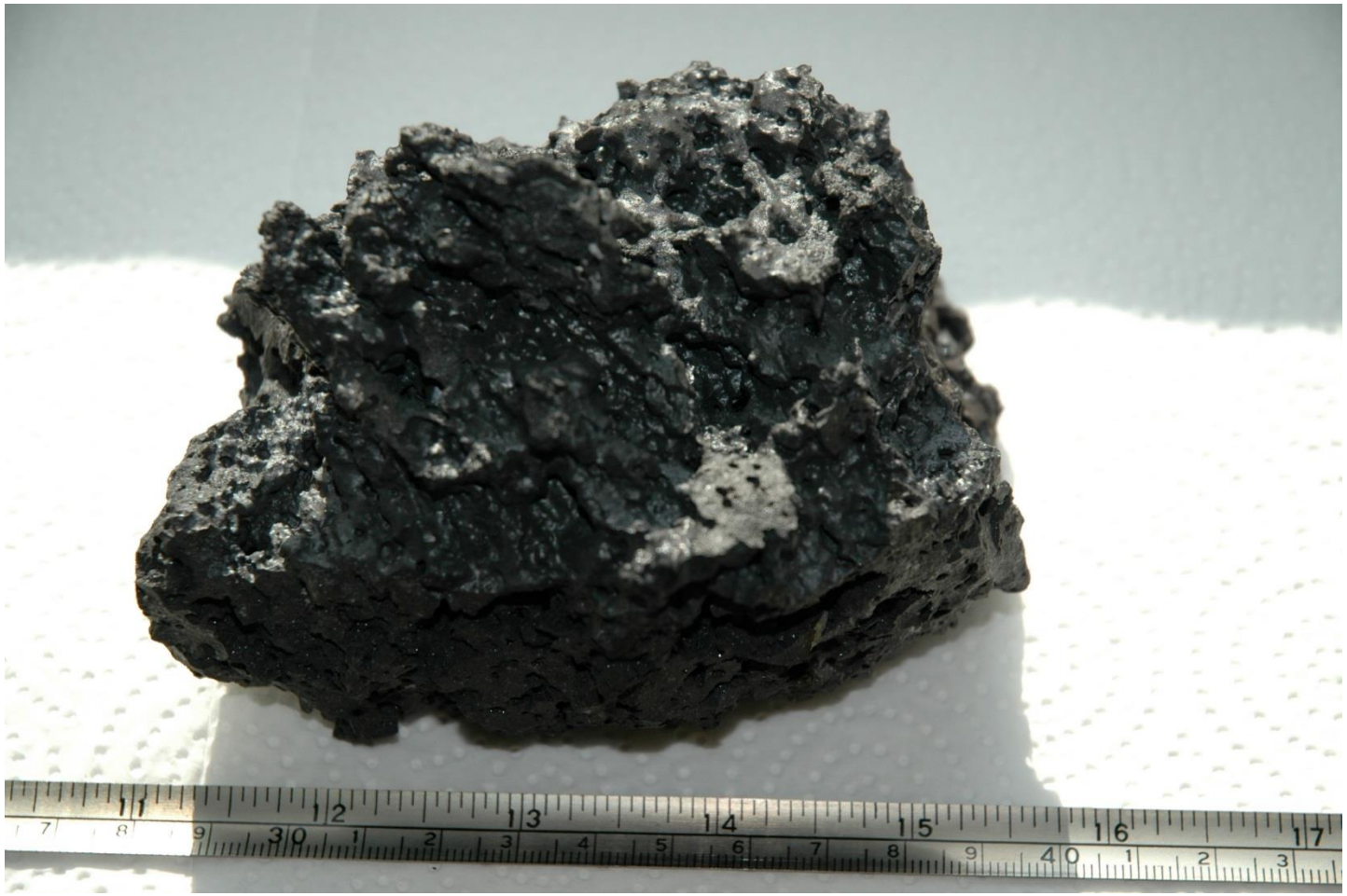




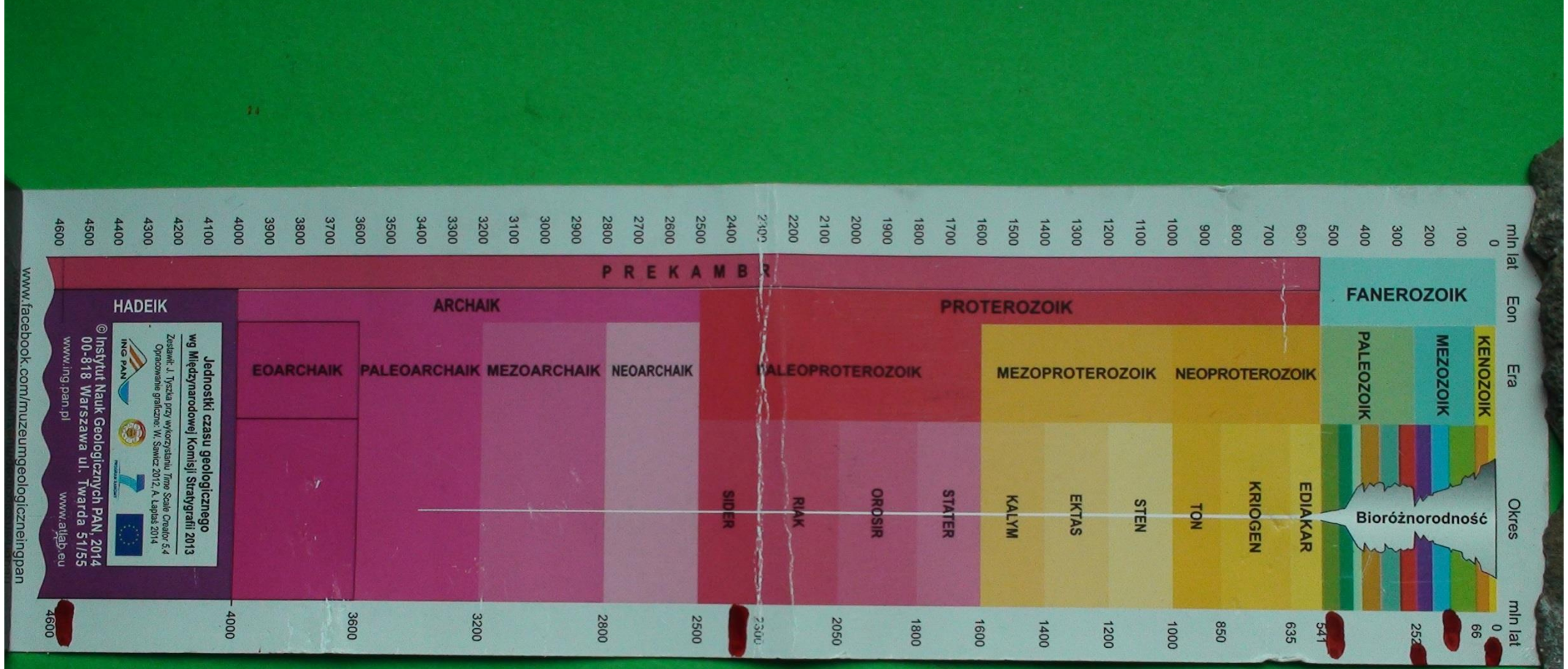


Understanding the message from the mantle… diamonds found in the sand of the Orange River bank.
Photo: courtesy of Leica Co., at their stand of the Geological Congress in Cape Town, 2016

The youngest rock in the stuff



Lava of Holuhraun eruption (2014, Iceland, collected by Armann Hoskuldsson) as a source of an isotopic clock to identify a time frame the capsule has been prepared.



Stratigraphic timetable (Tyszka et al. 2014, designed for a basic school education)
Position of samples included in the container are marked red.
Coll. Institute of Geological Sciences, PAS.

Selection of geological samples and a stratigraphic way they were arranged in the container envisage our understanding of the Earth evolution history

Geological samples are inserted into the plastic tube of 1” diameter in a stratigraphic order

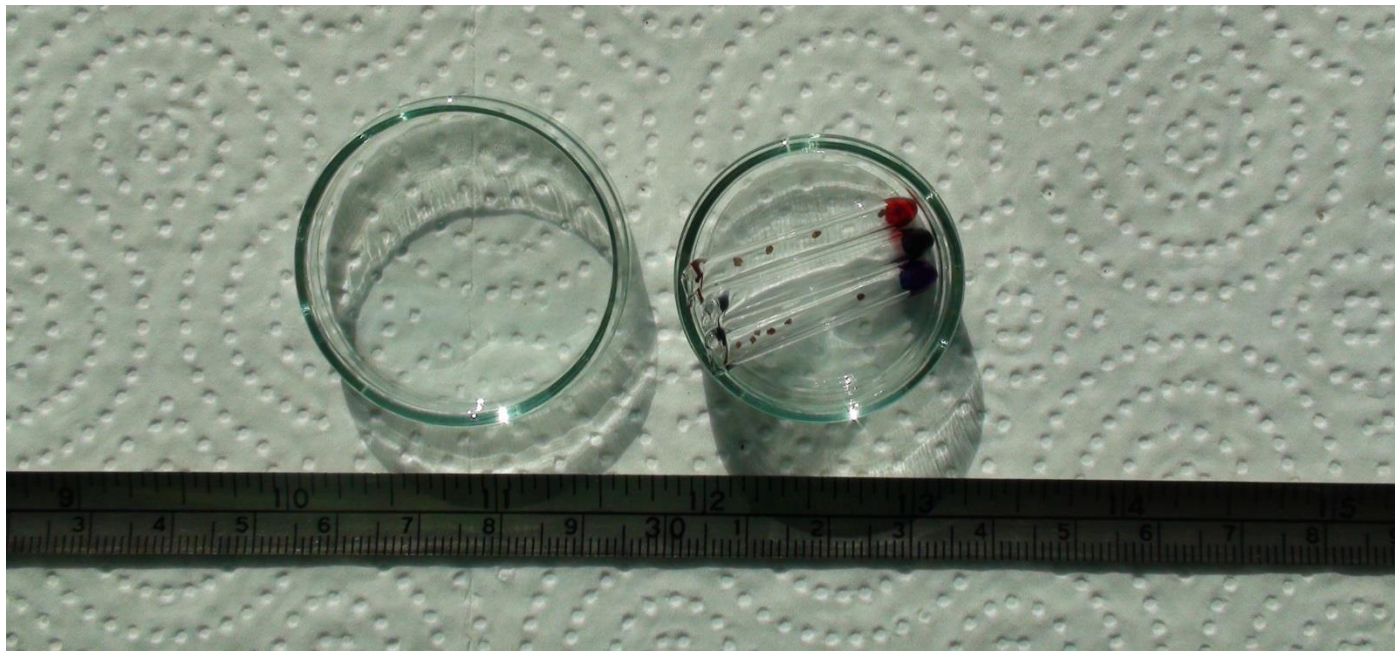
Life transfer in time

Grain selection
Beans, peas, sunflower, corn, oat, pumpkin + active coal added just before the scale pans were closed and sealed with epoxy resin
Coll. Adam Nawrot

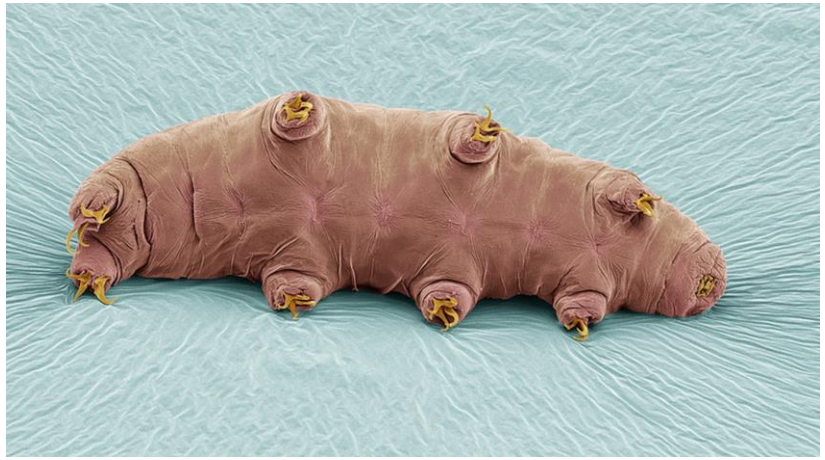
Raw green coffee beans, as DNA carriers of one of the most popular drink in the World (Columbia)
Coll. Marek Lewandowski (provided by Dorota Długaszek)

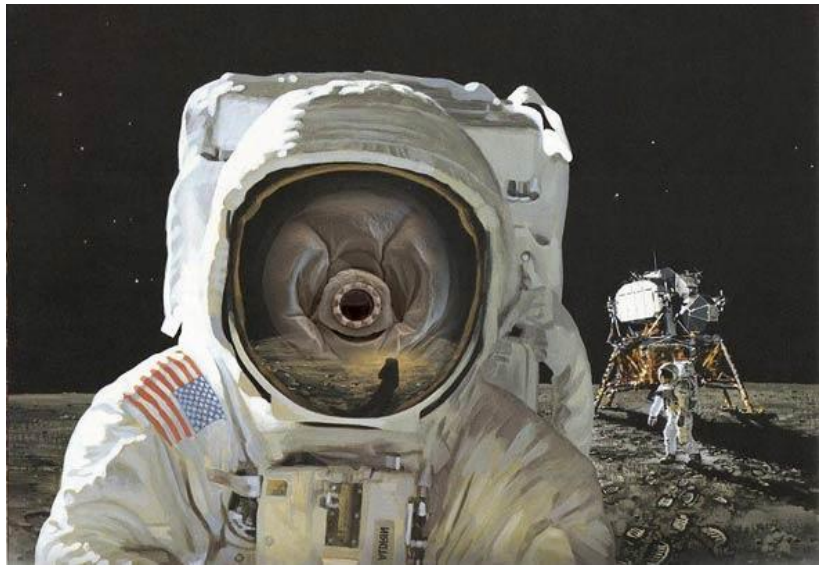
Lyophilized DNA of male, female, rat, salmon and potato
Coll. Ewa Gojska-Sledziewska, photo: Ewa Gojska-Śledziewska

Deciduous teeth of Mr Grzegorz Ostrowski
Coll. Anna Ostrowska



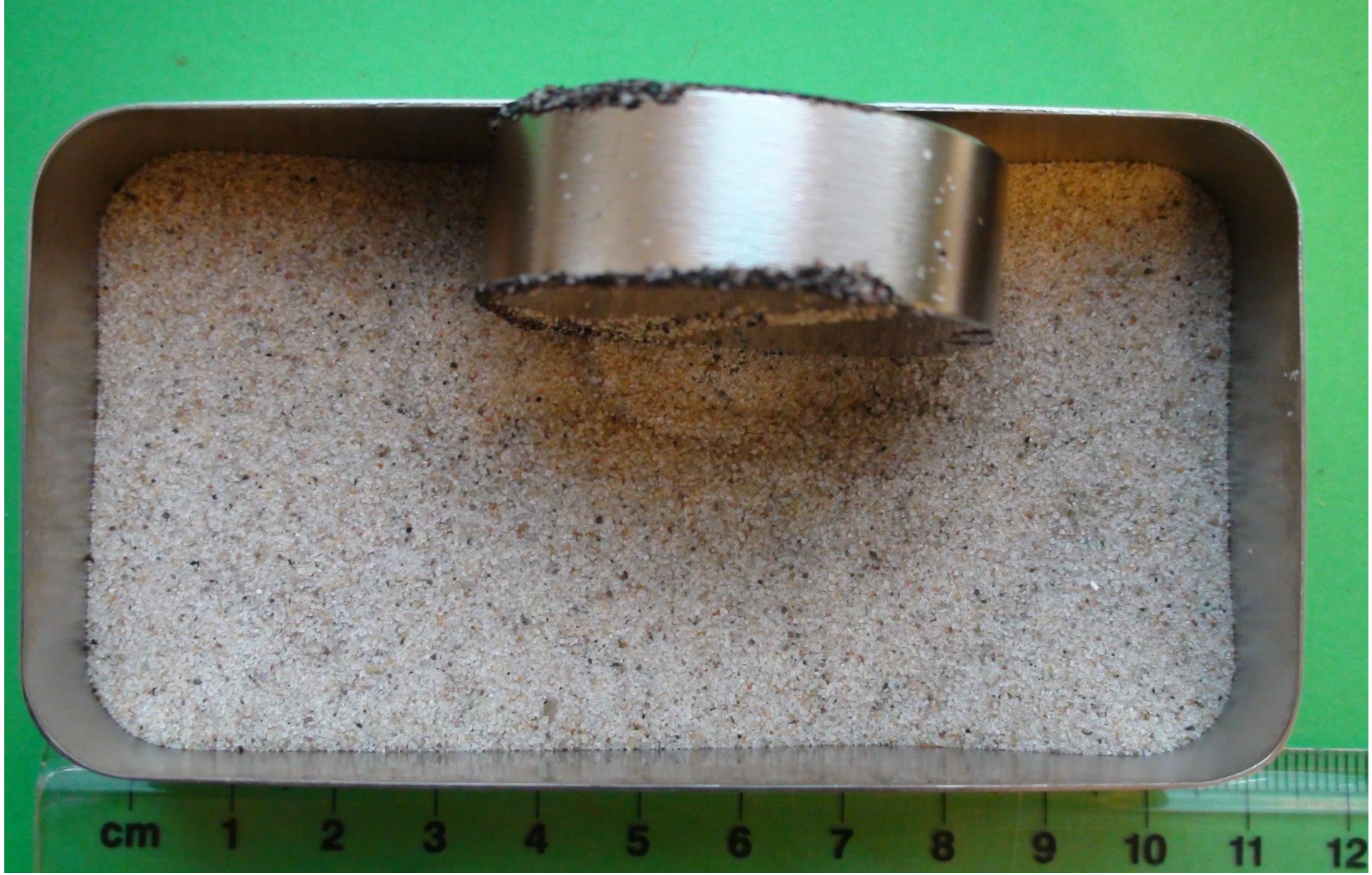
Present-day Tardigrada (in Polish: Niesporczaki)
Three different species of imperishible animals, sealed in glass tubes, before emersion in the epoxy resin
Coll. Łukasz Michalczuk

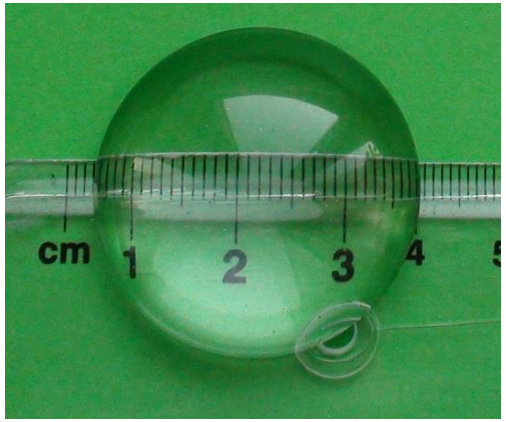

Examples of the present-day Tardigrada
From Wikipedia

Meaning of silicon:
from the sand
to the high-tech electronics

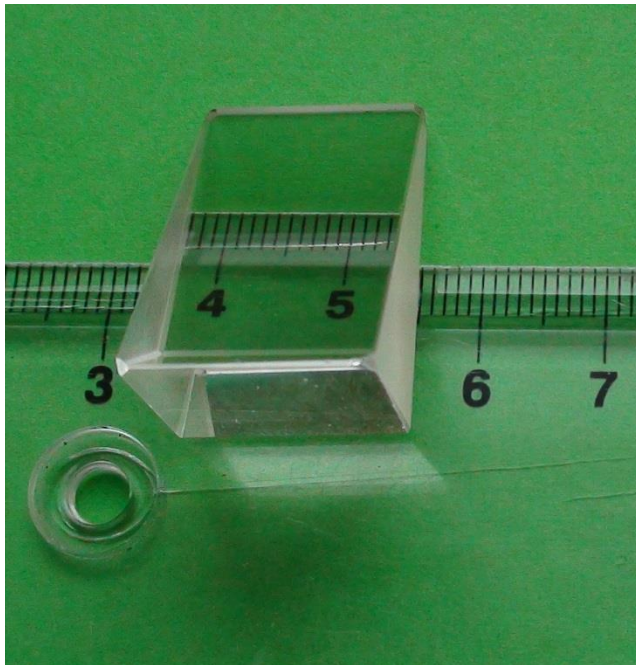


Quartz sand, being cleaned from magnetic phases by a neodymium magnet
The sand is the raw material for the silica crystals, which are produced chiefly by the method of Czochralski
Coll. Marek Lewandowski

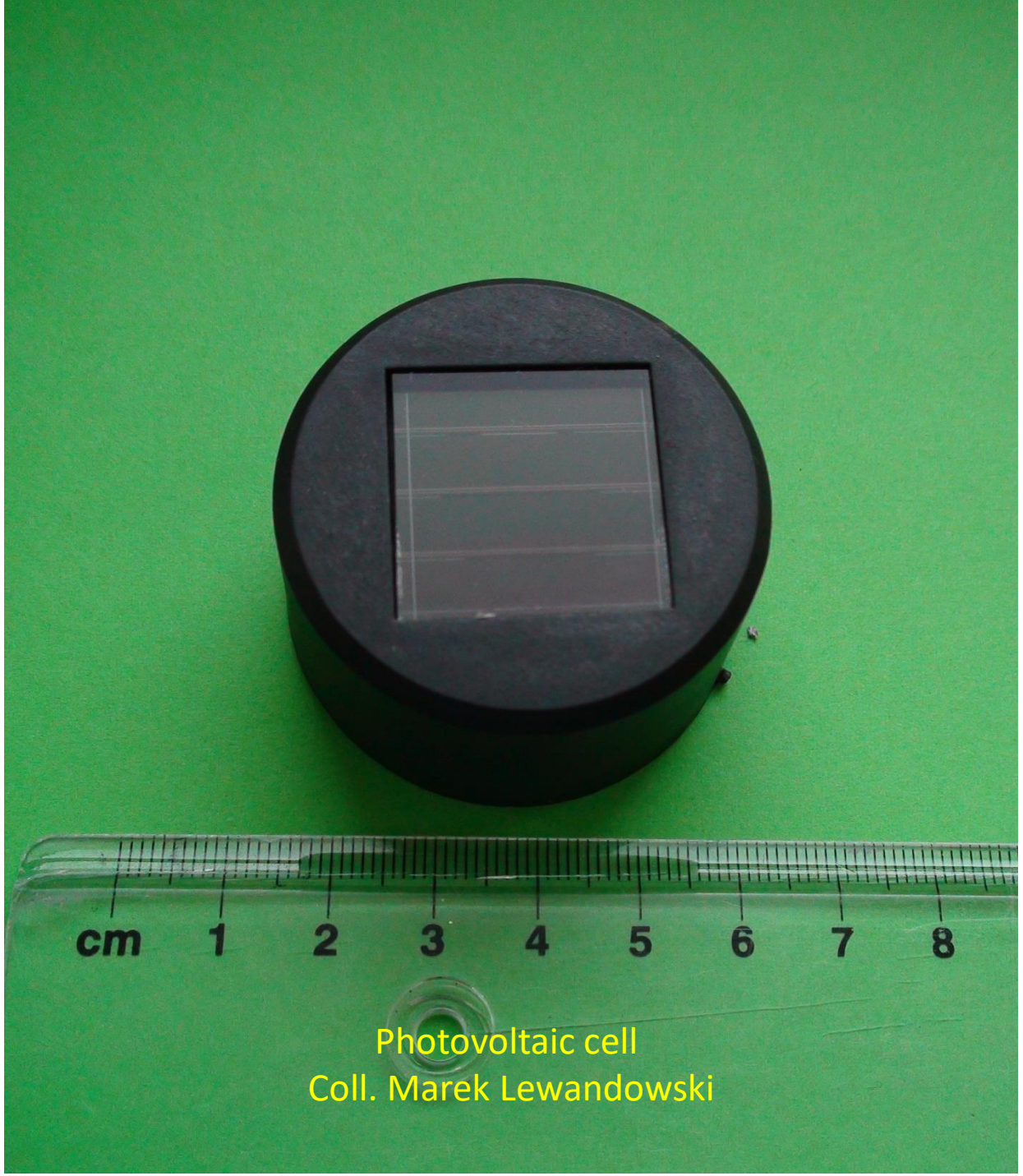
Quartz crystal
The purest source of silica (Strzegom quarry, Poland).
Diamonds (provided in the geological container) are the only tool able to cut the quartz and the silica crystals into wafers
Coll. Marek Lewandowski



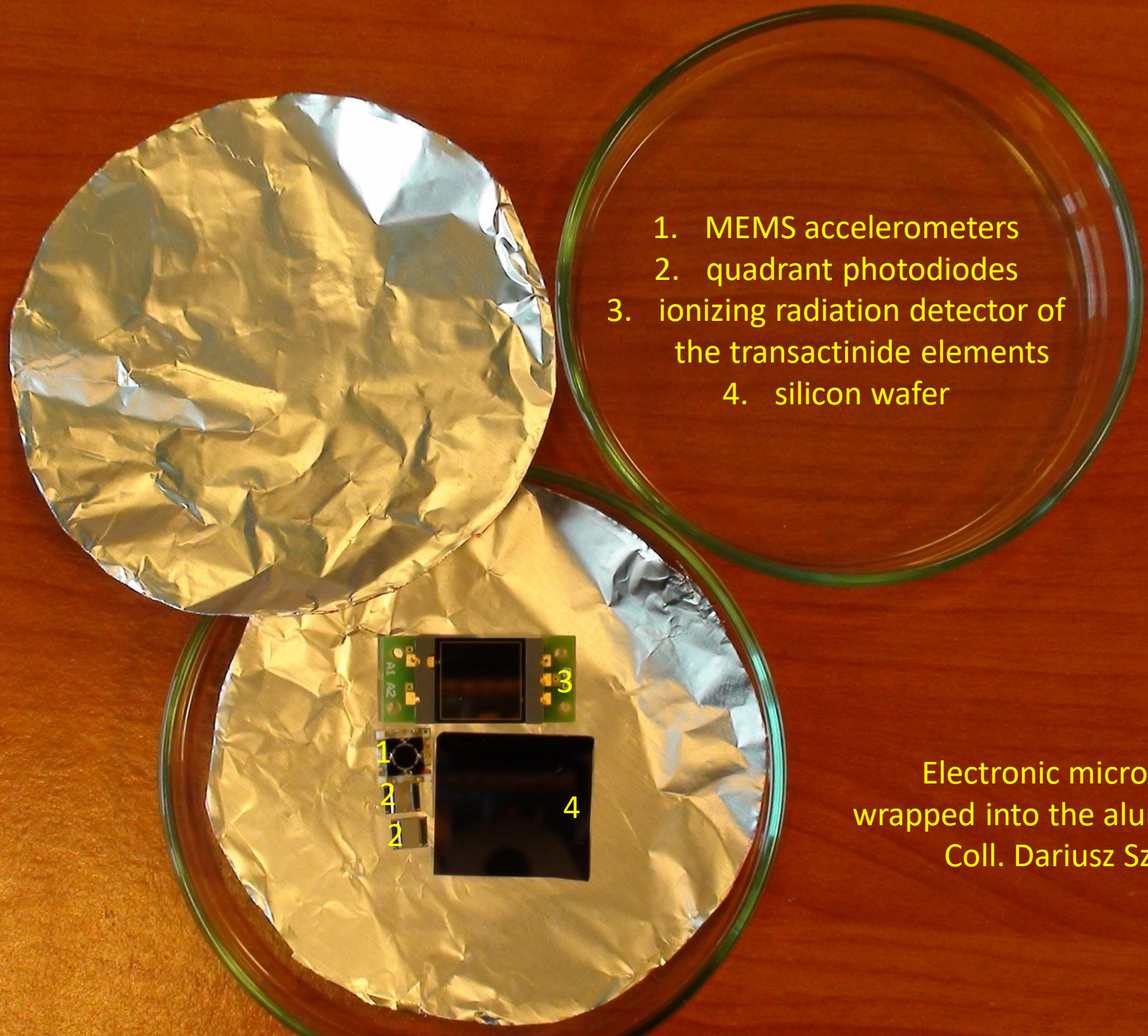
Magnifying glass, made of a high quality lead glass
Coll. Marek Lewandowski



A prism cut off the led crystal glass
may demonstrate our knowledge on properties of light
Coll. Marek Lewandowski



Photovoltaic cell
Coll. Marek Lewandowski



Electronic microdevices
wrapped into the aluminium folia
Coll. Dariusz Szmigiel

Our everyday life

Examples of gadget of our everyday life

Russian mechanical wrist watch

Credit card with a chip

Charcoal for grill

Coins of 25 countries (specified on the next slide)

Model of a US car (brand not revealed)

Matchbox

Small cell phone (not shown to keep a brand hidden)

Indian sundial integrated with compass

Syringe

Love story excerpted from the Polish national poem „Pan Tadeusz” by Adam Mickiewicz

Pencil and sharpner

Multifunctional knife

Measure for a scale (not included)

Coins specification

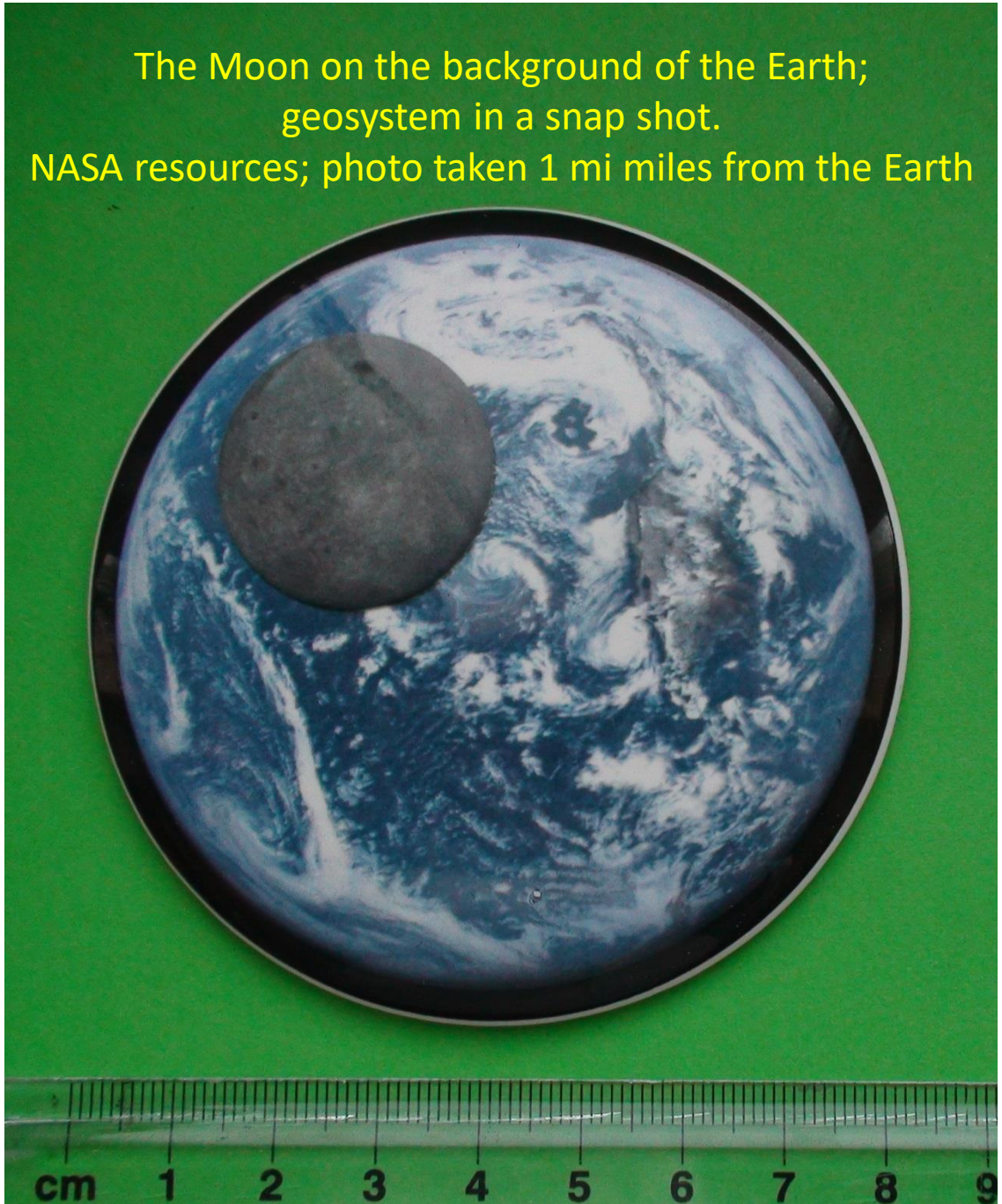
Albania (Shqiperise Rep.)	5	leke
Austria	1	schilling
Brasil	50	centavos
Canada	25	Cents
Chile Rep.	1	pecos
China	1	juan
Croatia	2	kuna
Czech Rep.	1	koruna
Egypt	10	piastr
Euro zone	1	euro
Greece	10	drahme
Iceland	1	krona
India	2	???
Japan	100	jen
Macedonia Rep.	10	denari
Norway	1	krone
Poland	2	złoty
Romania	5	bani
Russia	1	rubl
Singapore	20	cents
Spain	5	cents
Sweden	1	krone
Switzerland	20	cents
United Kingdom	20	pence
USA	1	cents

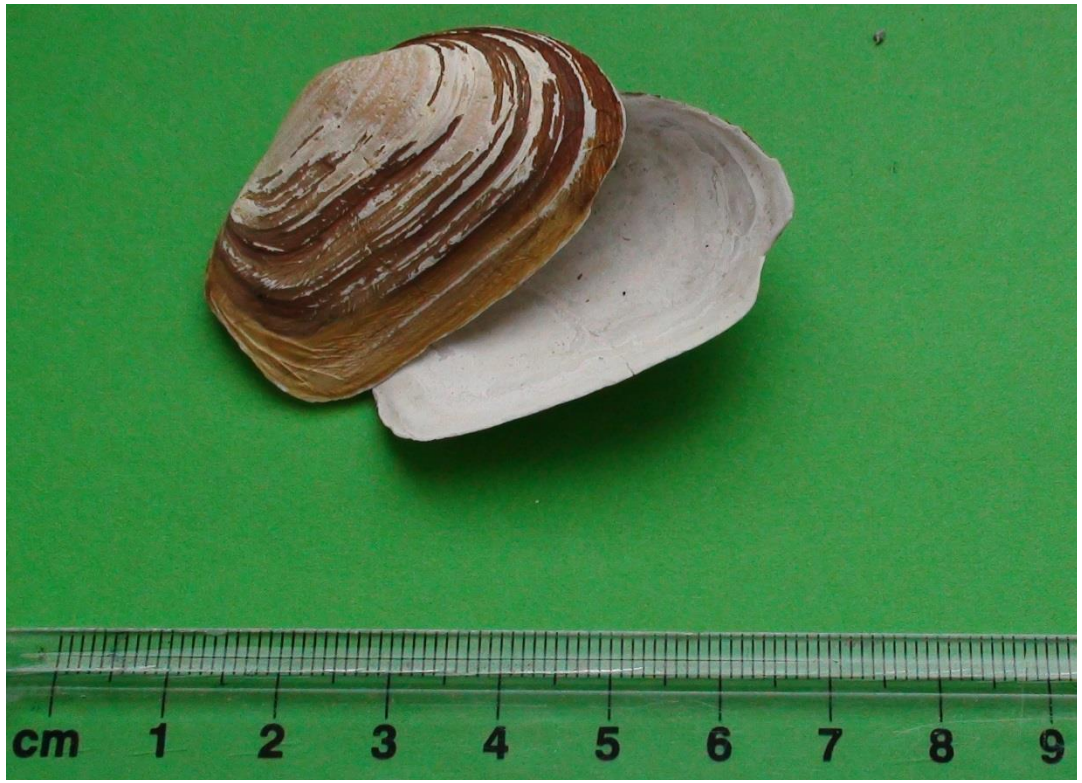
Coll. Tomasz Ernst, Waldemar Jóźwiak, Marek Lewandowski, Krzysztof Mizerski

Sundial is the simplest way of time measurement – need no built-in mechanism
But it needs the light from the Sun …
Coll. Marek Lewandowski and Magda Sidorczuk

Environment – focus on Spitsbergen

The Moon on the background of the Earth;
geosystem in a snap shot.
NASA resources; photo taken 1 mi miles from the Earth



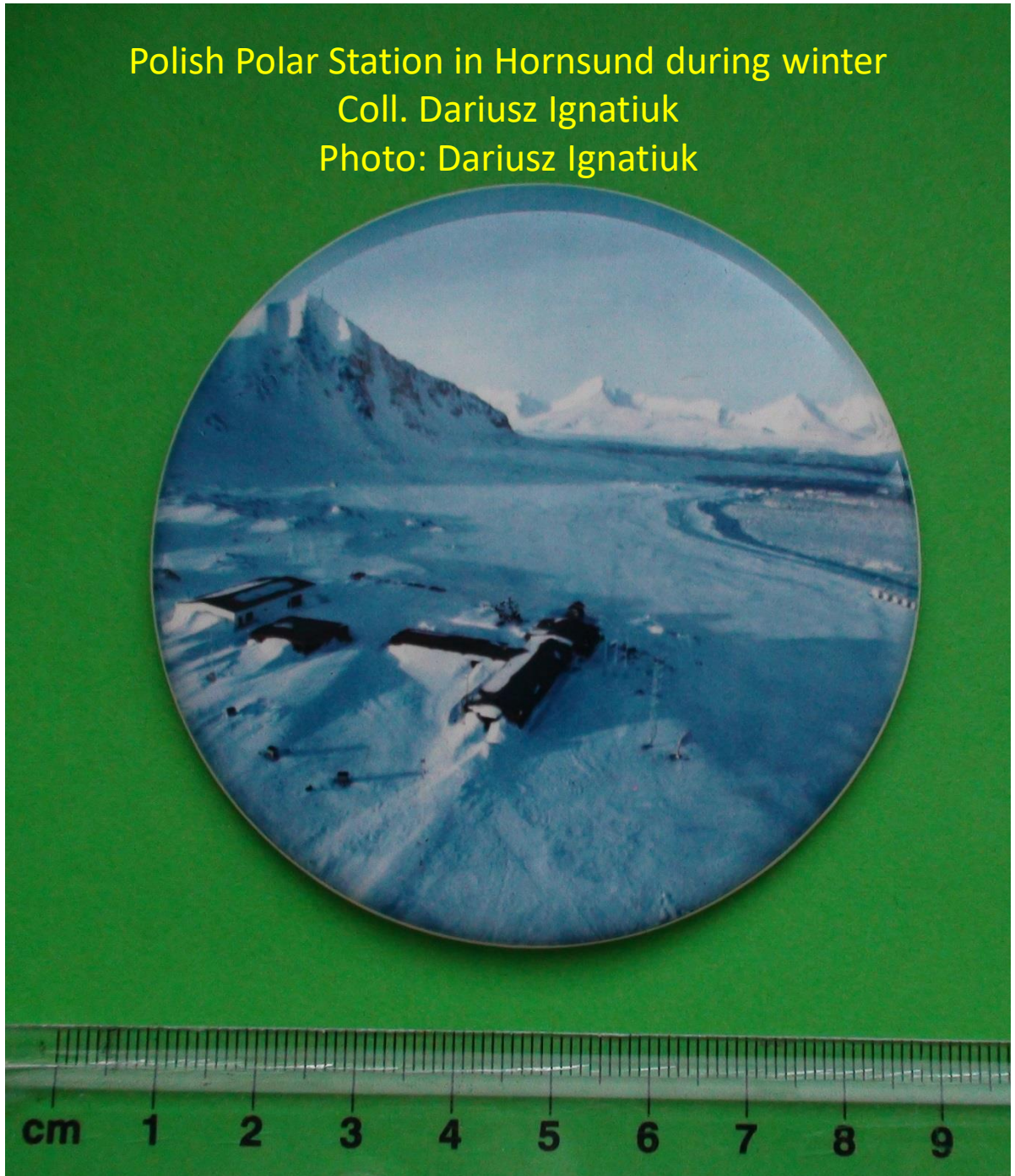


Shelfish shell of Hornsund.
To be used by a discoverer for the $^{16}O/^{18}O$ analysis to recognize a temperature of the ocean
Coll. Tomasz Wawrzyniak

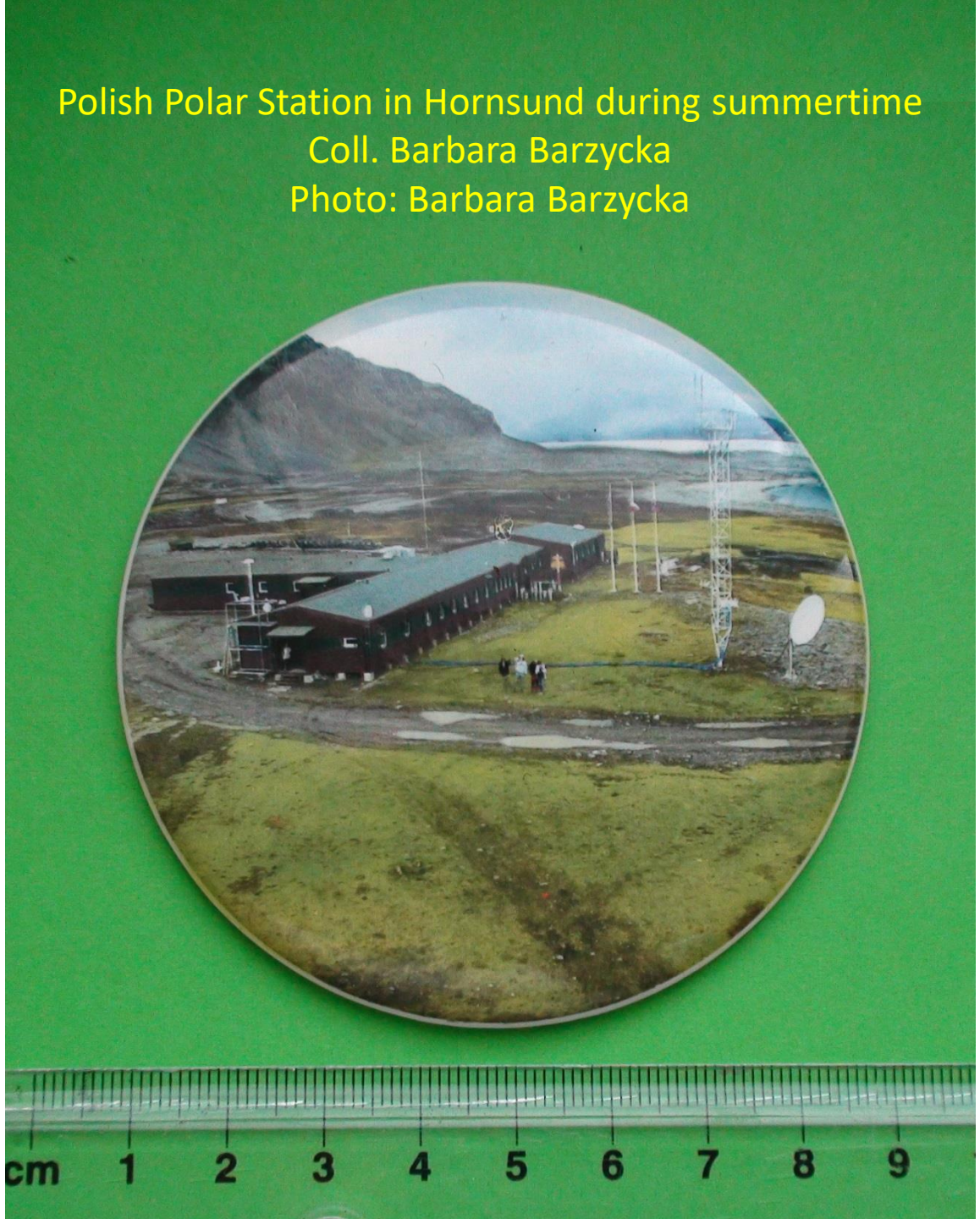

Spitsberen - reindeer antler
Coll. Tomasz Wawrzyniak
cm 1 2 3 4 5 6 7 8 9 10 11 12

A coal of Longyerbyean (Spitsbergen)
Coll. Tomasz Wawrzyniak

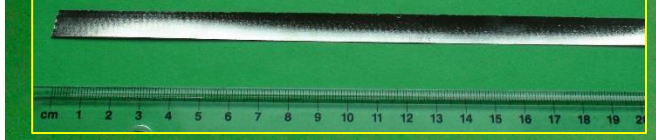
Polish Polar Station in Hornsund during winter
Coll. Dariusz Ignatiuk
Photo: Dariusz Ignatiuk



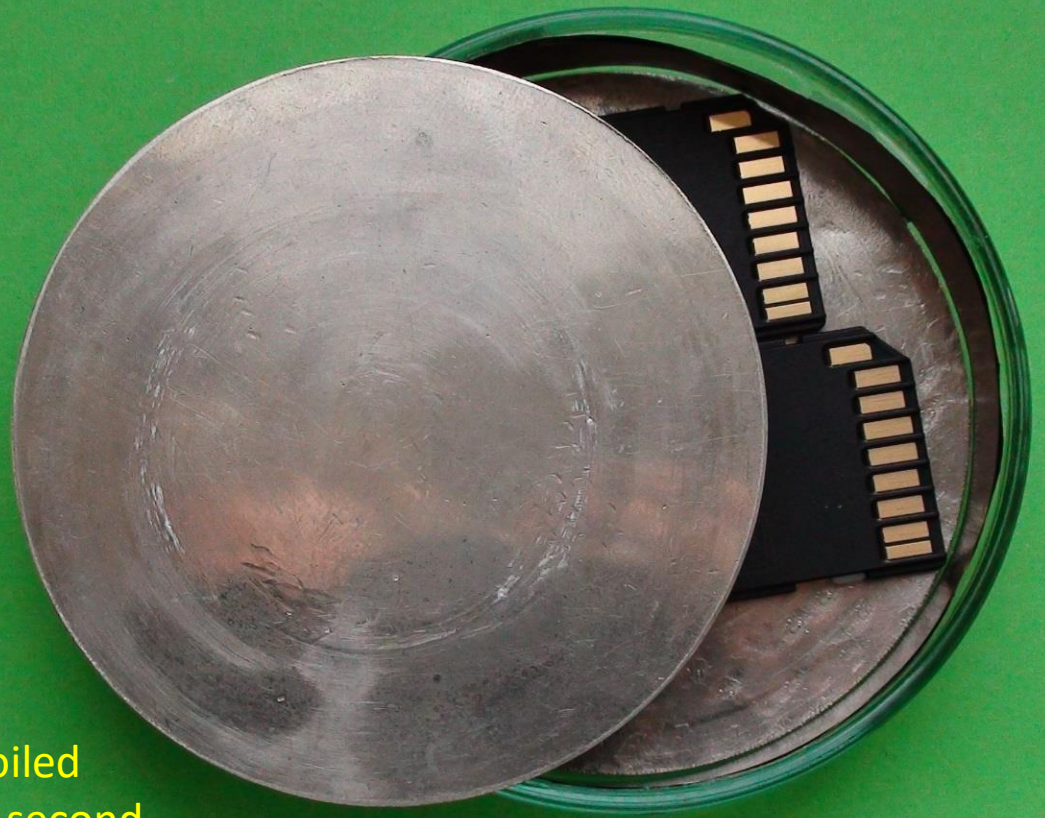
Polish Polar Station in Hornsund during summertime
Coll. Barbara Barzycka
Photo: Barbara Barzycka



Coll. Zbigniew Stokłosa



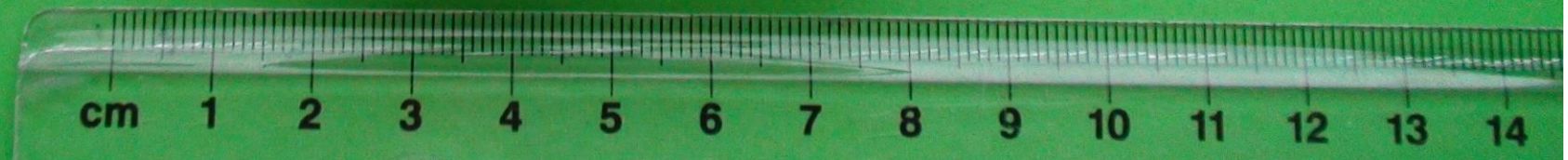
A strip of the permalloy (left)
and two permalloy plates (below)
form a box to prevent the memory cards
from the electromagnetic field



LIST
of mp4 files attached:
Movie 1
Movie 2
Movie 3

Memory cards – two
with identical content,
presenting life on the Earth
and beauty of Svalbard.

The first card will be spoiled
to learn, how to decode the second…



A four meters deep hole, drilled in Quaternary and Precambrian rocks, is wating for the Time Capsule nearby the Polish Polar Station in Hornsund (Spitsbergen, Svalbard, Norway)
Coll. Tomasz Wawrzyniak, photo: Tomasz Wawrzyniak

Concluding remarks

- The project aimed to envisage our days, ourselves, and our environment to a forthcoming civilization, which we hope still be living on the Earth far away in a time
- We selected natural samples and artefacts and, by their arrangements, constructed specific language of objects that speak by itself
- The characters of the language stem from six continents and 26 countries, covering an area populated by more than five bilion of people

Authors

References

Black, L.P., Kamo, S.L., Allen, C.M., Aleinikoff, J.N., Davis, D.W., Korsch, R.J., Foudoulis, C., 2003. TEMORA 1: a new zircon standard for Phanerozoic U–Pb geochronology. Chemical Geology, 200, 155-170.

Kusiak, M.A., Whitehouse, M.J., Wilde, S.A., Dunkley, D.J., Menneken, M., Nemchin, A.A., Clark, C., 2013. Changes in zircon chemistry during Archean UHT metamorphism in the Napier Complex, Antarctica. American Journal of Science 313, 933-967.

Vågnes, E., Amundsen, H.E.F., 1993. Late Cenozoic uplift and volcanism on Spitsbergen: Caused by mantle convection? Geology 21, 251-254.

Wilde, S.A., Valley, J.W., Peck, W.H., Graham, C.M., 2001. Evidence from detrital zircons for the existence of continental crust and oceans on the Earth 4.4 Gyr ago. Nature 409, 175-178.

Williams, I.S., Compston, W., Black, L.P., Ireland, T.R., Foster, J.J., 1984. Unsupported Radiogenic Pb in Zircon -a Cause of Anomalously High Pb-Pb, U-Pb and Th-Pb Ages.Contributions to Mineralogy and Petrology 88, 322-327

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Museum of the Earth (Warsaw, Poland) kindly agreed to provide us with the Pułtusk meteorite sample, in exchange with the one from the private collection of Marek Lewandowski and Magda Sidorczuk.

We acknowledge Anna **Zagórska** and Izabela **Kocjan** for their help in mount preparation.

Sylwia **Dytłow, T**omasz **Ernst,** Oskar **Głowacki,** Agata **Goździk,** Waldemar **Jóźwiak,** Beata **Górka-Kostrubiec,** Jón Atli **Hermannsson**, Stanisław **Maroń,** Krzysztof **Mizerski, Adam Nawrot, Krzysztof Otto, Tomasz Praszkier,** Marcin **Ruszczak, Włodzimierz Sielski,** Jerzy **Sierhej,** Zbigniew **Stokłosa,** Agata **Szczegielniak,** Igor **Vlahovic,** Iga **Szczepaniak-Wnuk,** Tomasz **Werner** are acknowledged for their help at different stages of the project development.

Discussions with all sceptics helped to set up the project on the correct rails.

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All photos by Marek Lewandowski, unless indicated otherwise.