



UNIVERSITÀ DEGLI STUDI
DI MILANO
DIPARTIMENTO DI SCIENZE
DELLA TERRA "ARDITO DESIO"



BIBLIOTECA
DI SCIENZE
DELLA TERRA
"A. DESIO"

APEGEO

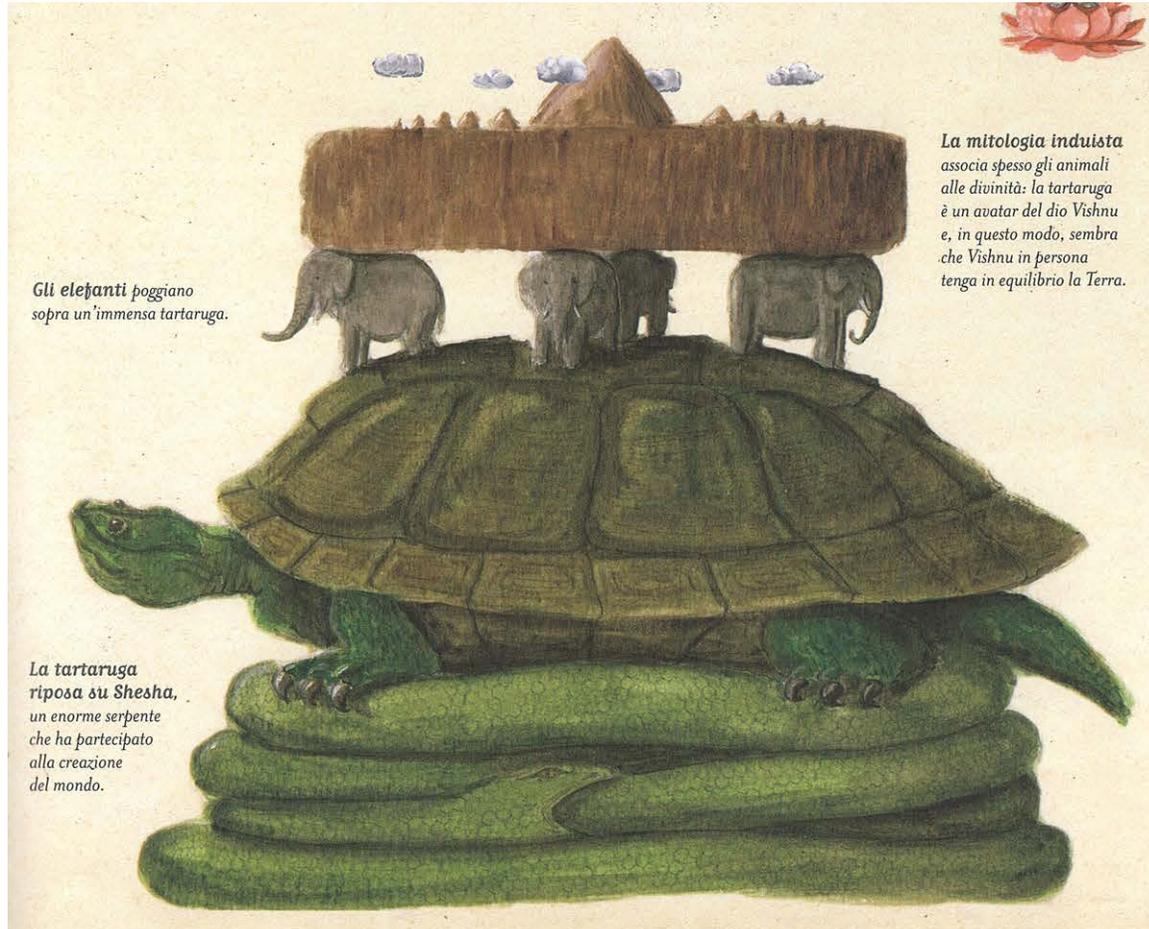
Aperitivi scientifici coi piedi per Terra!

Ri-costruiamo la Terra: alla scoperta delle
profondità del nostro pianeta e di altri mondi.

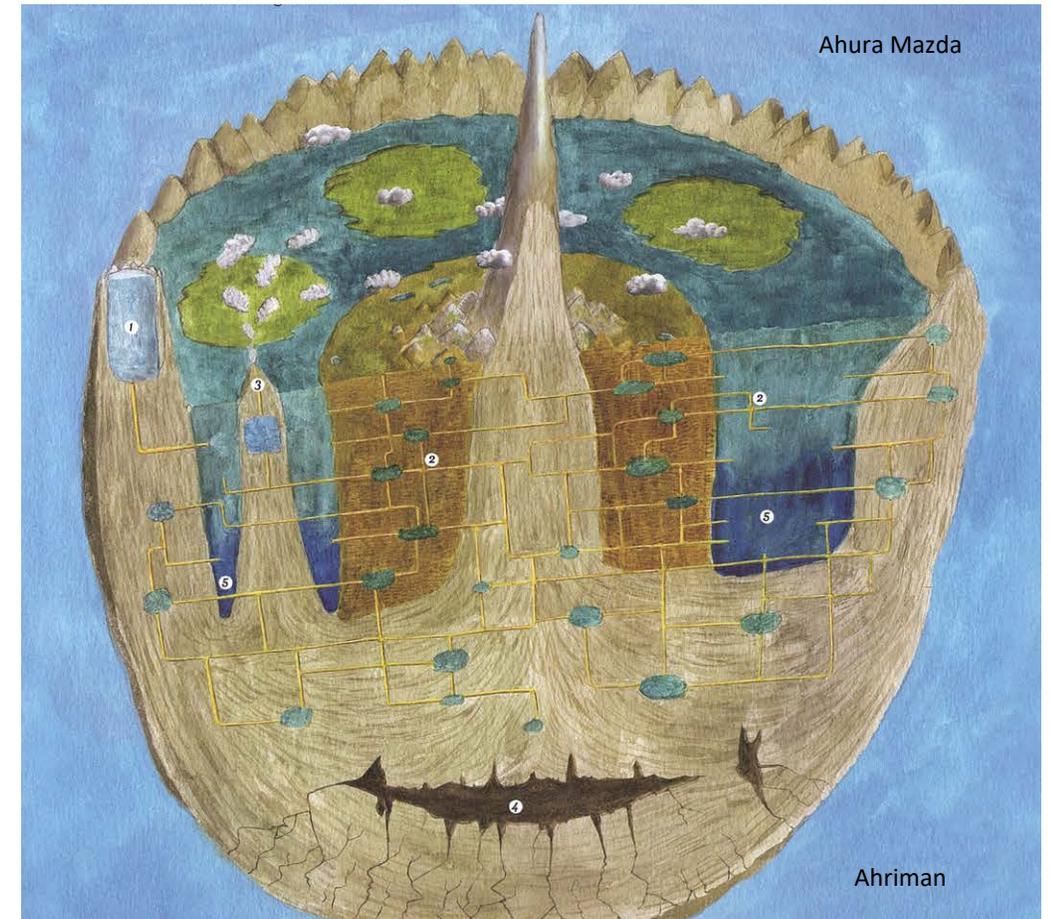


Stefano
Poli

India V sec. a.C.



L'interno della Terra nell'antichità



Iran VI sec. a.C.

L'interno della Terra nell'antichità



A—STRAIGHT *vena profunda*. B—CURVED *vena profunda* [should be *vena dilatata*(?)].

Similarly some *venae dilatatae* are horizontal, some are inclined, and some are curved.



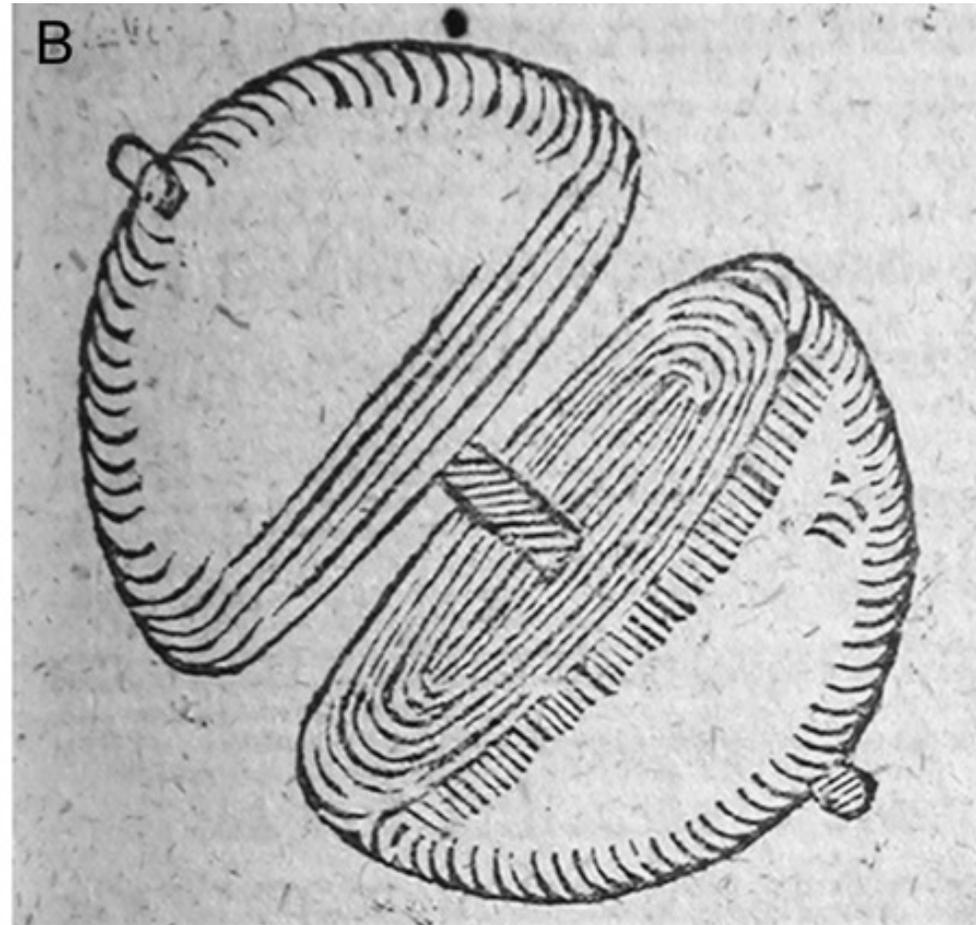
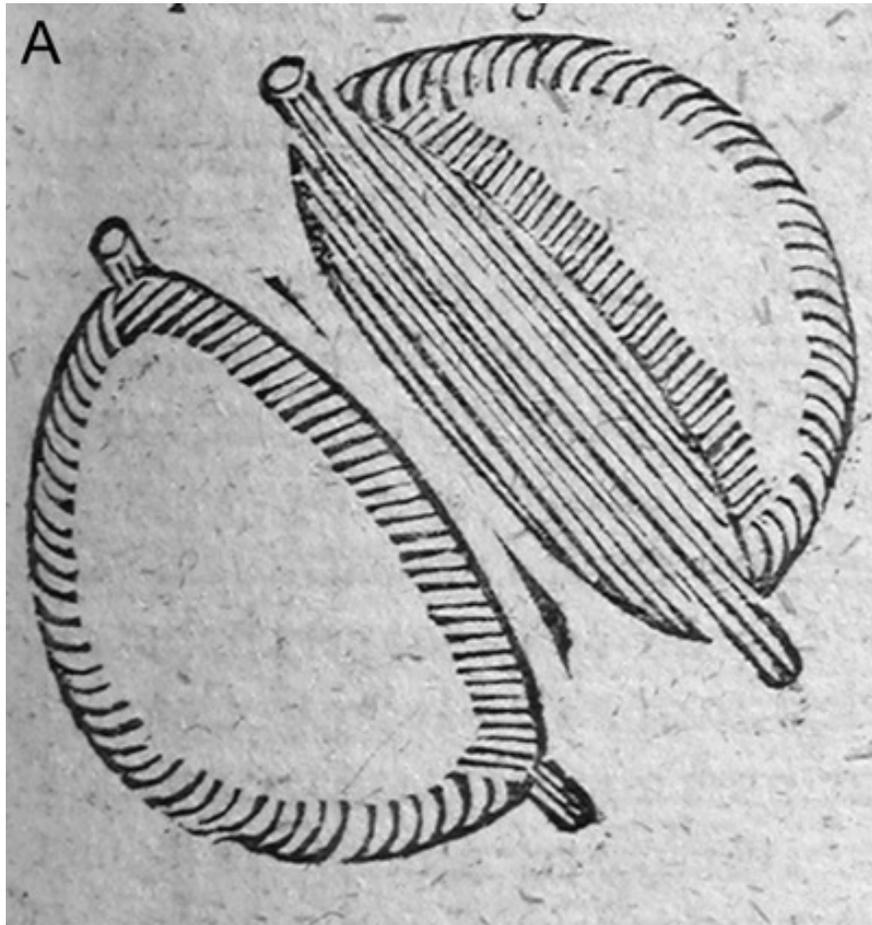
A—HORIZONTAL *vena dilatata*. B—INCLINED *vena dilatata*. C—CURVED *vena dilatata*.

7



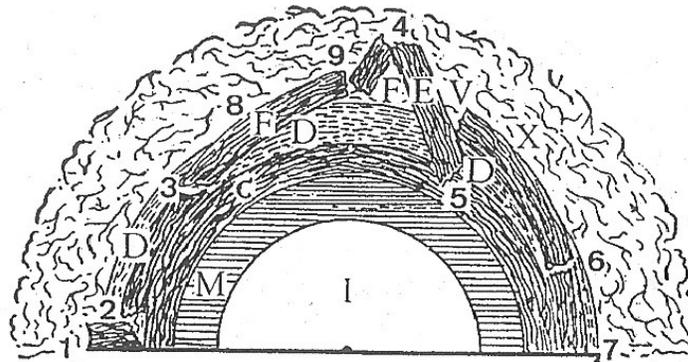
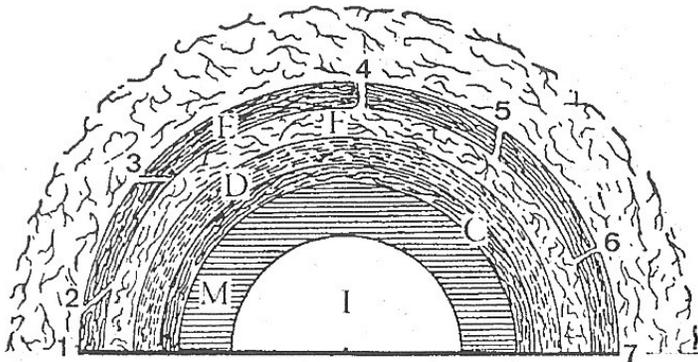
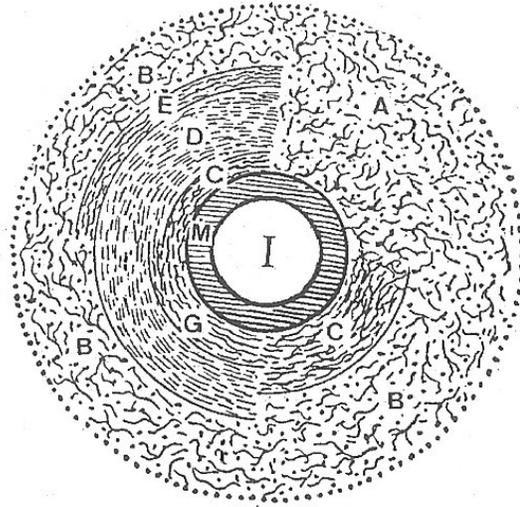
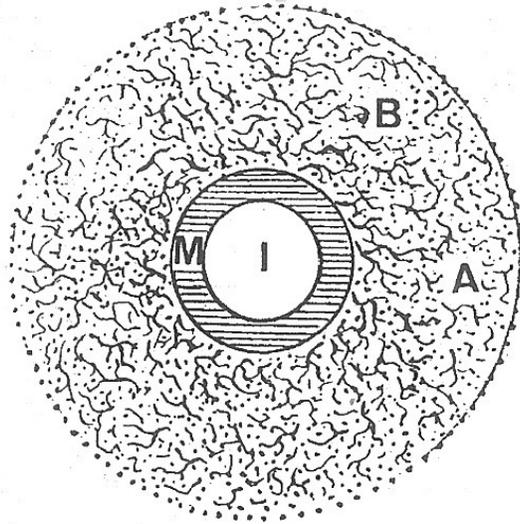
Agricola, *De re metallica*, 1556

L'interno della Terra nell'antichità

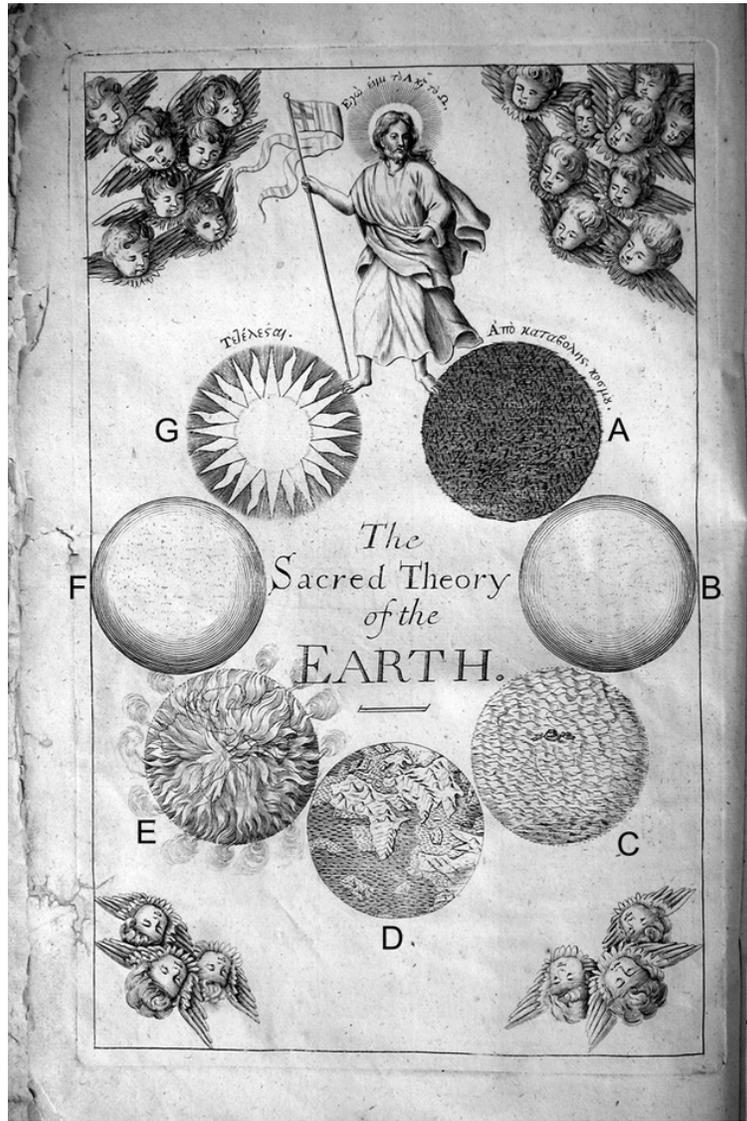


Johannes Kepler, *Epitome of Copernican Astronomy*, 1618

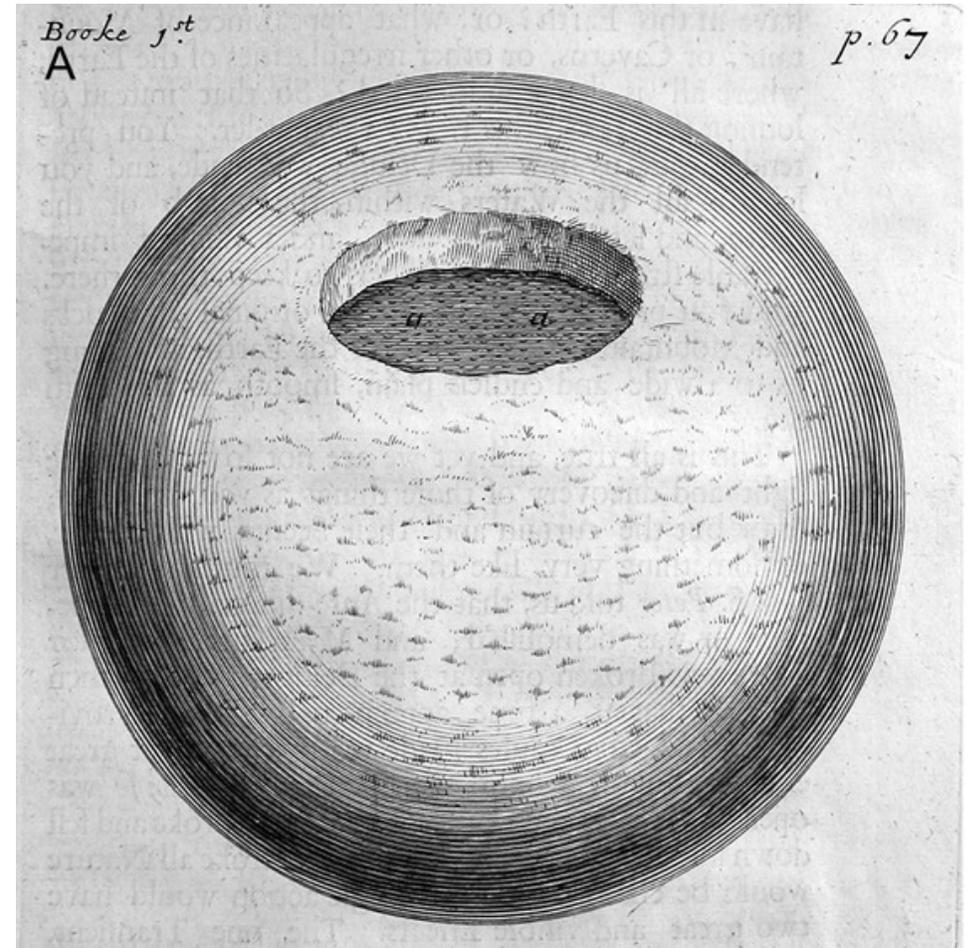
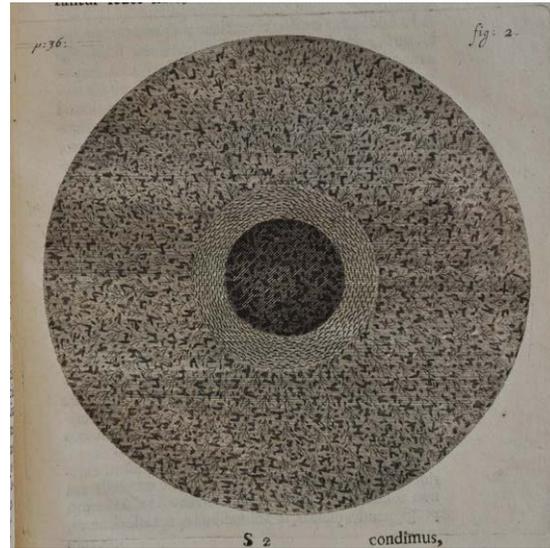
I: Ignis, M: Macula, C: Crustis, D: acqua, E-F: crosta rigida



René Descartes, *Principia Philosophiae*, 1644



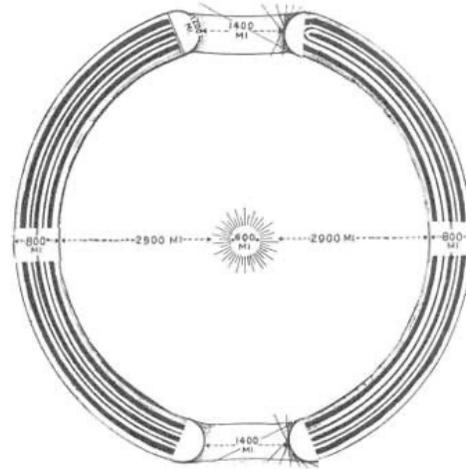
- (a) Chaos
- (b) Paradiso
- (c) Diluvio
- (d) Il mondo attuale
- (e) Conflagrazione
- (f) Millennio
- (g) Consumazione



Thomas Burnet, *Teoria Sacra della Terra*, 1684

La Terra è «cava»?

Halley, XVII secolo
Symmes XIX secolo



Isaac Newton a Richard Bentley, nel 1692:

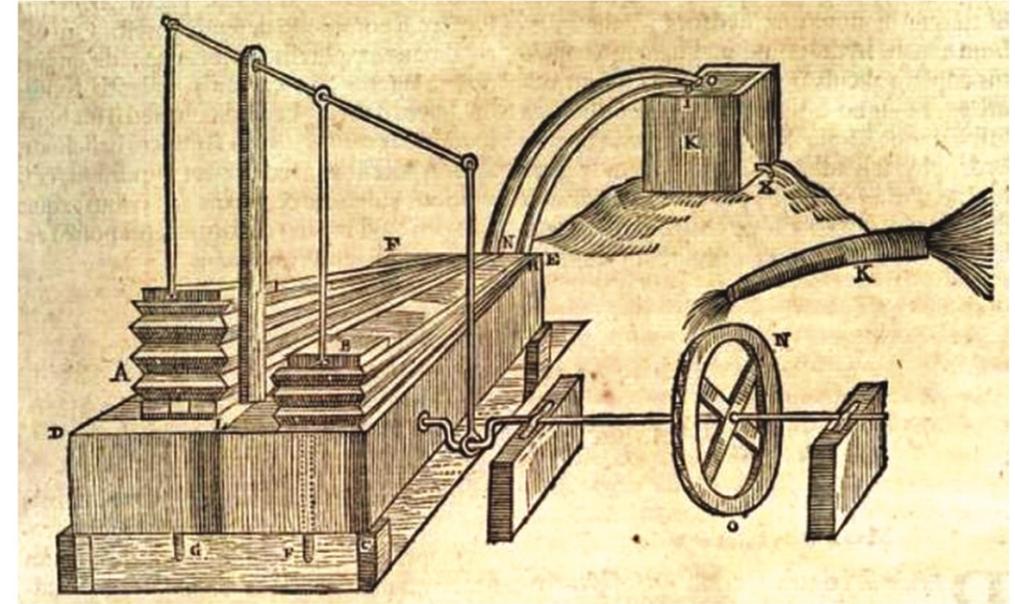
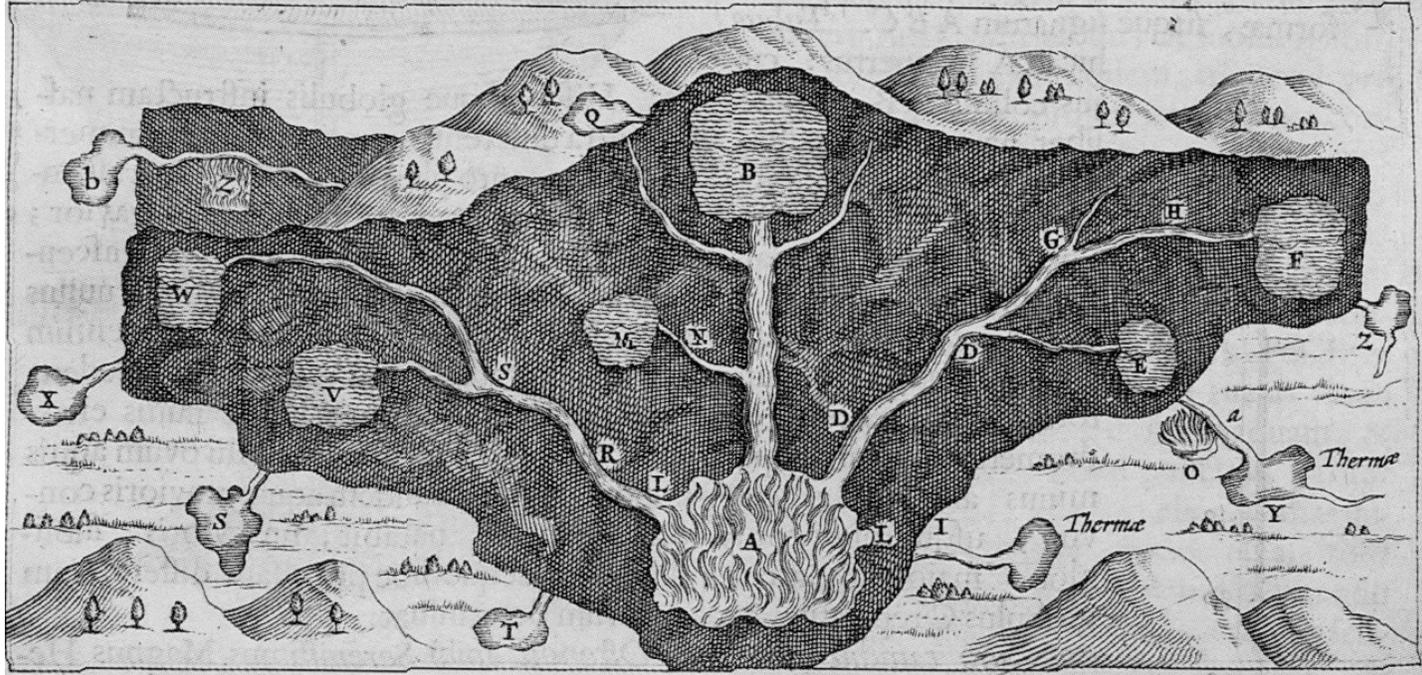
“E così dai fenomeni delle comete, deduco che la materia della Terra e dei pianeti è di una natura molto più fine e uniforme di quella del Sole e delle stelle fisse; e che la materia del Sole e delle stelle fisse è di una natura molto più fine e uniforme di quella delle comete”.



Interazione tra i reticoli detti:

pyroplacia
aerophilacia
hydrophilacia

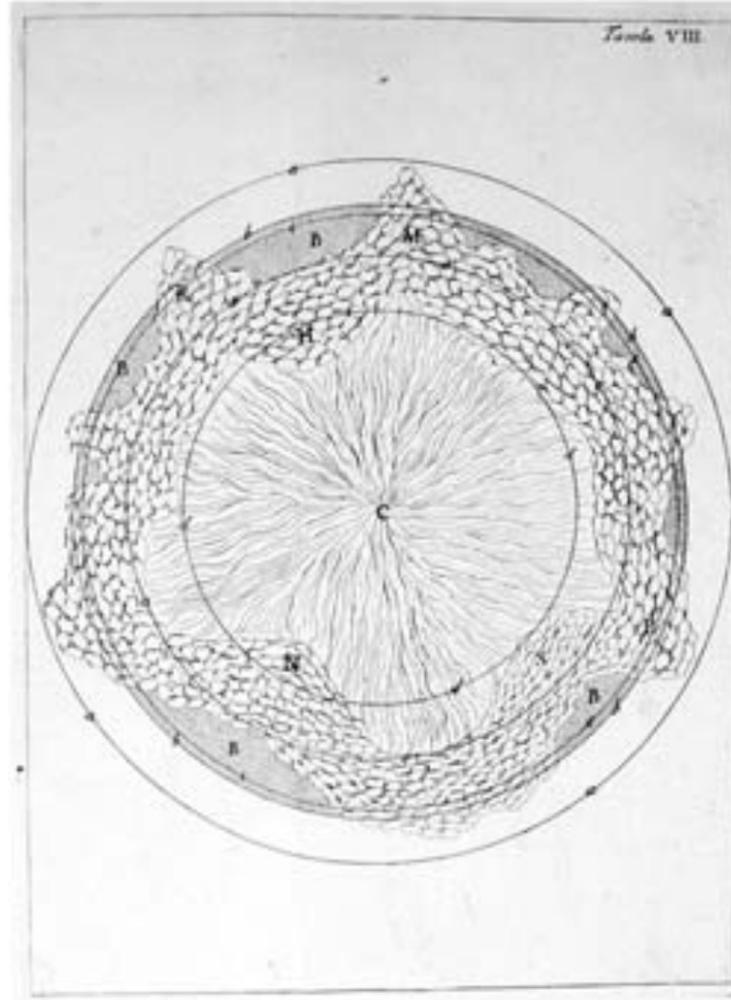
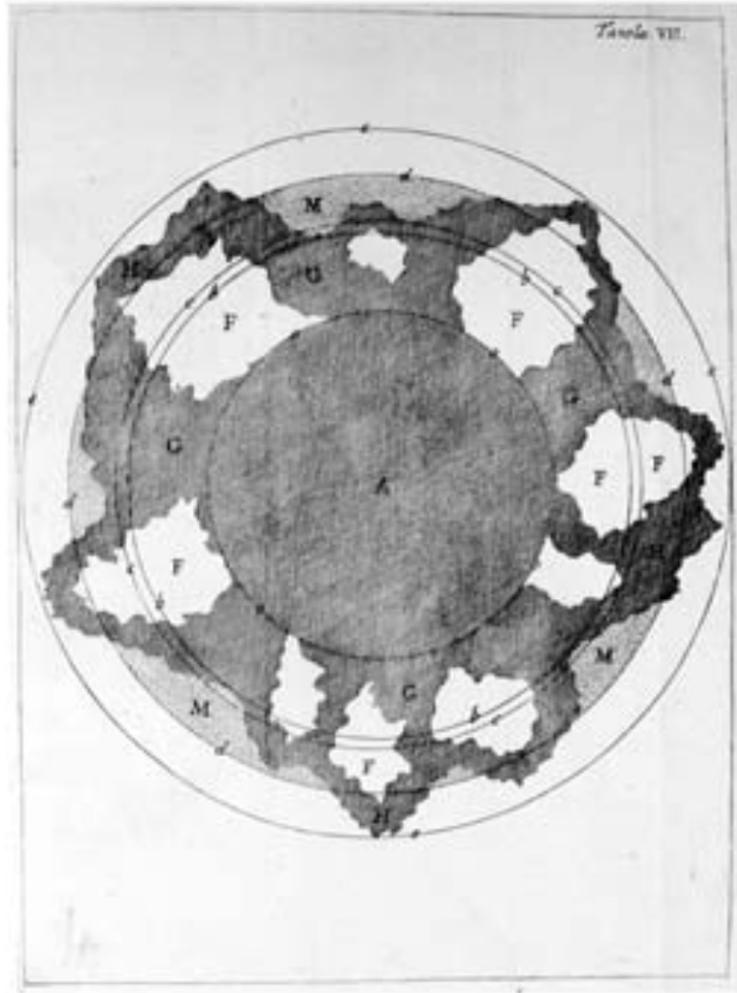
Athanasius Kircher, *Mundus subterraneus*, 1655



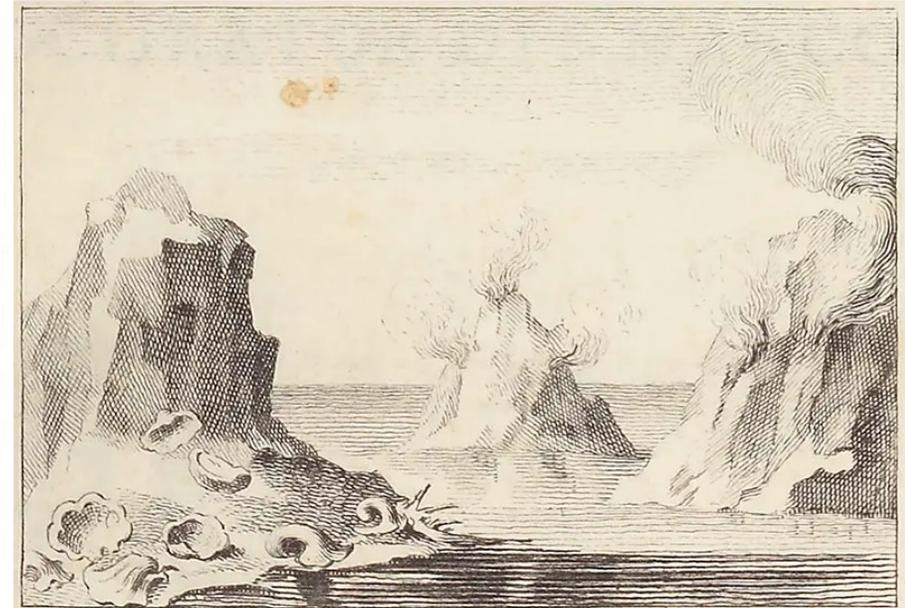
“fontes et flumina omnia ex mari egredi, et in illud redire”

Athanasius Kircher, *Mundus subterraneus*,
1655

L'interno della Terra nell'antichità



Lazzaro Moro, *De Crostacei e degli altri Marini Corpi Che si truovano su' monti*, 1740



Il contributo della Geofisica: il mantello, il nucleo esterno e interno



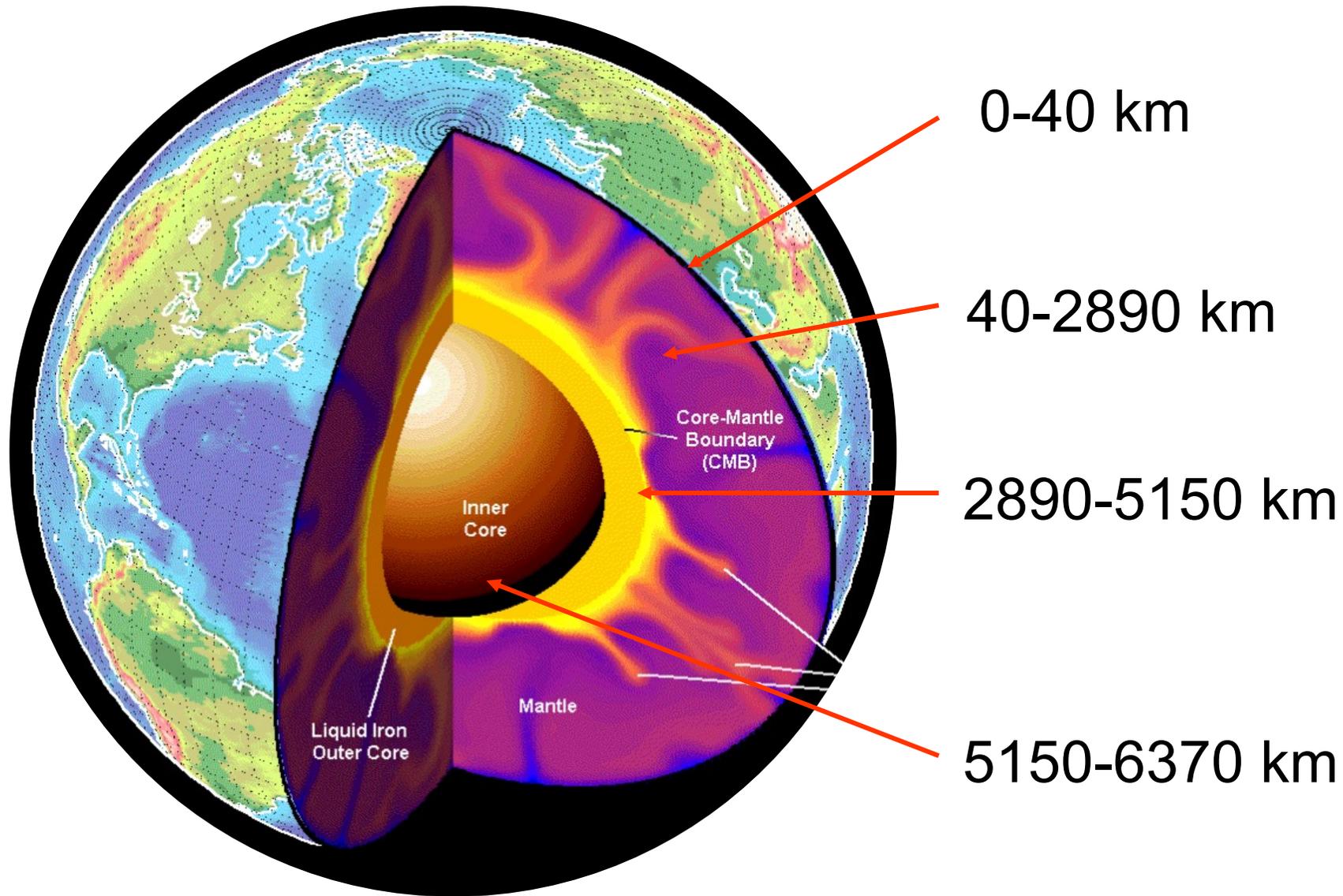
Emil Wiechert

*la Terra ha un
nucleo ricco in ferro
e nichel, 1896*



Beno
Gutenberg

il “Samoa-core”
1914



Pressione



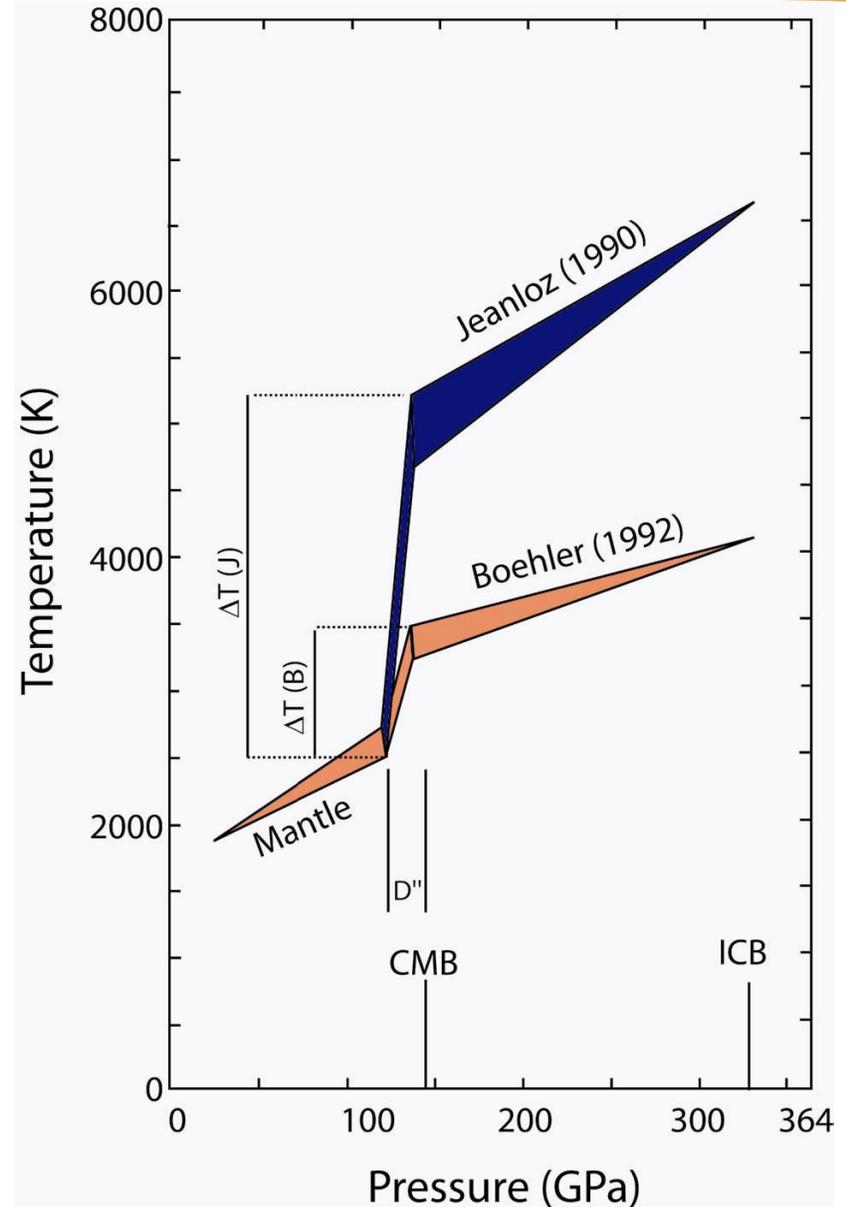
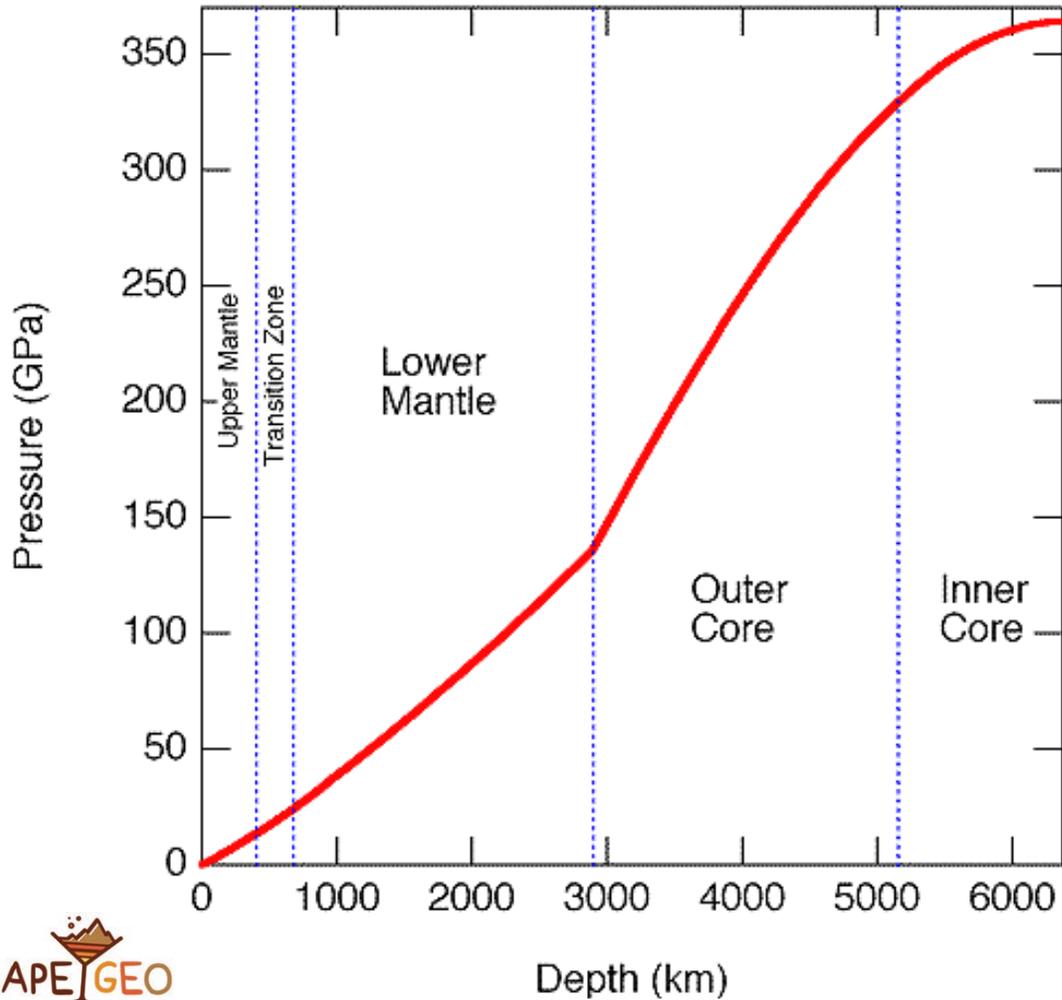
fino a 50 bar

Temperatura



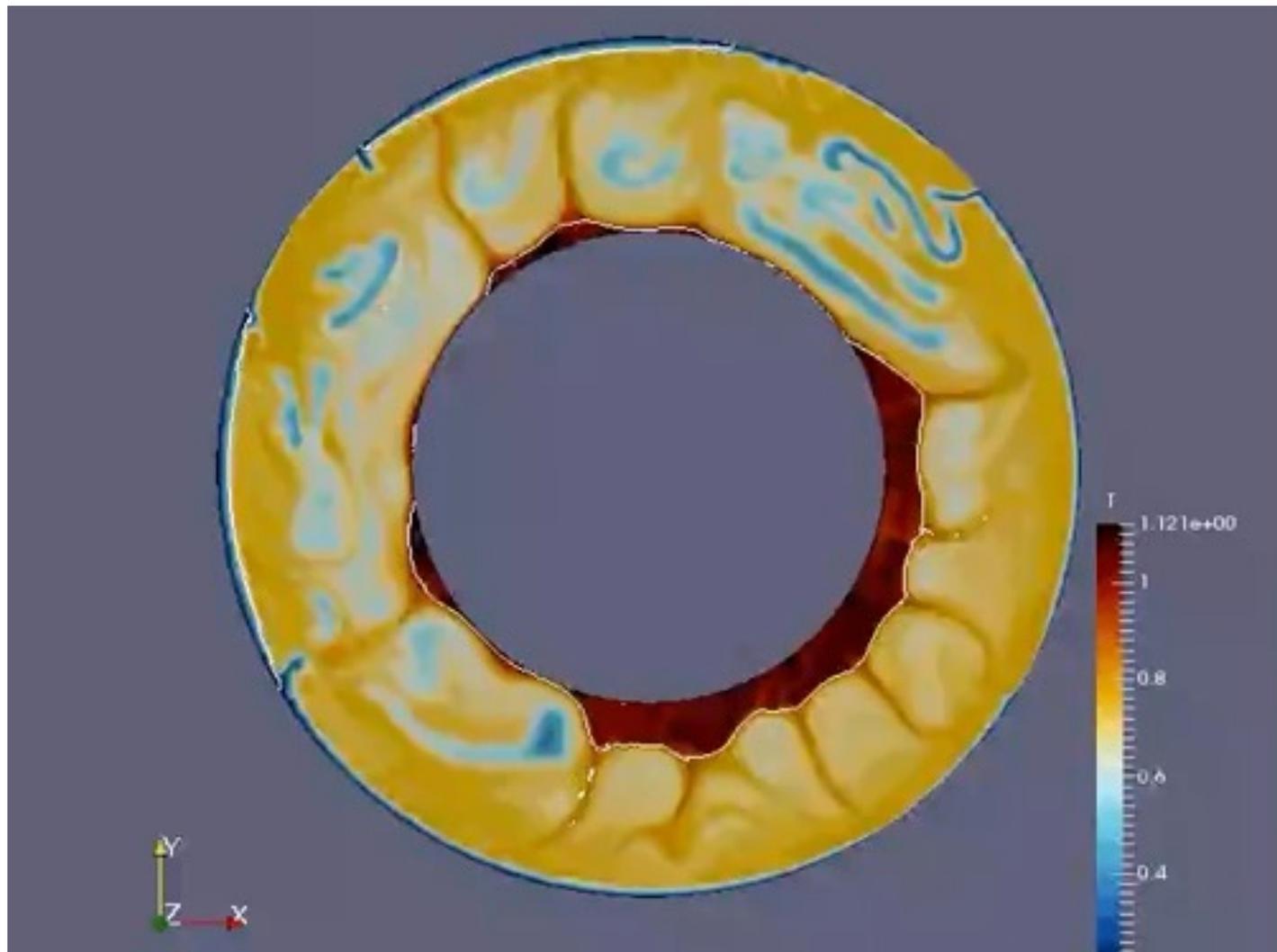
circa 800 ° C

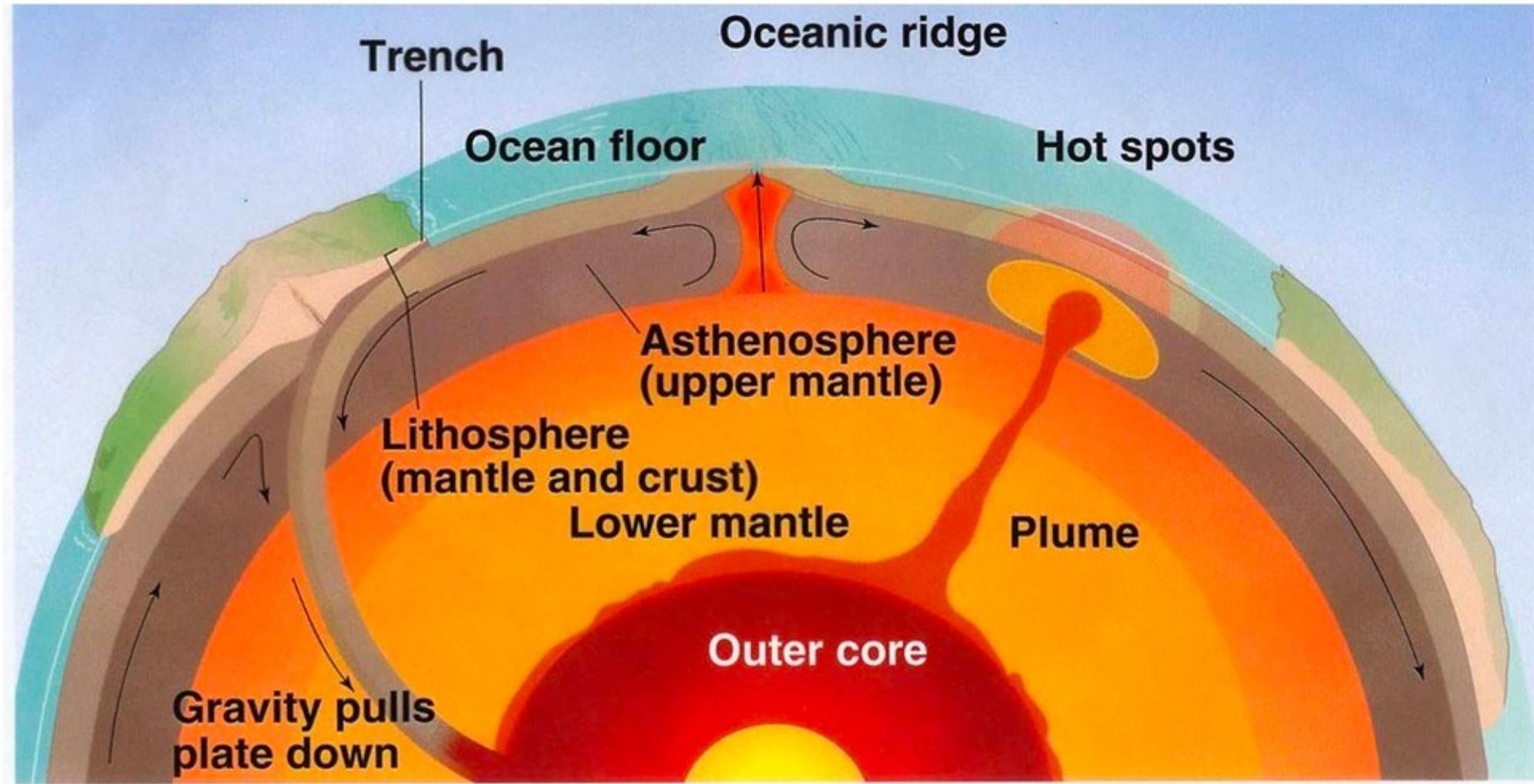
3.638.500 bar al centro della Terra,
6378 km di profondità (all'equatore)
(1 GPa = 10.000 bar)



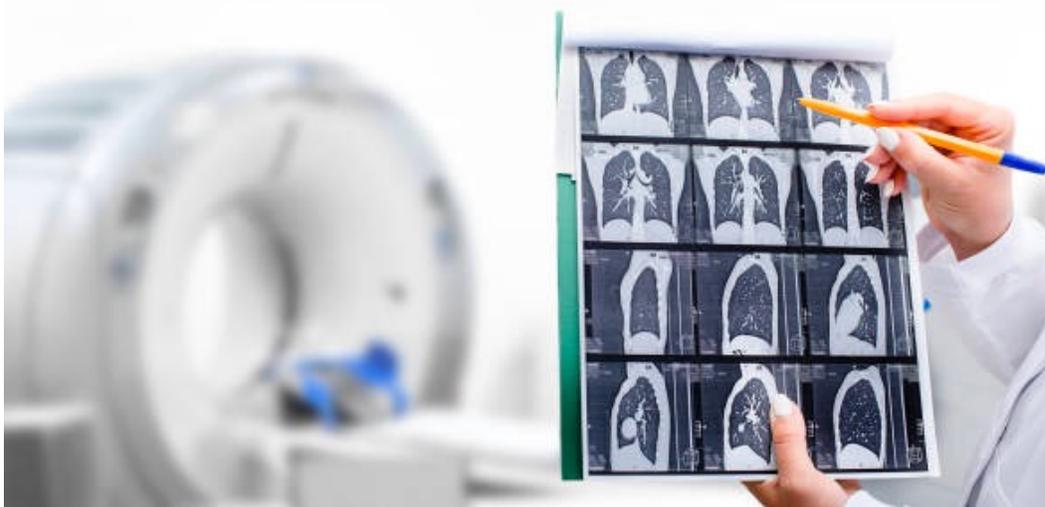
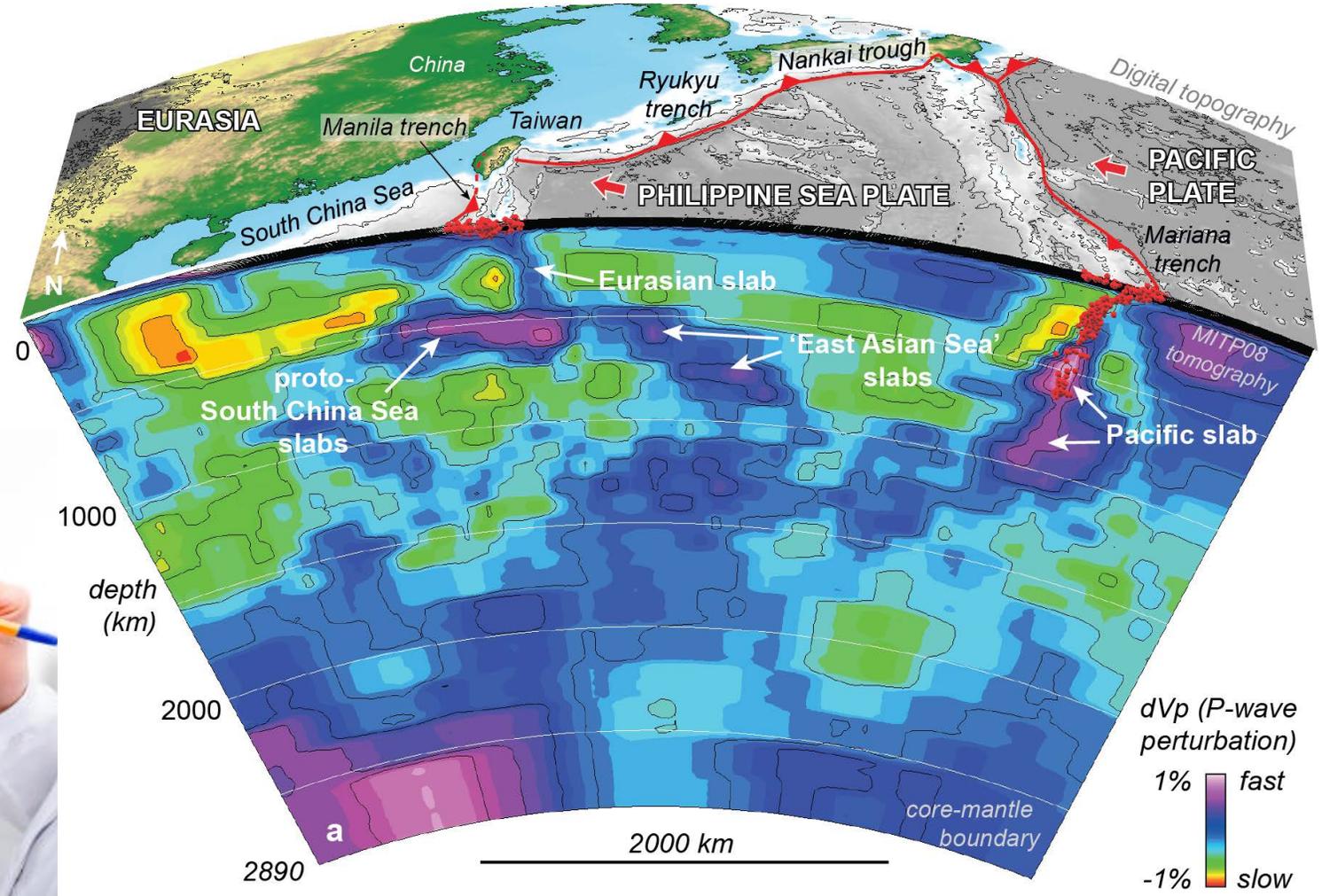
Ri-costruiamo la Terra:
alla scoperta delle profondità del nostro pianeta e di altri mondi.

Le rocce fluiscono nel tempo geologico





Tomografia sismica

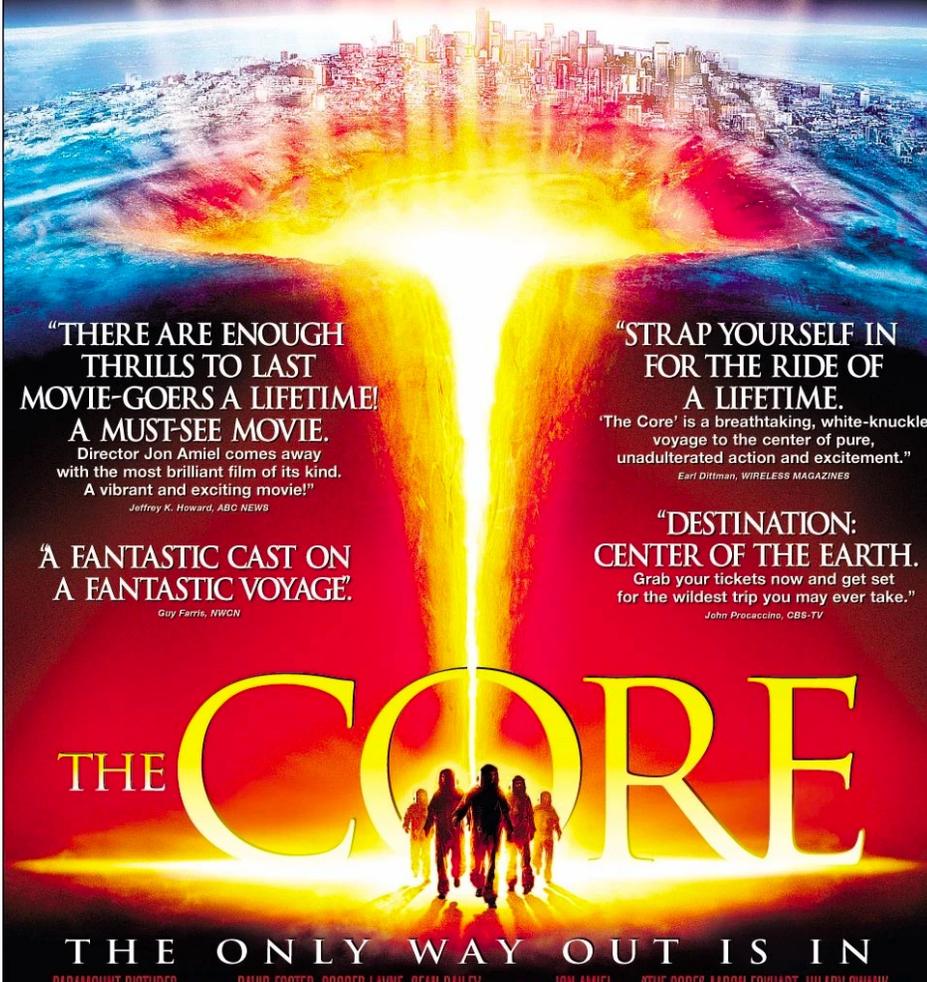


Li et al. (2008)

"100% EXCITING!"

A good old fashion edge-of-your-seat sci-fi thrill ride that's a total blast."

Shawn Edwards, FOX-TV



"THERE ARE ENOUGH
THRILLS TO LAST
MOVIE-GOERS A LIFETIME!

A MUST-SEE MOVIE.

Director Jon Amiel comes away
with the most brilliant film of its kind.
A vibrant and exciting movie!"

Jeffrey K. Howard, ABC NEWS

A FANTASTIC CAST ON
A FANTASTIC VOYAGE."

Guy Farris, NWCN

"STRAP YOURSELF IN
FOR THE RIDE OF
A LIFETIME.

'The Core' is a breathtaking, white-knuckle
voyage to the center of pure,
unadulterated action and excitement."

Earl Dittman, WIRELESS MAGAZINES

"DESTINATION:
CENTER OF THE EARTH.

Grab your tickets now and get set
for the wildest trip you may ever take."

John Procaccino, CBS-TV

THE ONLY WAY OUT IS IN



Ri-costruiamo la Terra:
alla scoperta delle profondità del nostro pianeta e di altri mondi.

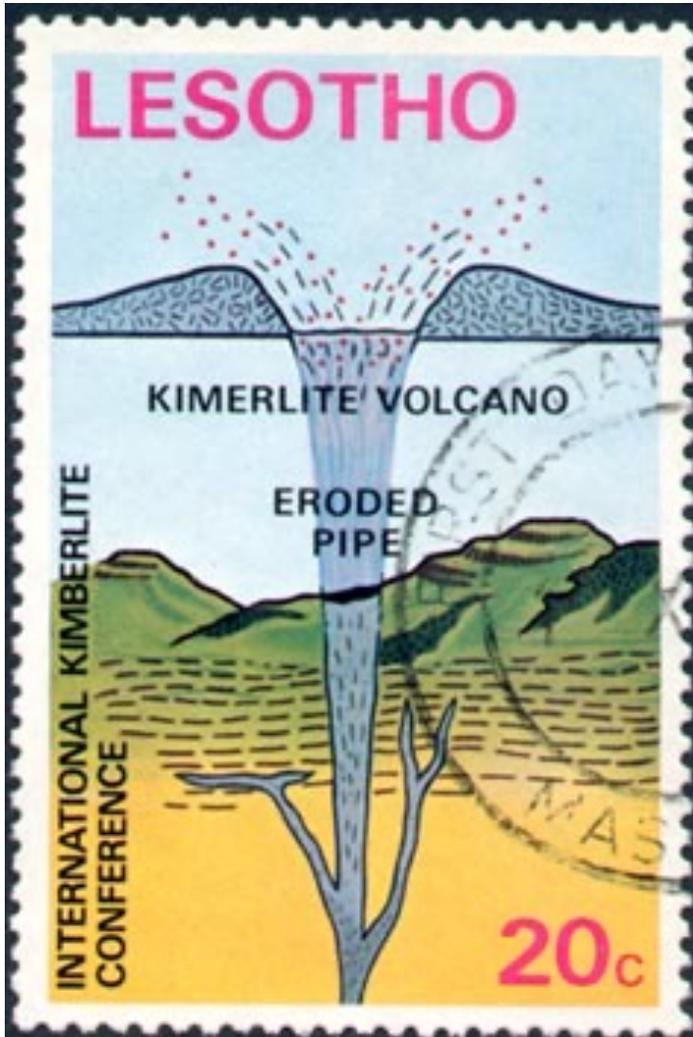
La perforazione superprofonda alla penisola di Kola (Russia)



Xinjiang's Taklamakan Desert

Messaggeri dall'interno della Terra: i diamanti

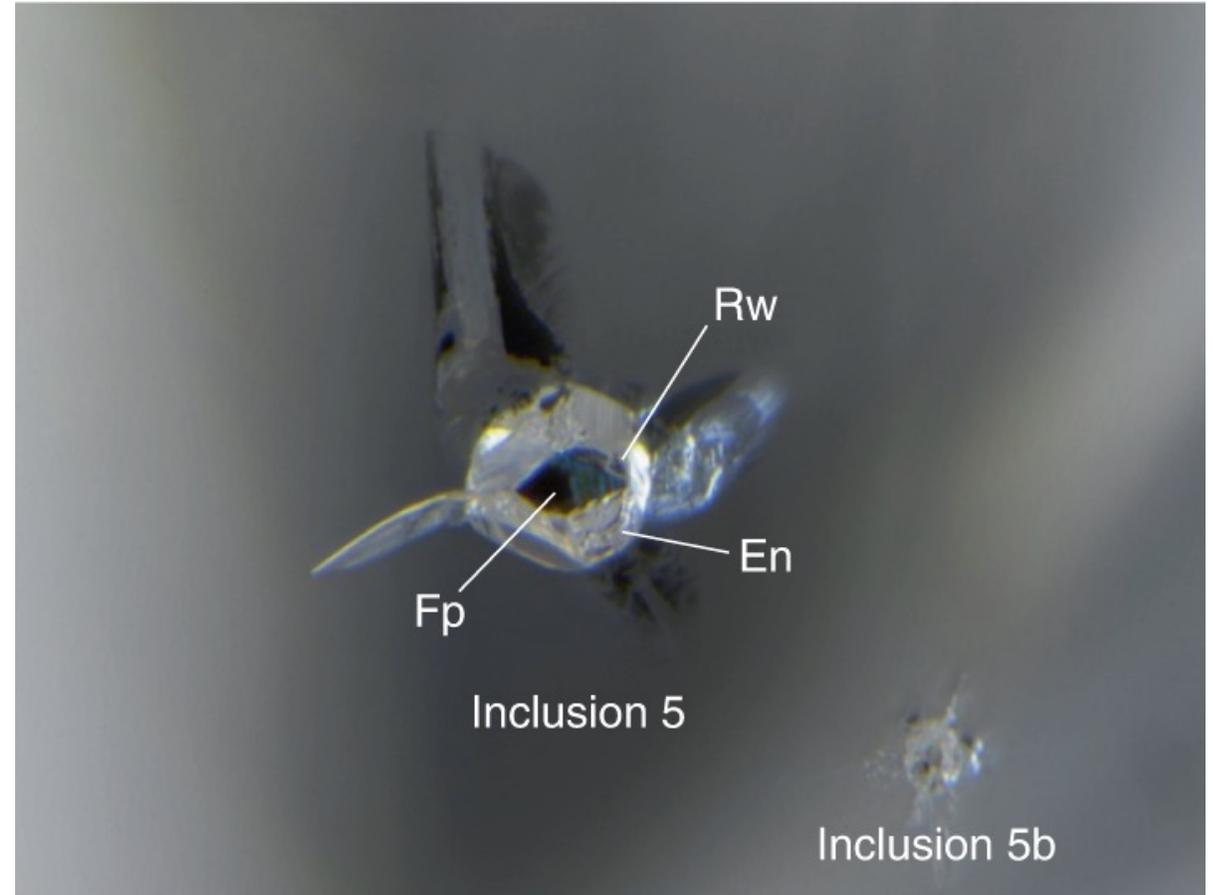
Il diamante Cullinan



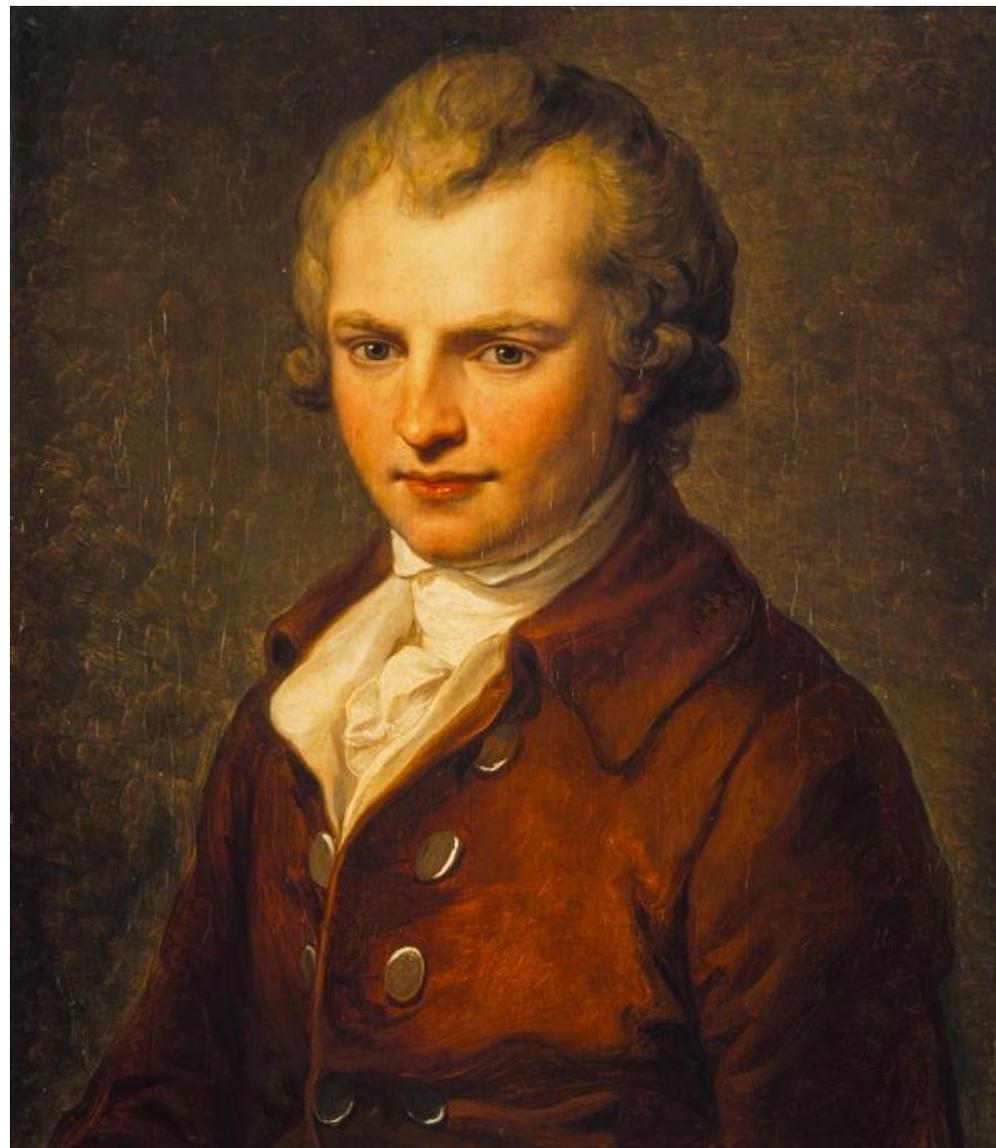
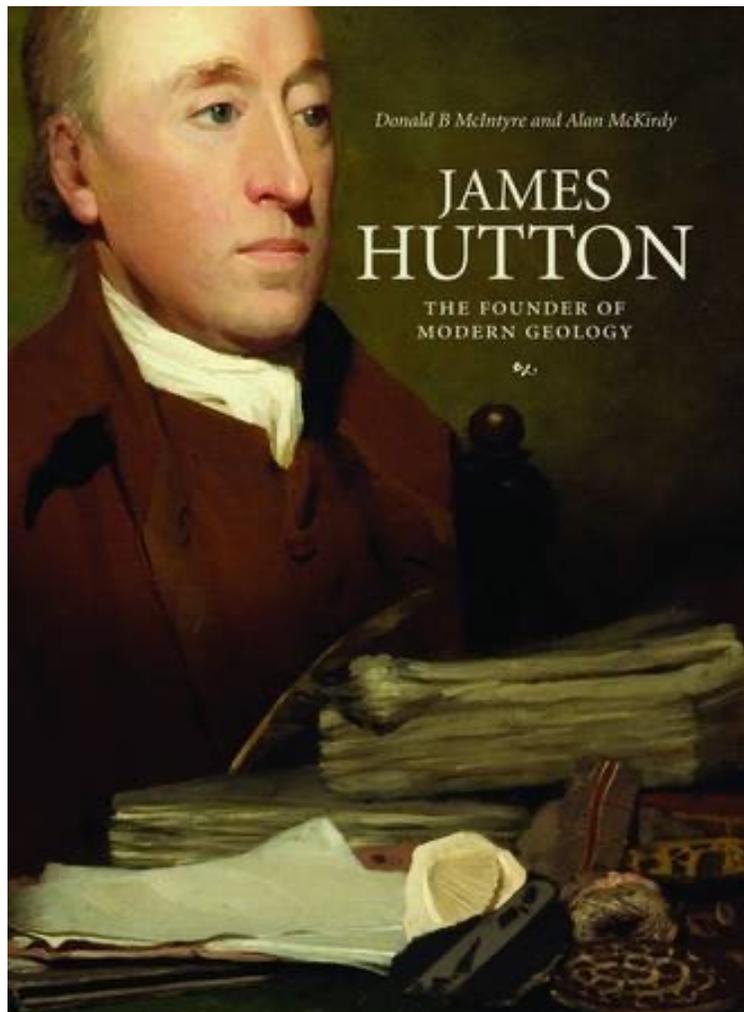
Diamanti dalla discontinuità a 660 km di profondità (1650 °C, 23.5 GPa)



Rw: Ringwoodite, Fp: ferro-periclasio



Gu et al. (2022)



**Sir James Hall
(1761-1832)**

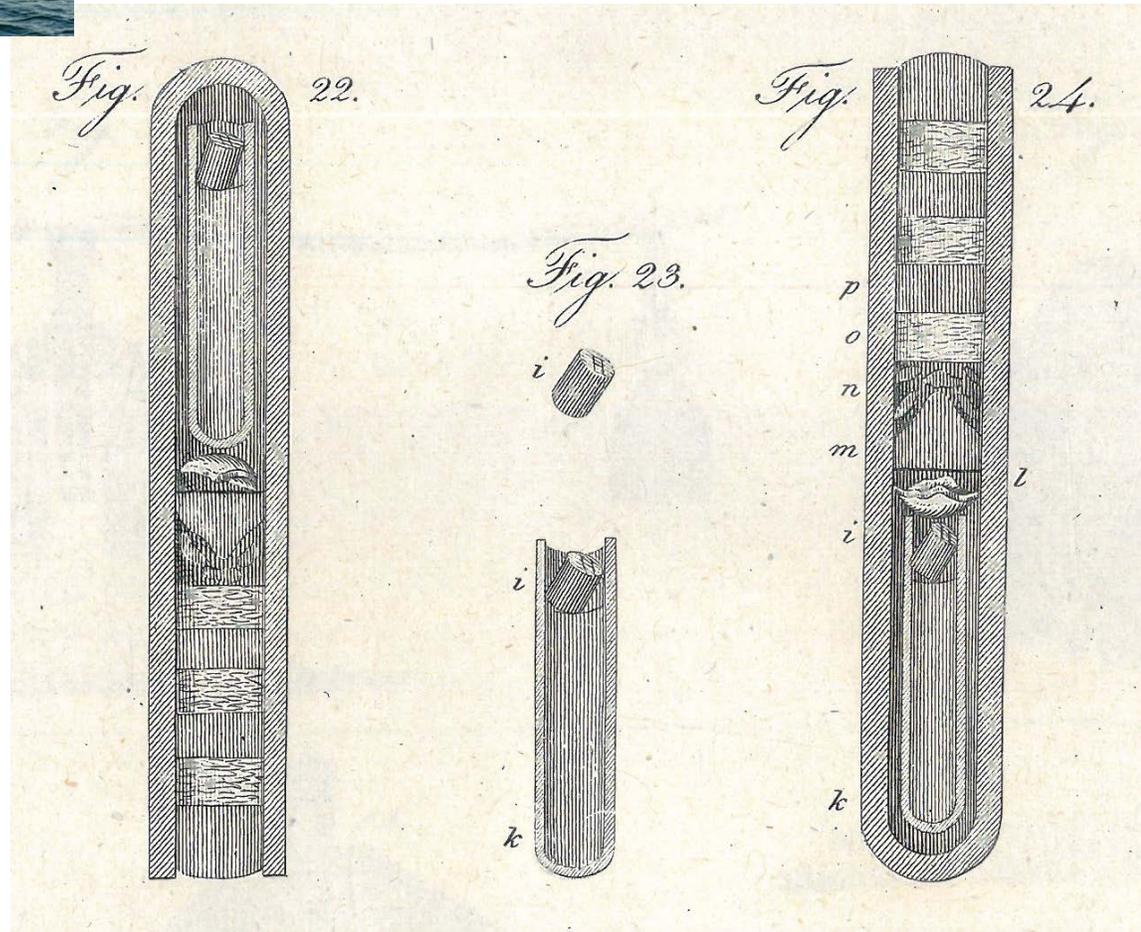
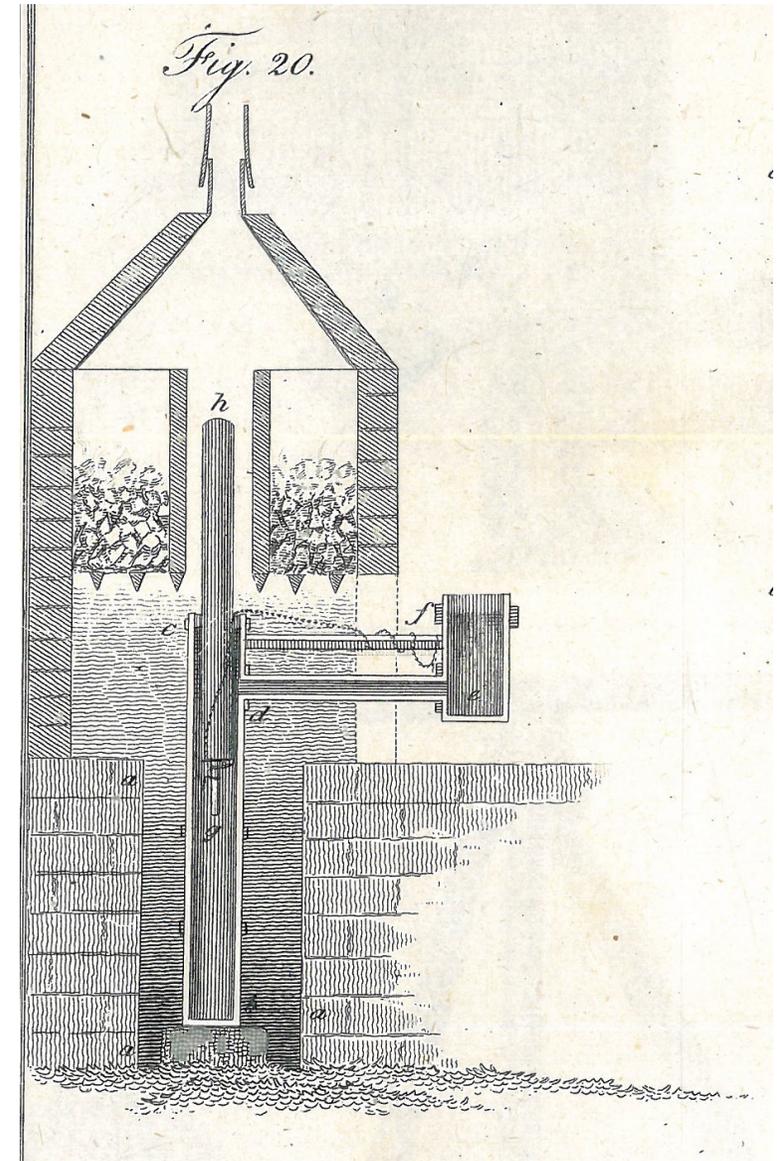
1805

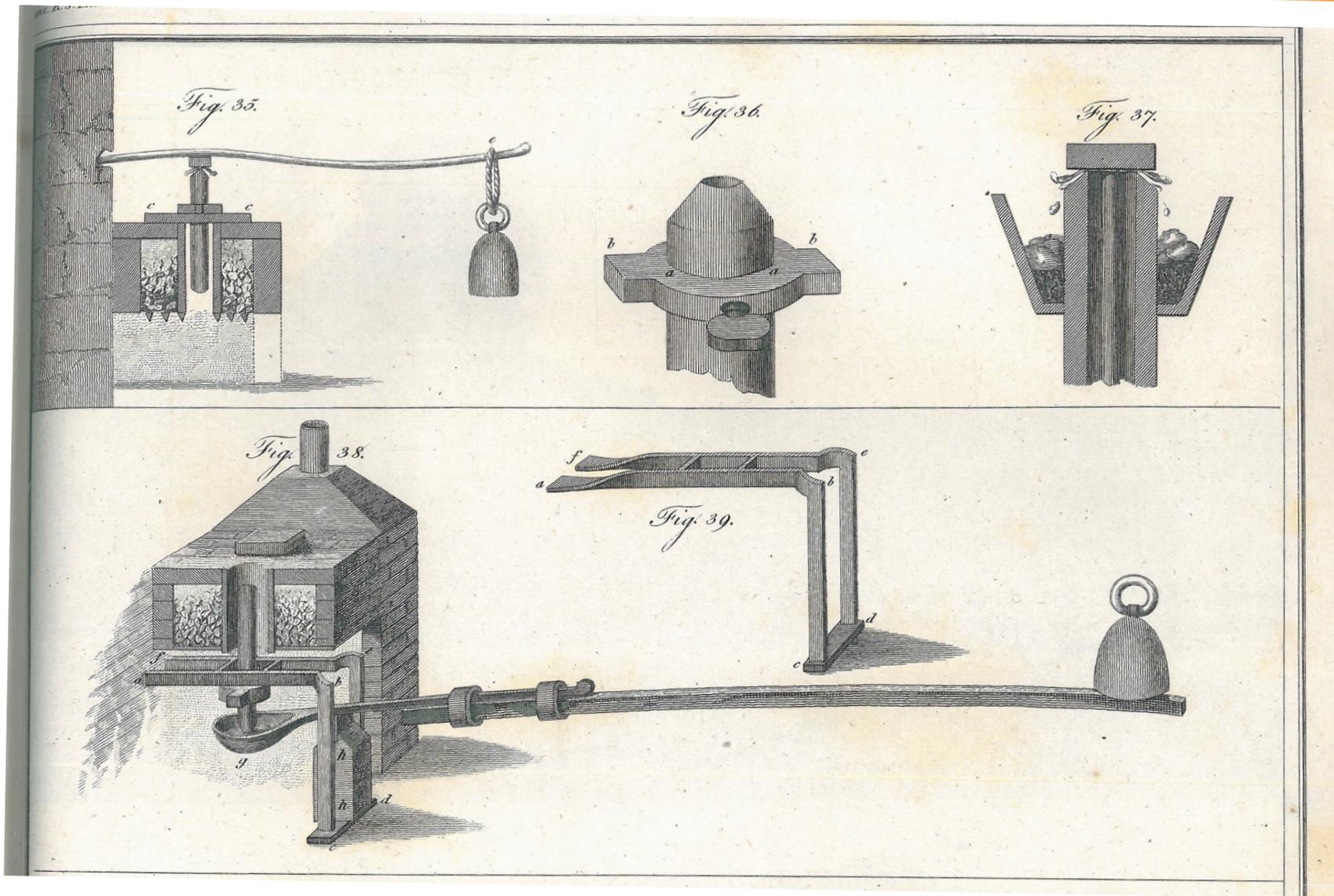
III. ACCOUNT of a SERIES of EXPERIMENTS, *shewing the* EFFECTS of COMPRESSION in modifying the ACTION of HEAT.
By Sir JAMES HALL, Bart. F. R. S. EDIN.

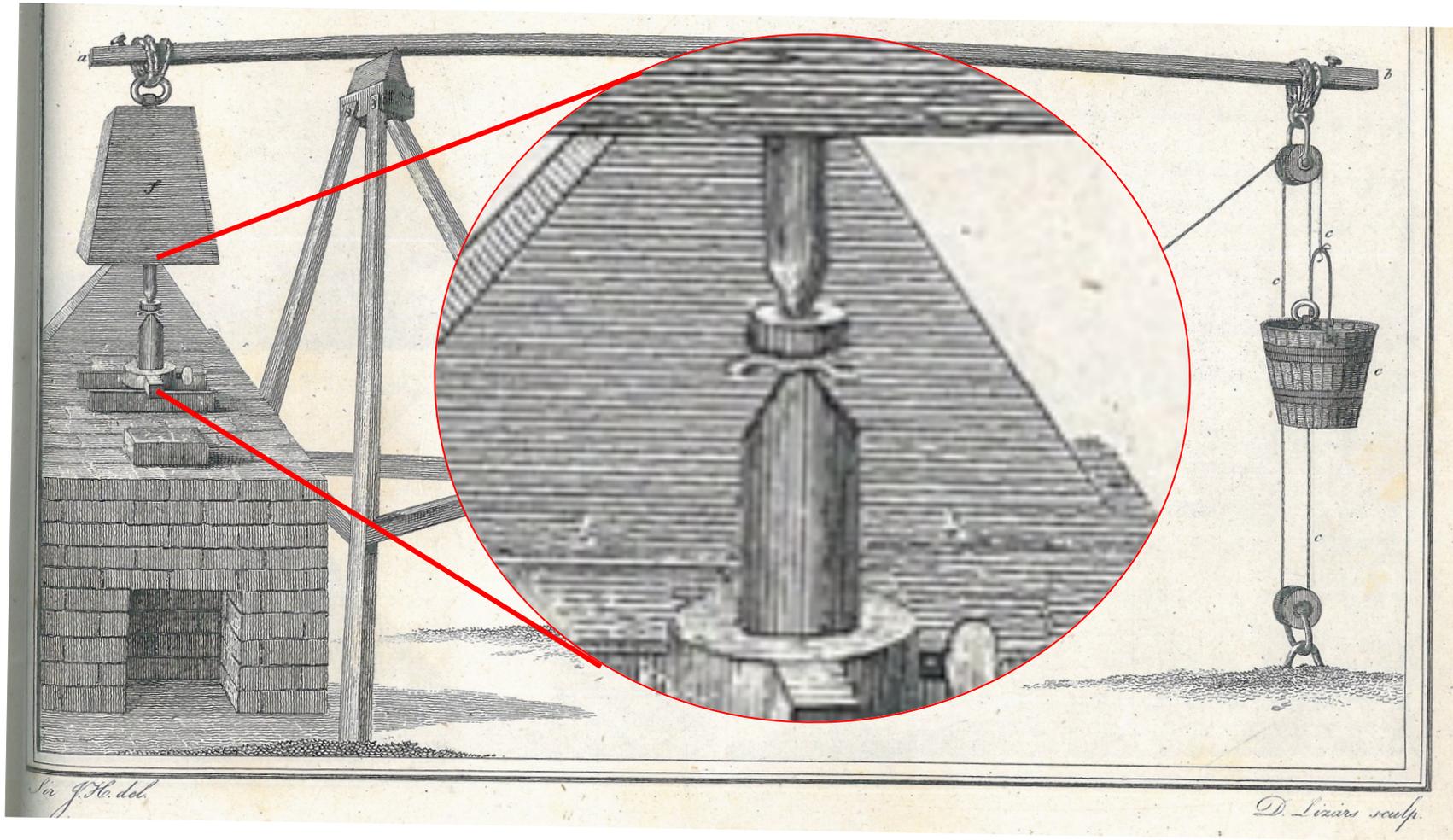
FIRE and WATER, the only agents in nature by which stony substances are produced, under our observation, were employed by contending sects of geologists, to explain all the phenomena of the mineral kingdom.

OF all mineral substances, the *Carbonate of Lime* is unquestionably the most important in a general view. As limestone

Primi esperimenti ad “alta pressione”
 $\approx 50 \text{ MPa}$, $\approx 1000 \text{ }^\circ\text{C}$





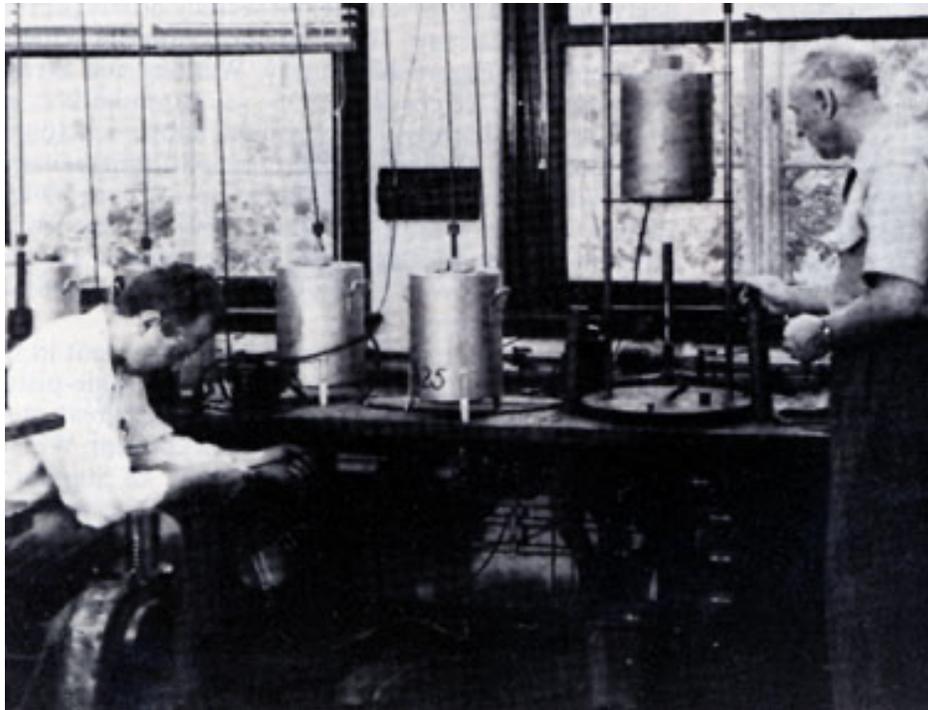


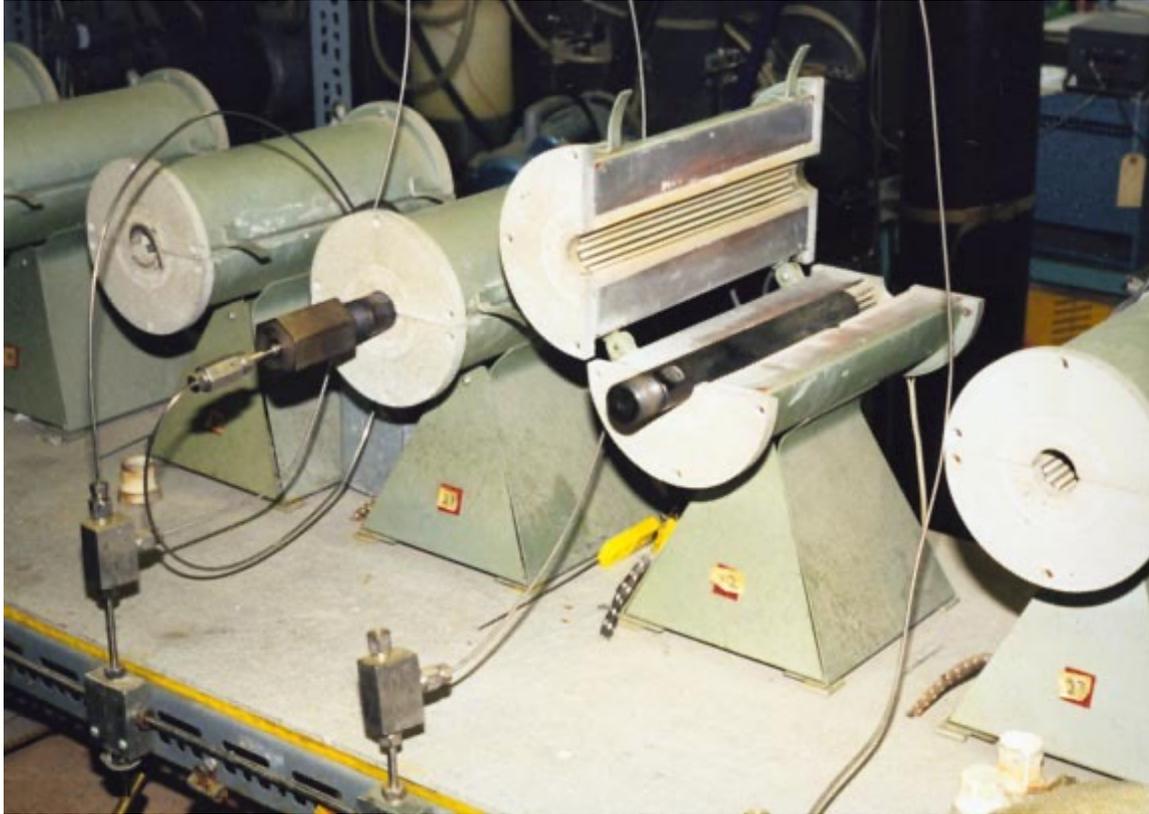
History of the Geophysical Laboratory

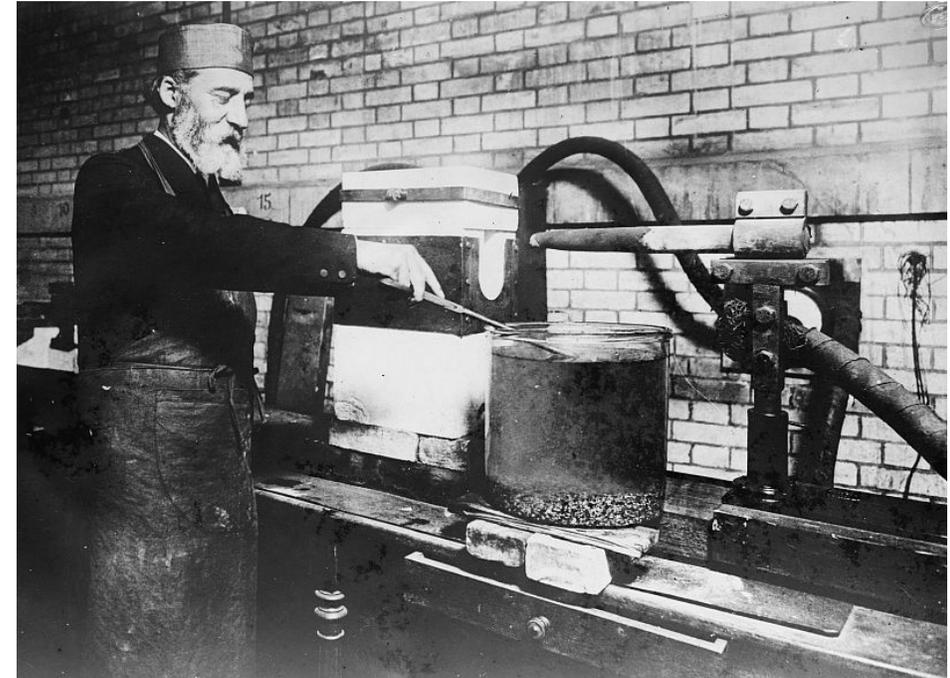
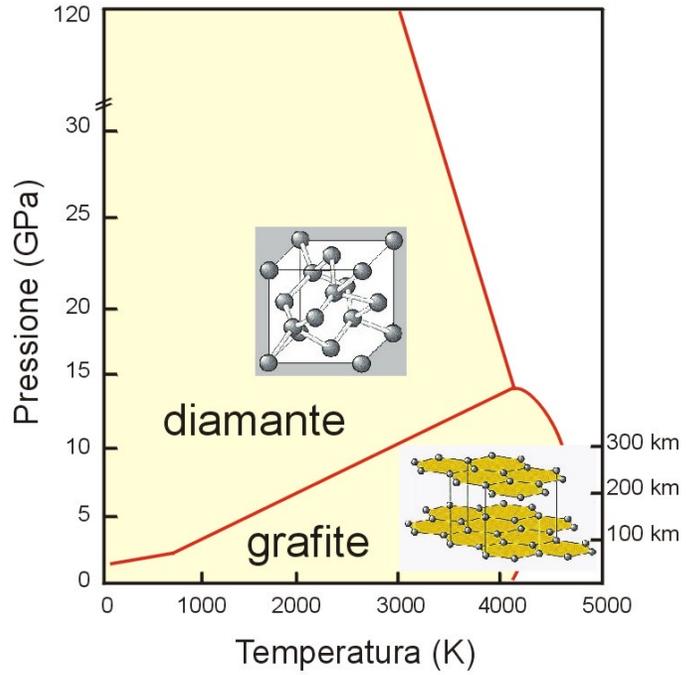


1905, Carnegie Institution for Science, Washington

Norman Levi Bowen 1887 - 1956







Henri Moissan, Premio Nobel 1907

1922

*Il
frigorifero
a gas !!!*



Blinders... *because she*
Shies
At New Ideas



FLYING MACHINES, horseless carriages — they had their skeptics. Every new idea, every great advance, does. Electrolux is no exception.

We don't mind that. For though Electrolux is four years old, has enjoyed a phenomenal success and is today in hundreds of thousands of homes, it is still the new idea, the big radical improvement in automatic refrigerators.

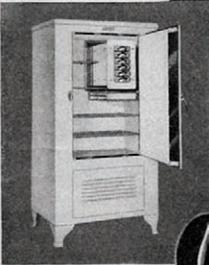
All we ask is that you go and see Electrolux with your eyes wide open. Judge the facts at first hand.

You will find that Electrolux not only freezes ice cubes quickly and provides perfect constant cold always, but does this without sound, without machinery, and at much less cost than any other refrigerator.

Is it any wonder that Electrolux sales in 1931 were far ahead of 1930?

You certainly owe it to yourself to see this remarkable refrigerator that has so greatly changed the old order of things. It is on display at the showroom of your gas company.

And if you'd like complete information by mail, write to us direct for free literature. Electrolux Refrigerator Sales, Inc., Evansville, Indiana.



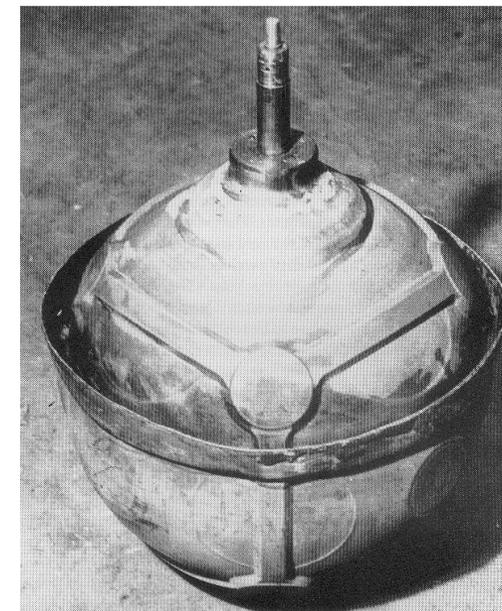
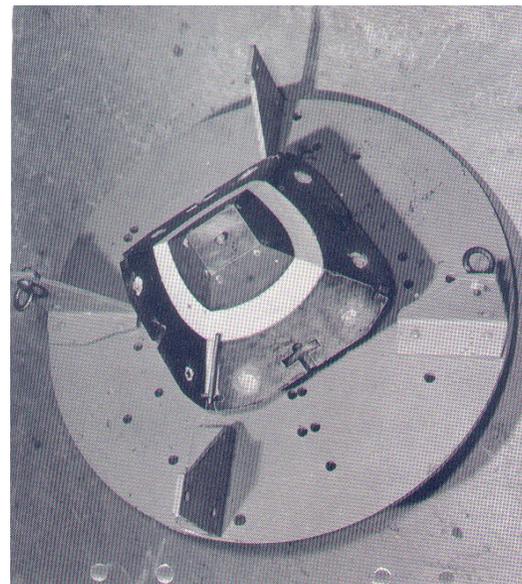
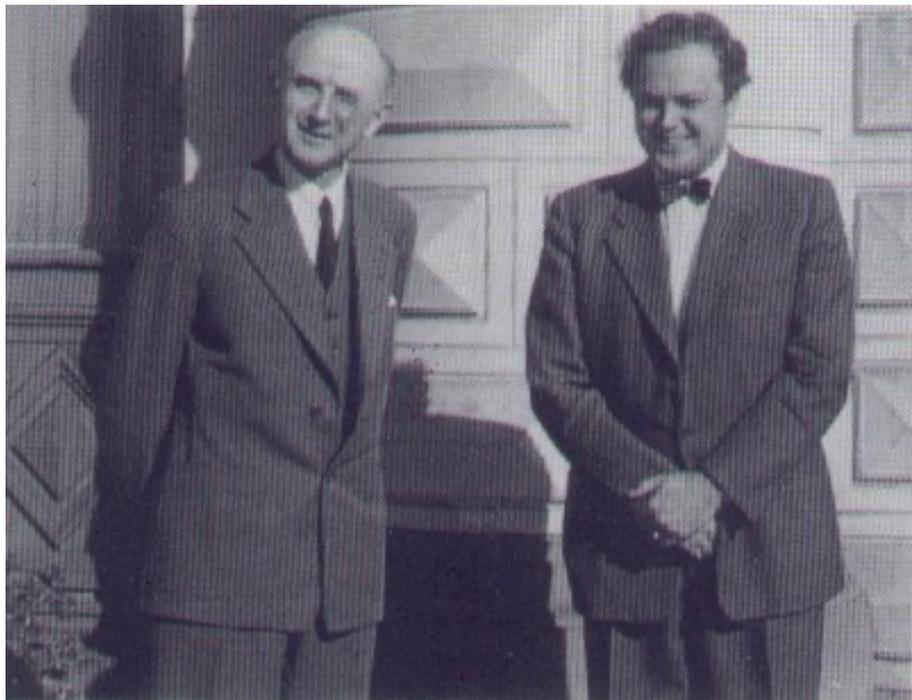
ELECTROLUX
THE *Gas* REFRIGERATOR



The old order changeth — a tiny gas flame takes the place of all moving parts

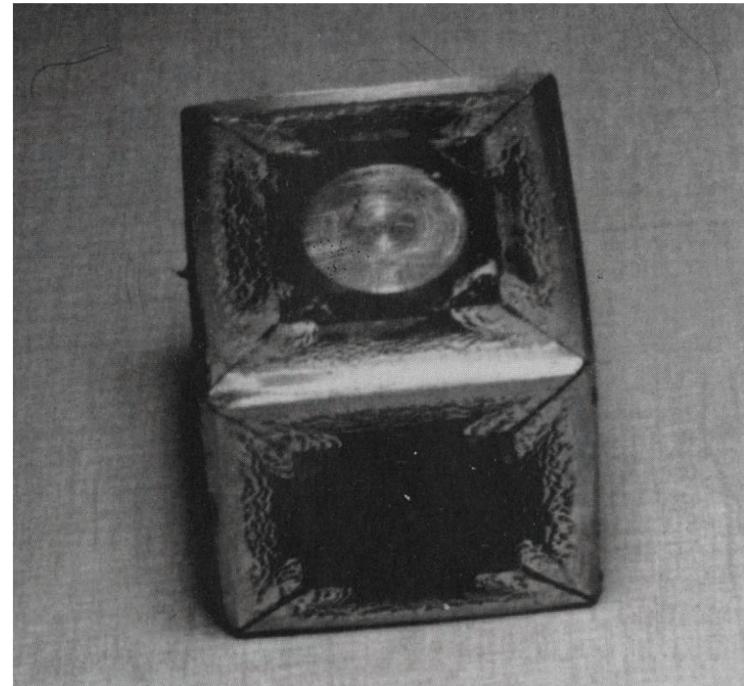
Ri-costruiamo la Terra:
alla scoperta delle profondità del nostro pianeta e di altri mondi.

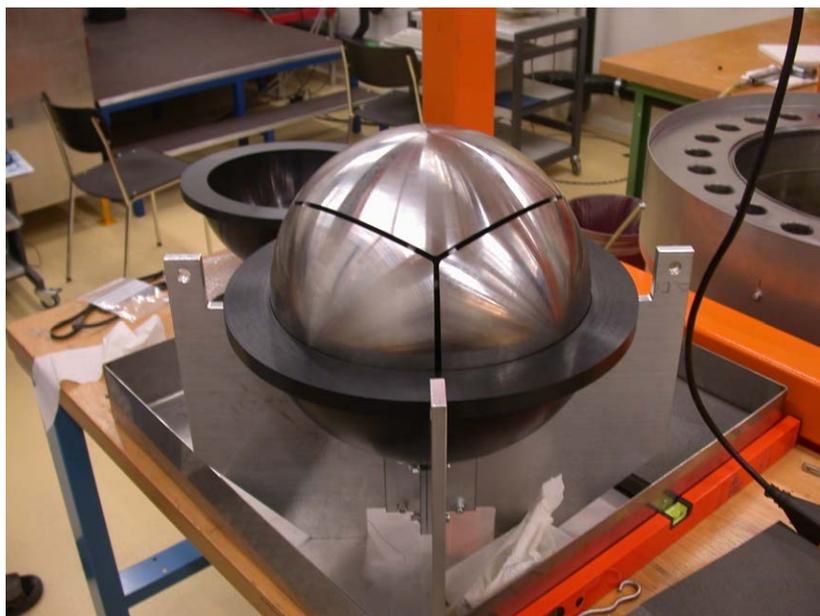
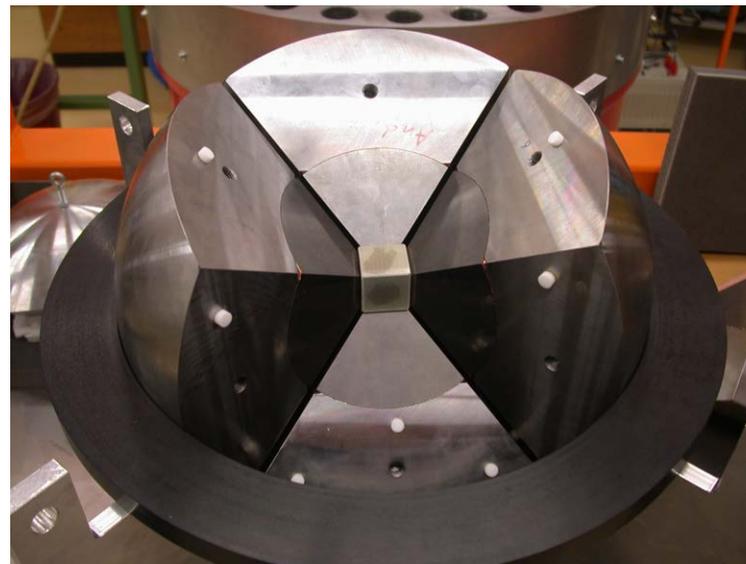
Baltzar von Platen, Erik Lundblad, il progetto QUINTUS ad ASEA (Svezia) e la grande sfida per la sintesi del diamante



16 Febbraio 1953

50000 bar, “fuoco” di thermite







Sintesi e trattamento industriale del diamante

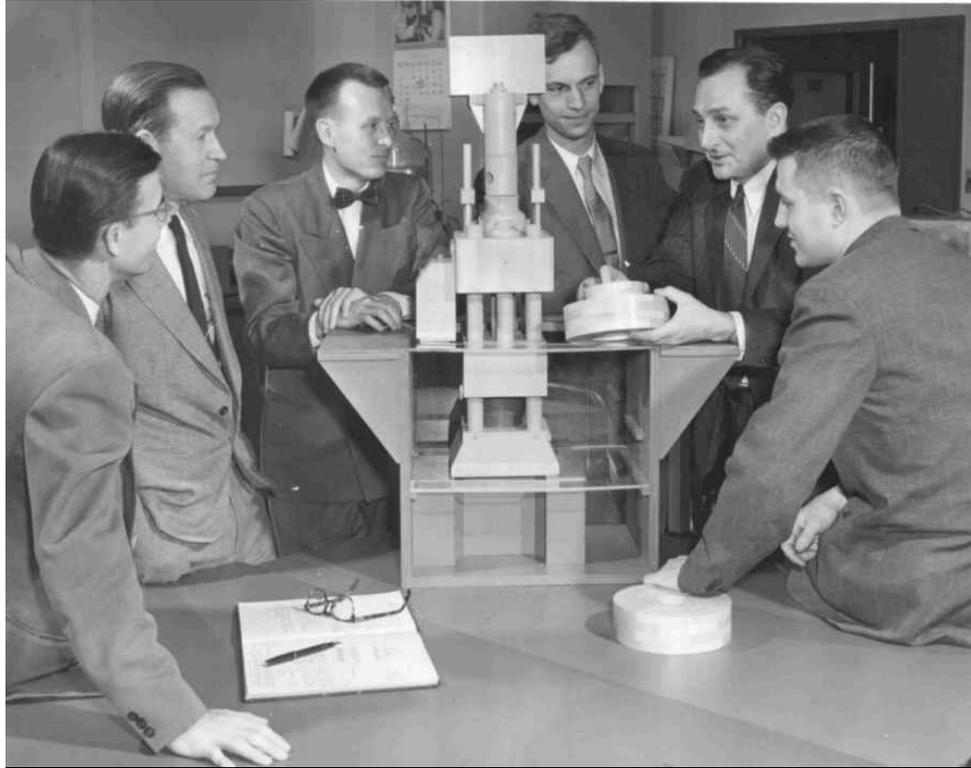


“BARS” Russia

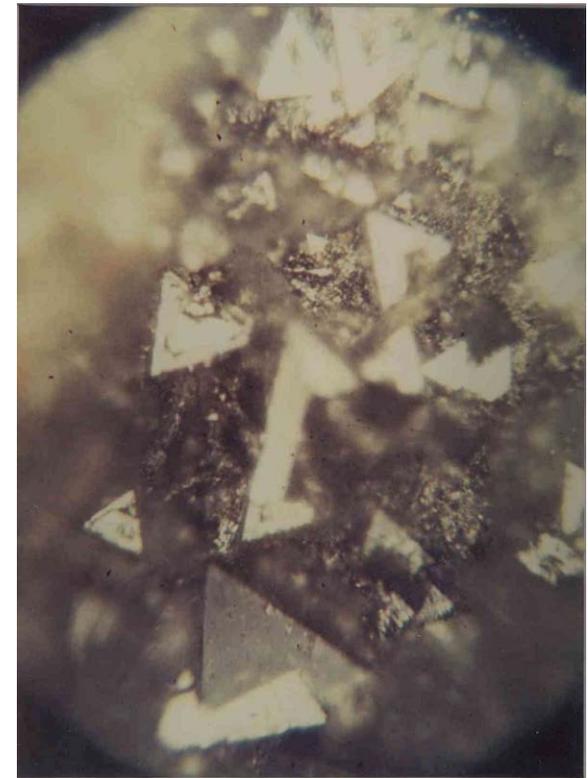


India

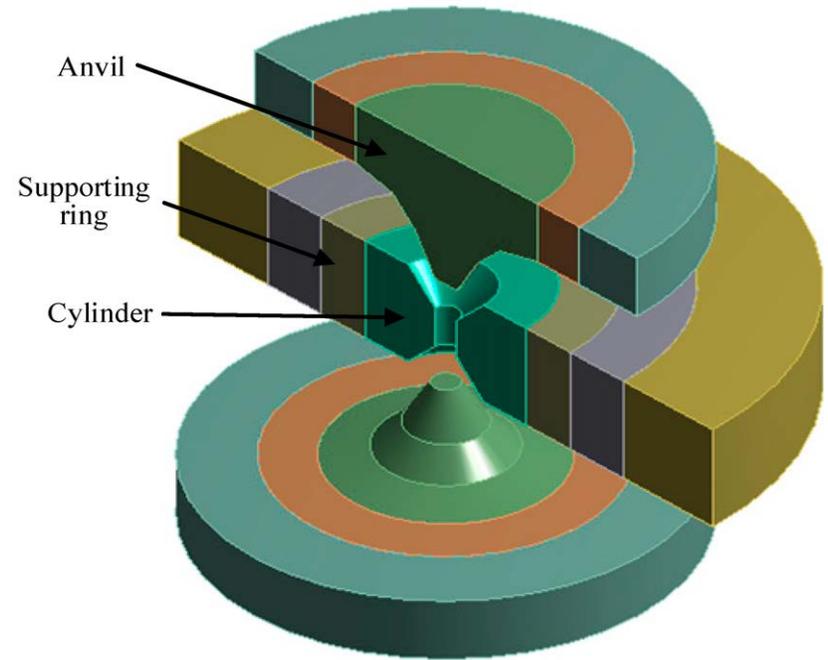
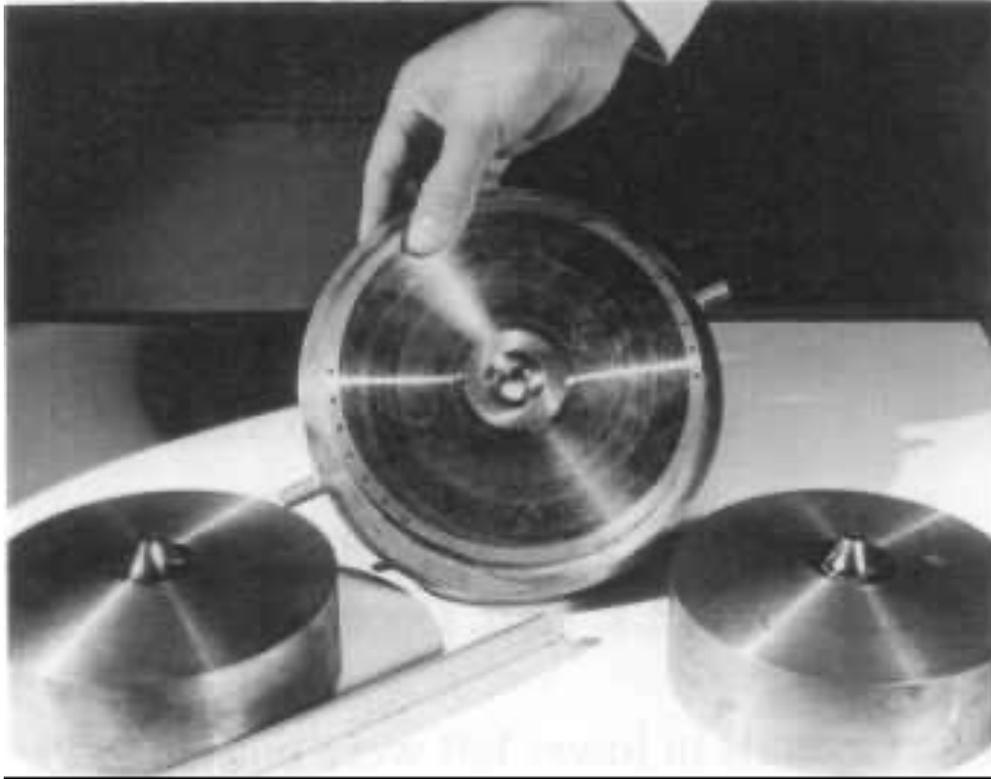
“DIAMOND MAKERS” General Electric, 1955



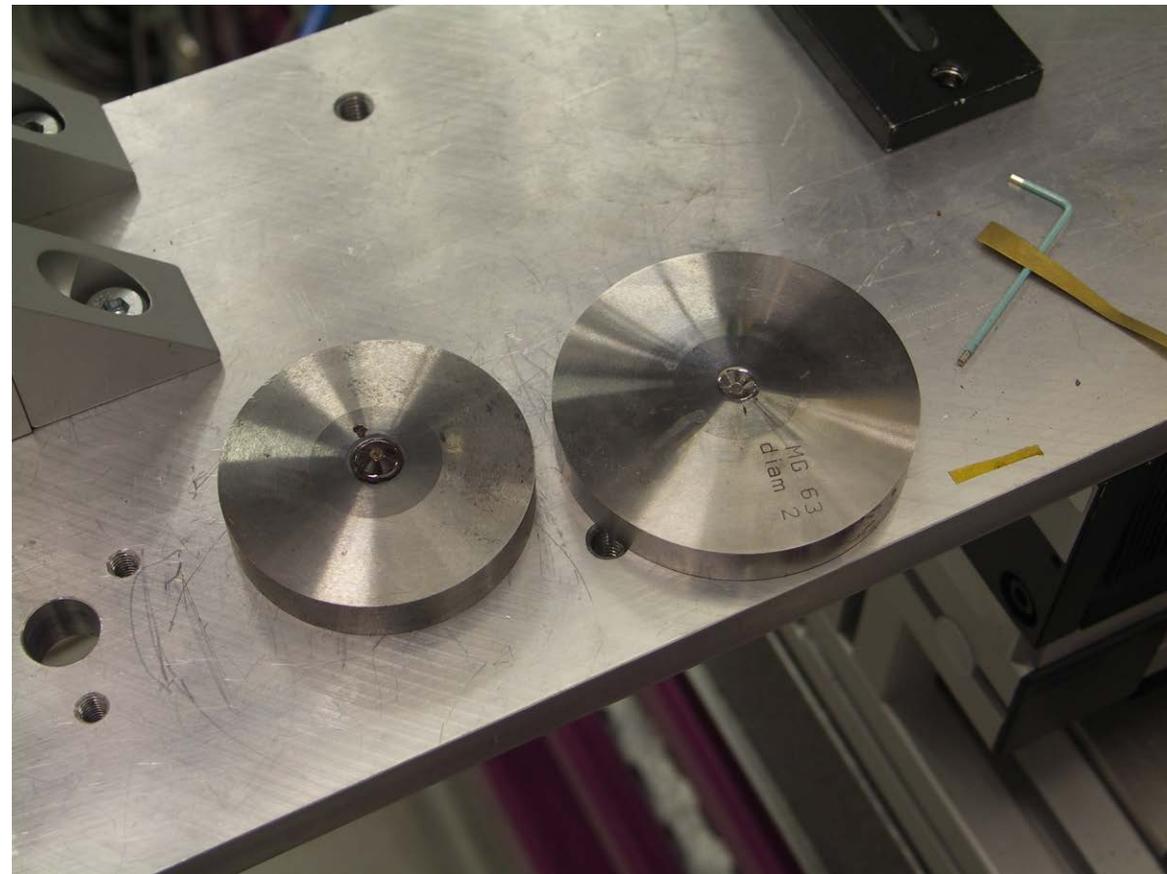
16 Dicembre 1954



Geometria toroidale

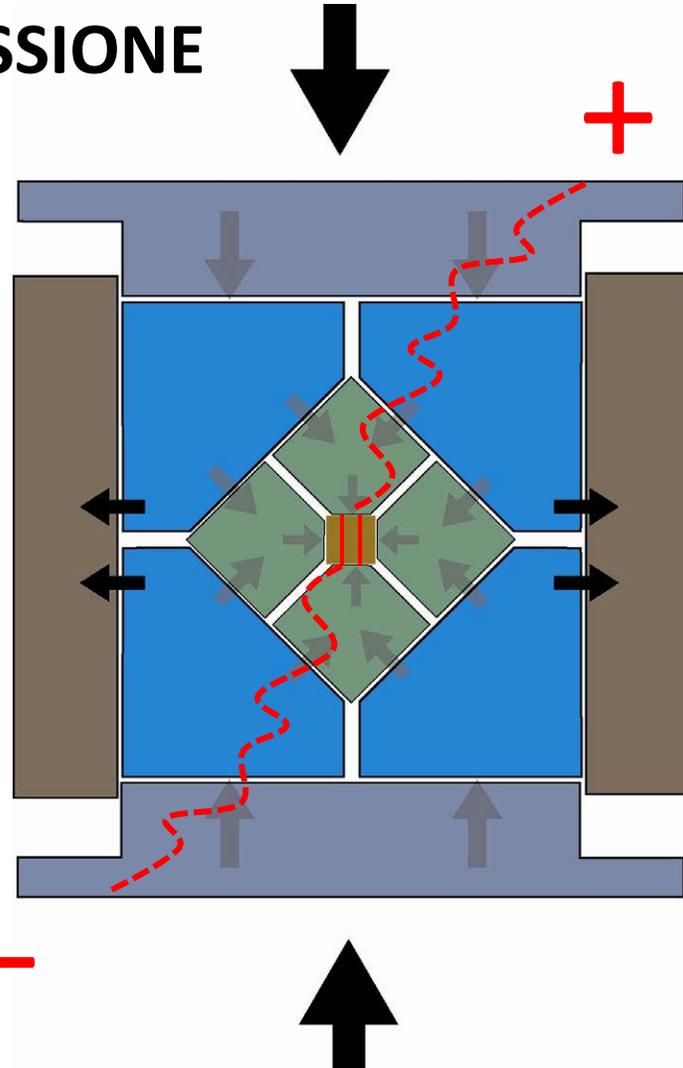


Apparato Paris-Edinburgh

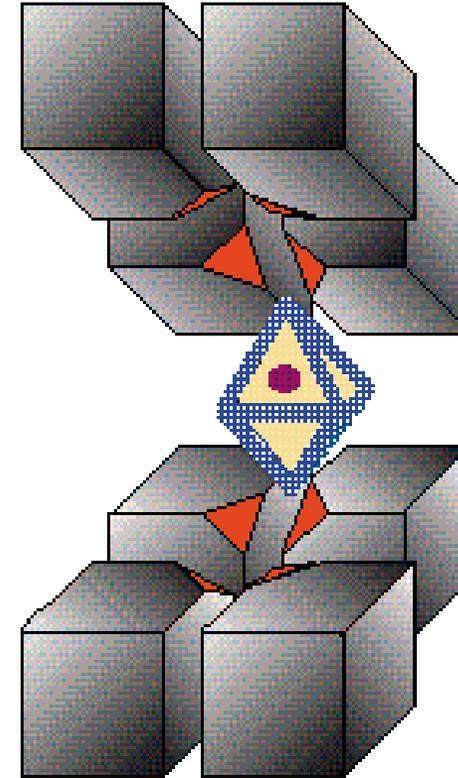


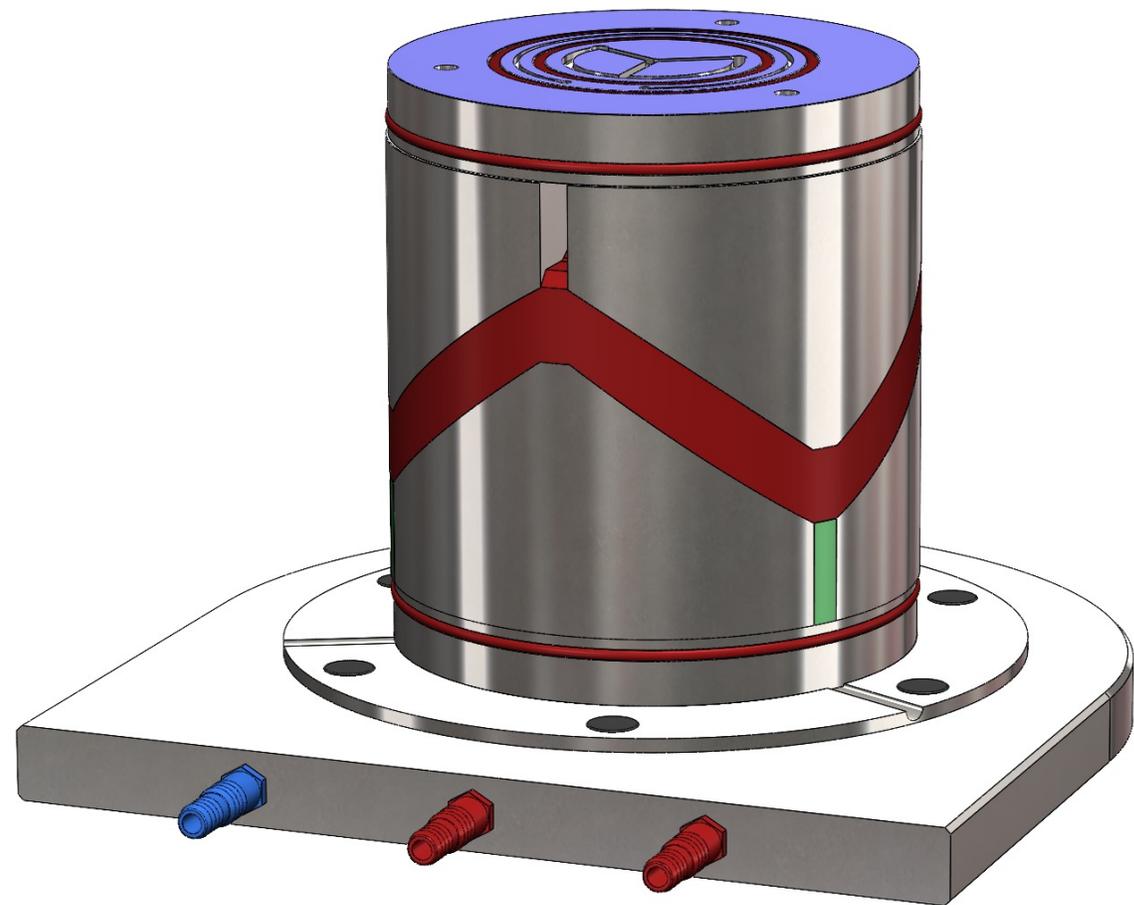
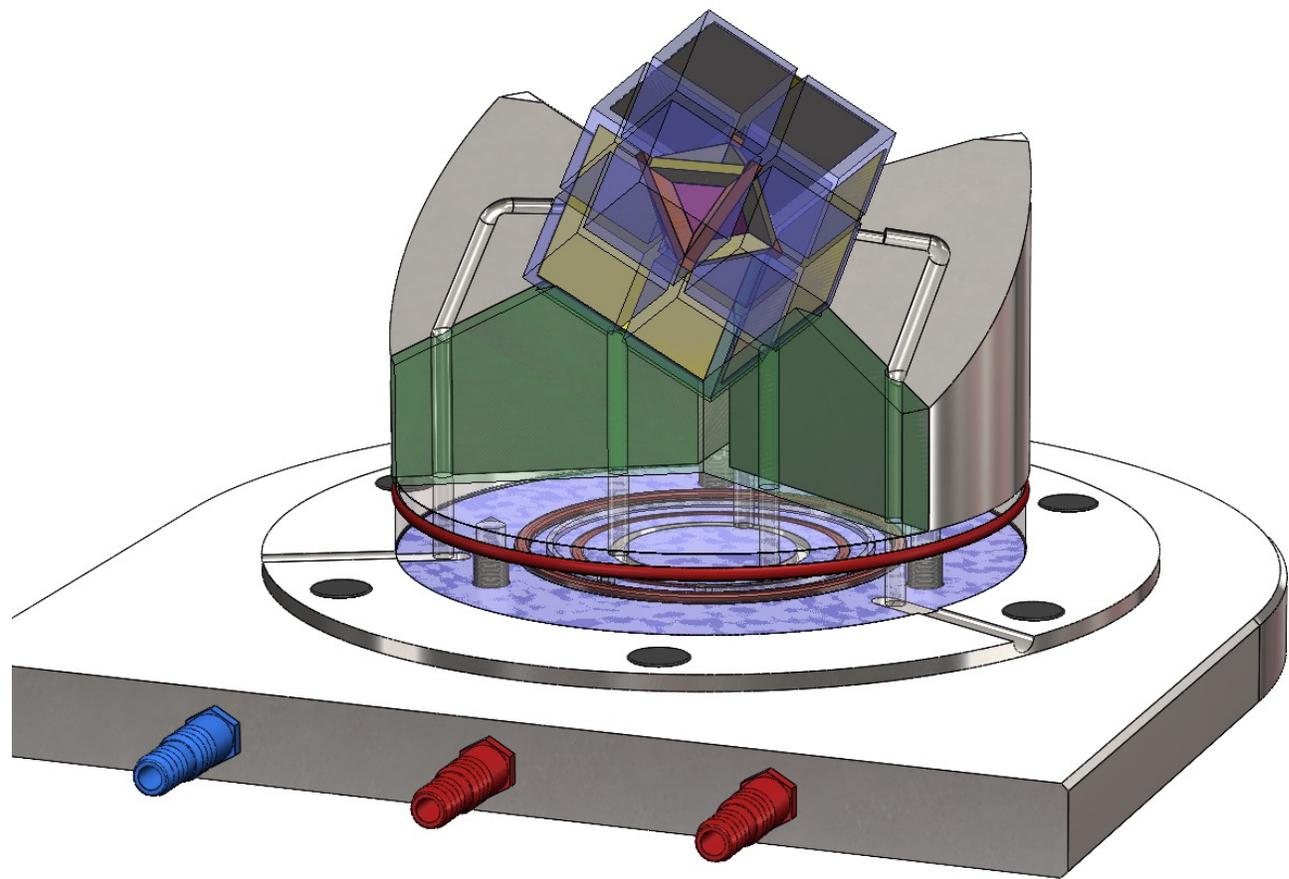
Apparato Multi-anvil 6/8

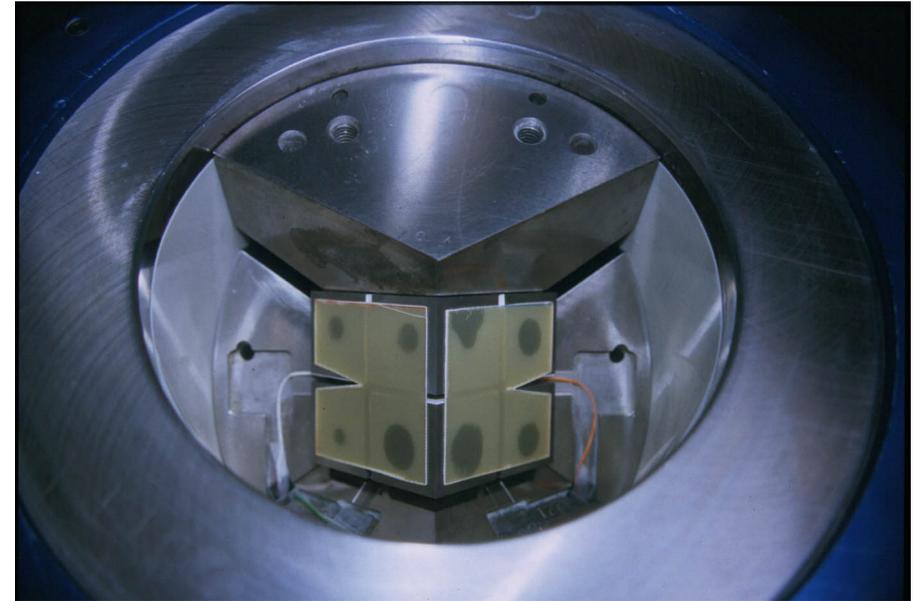
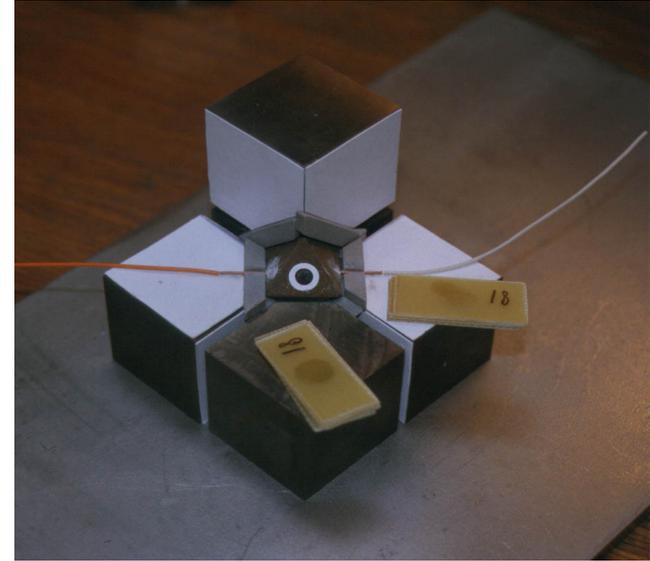
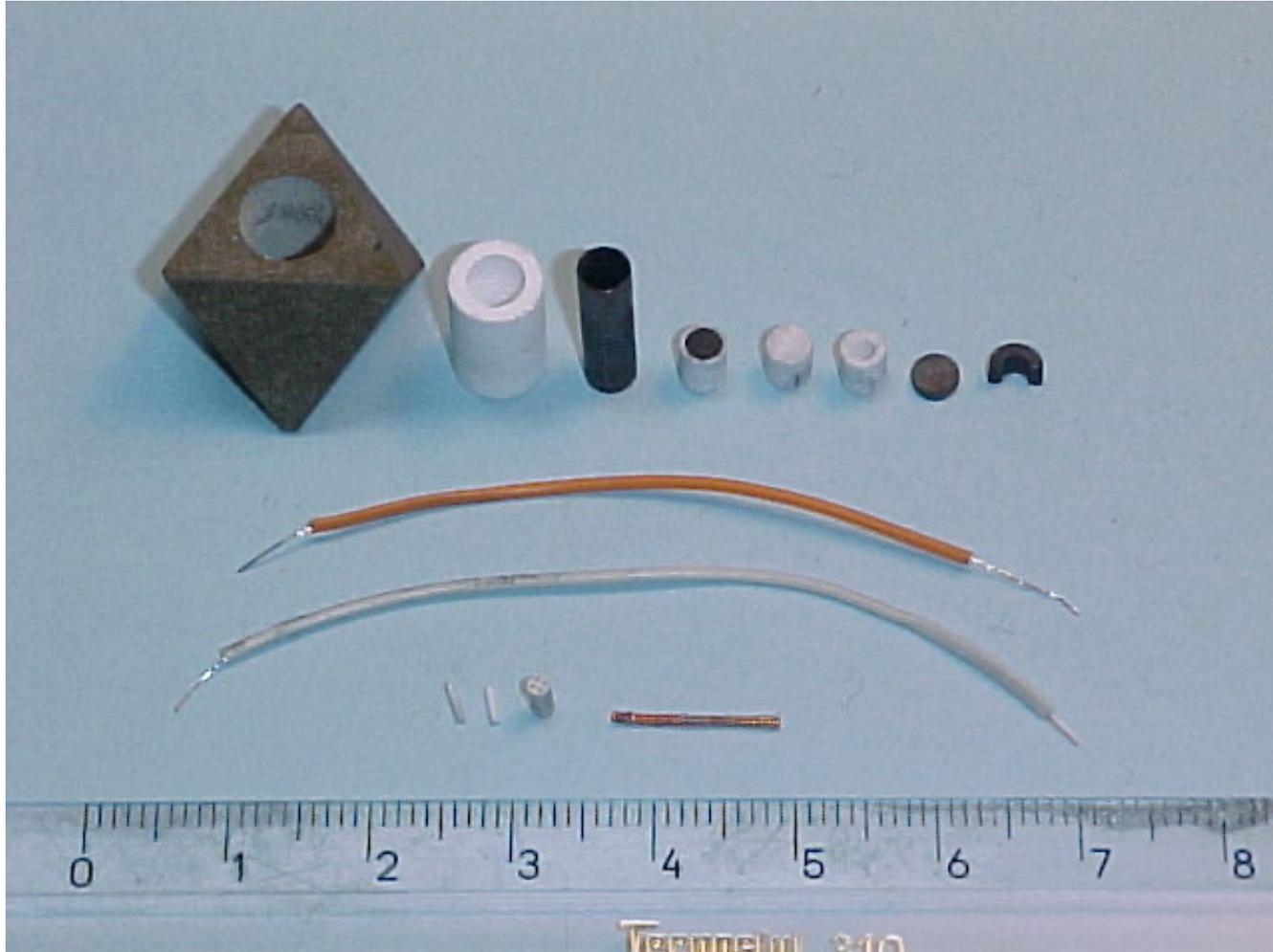
CARICO - PRESSIONE



TENSIONE - TEMPERATURA



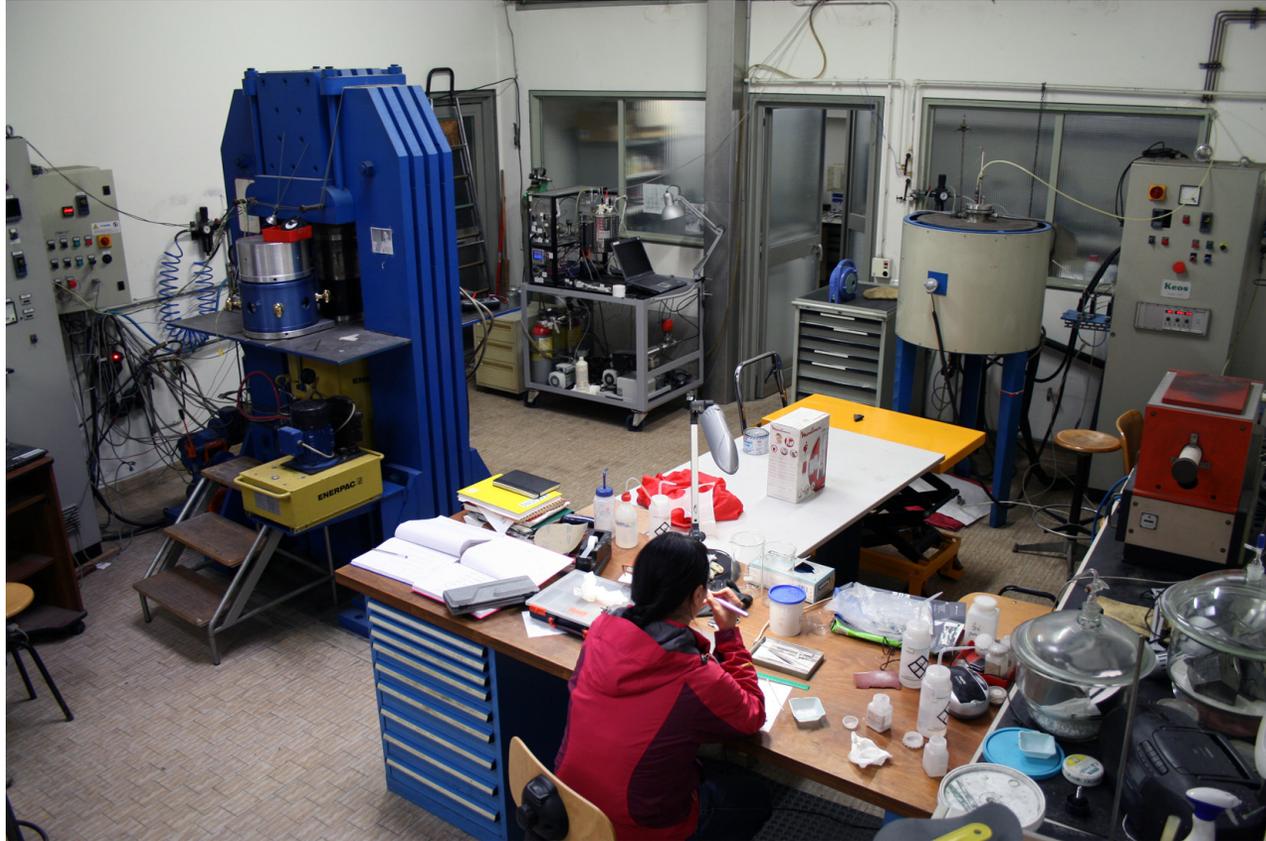




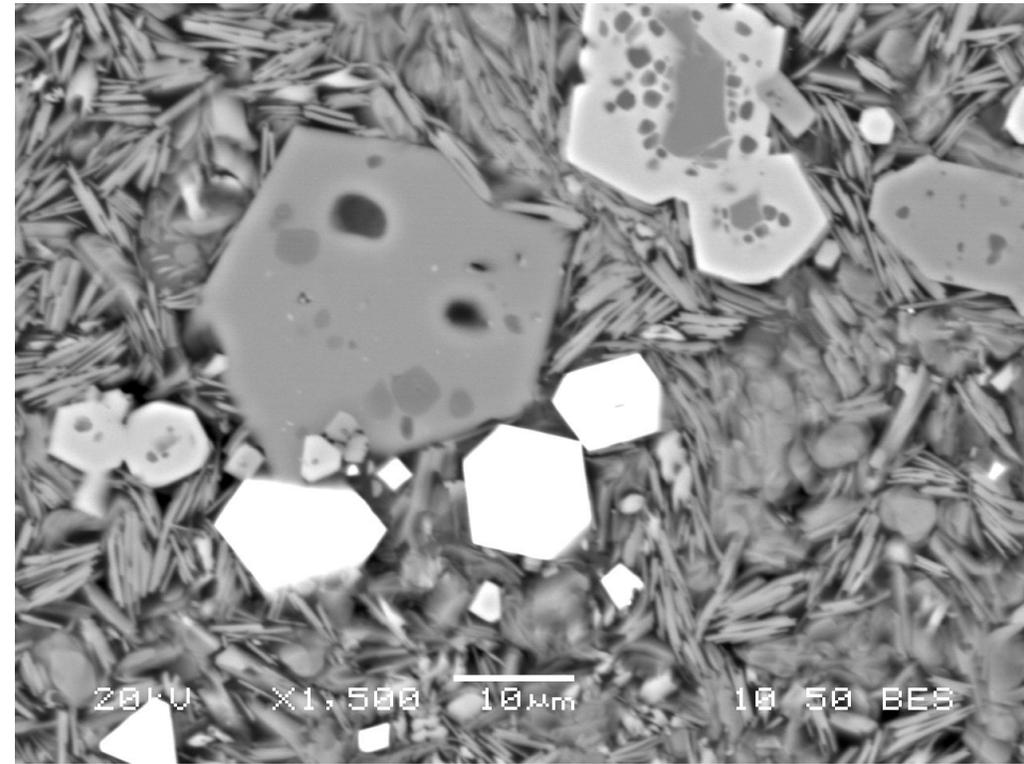
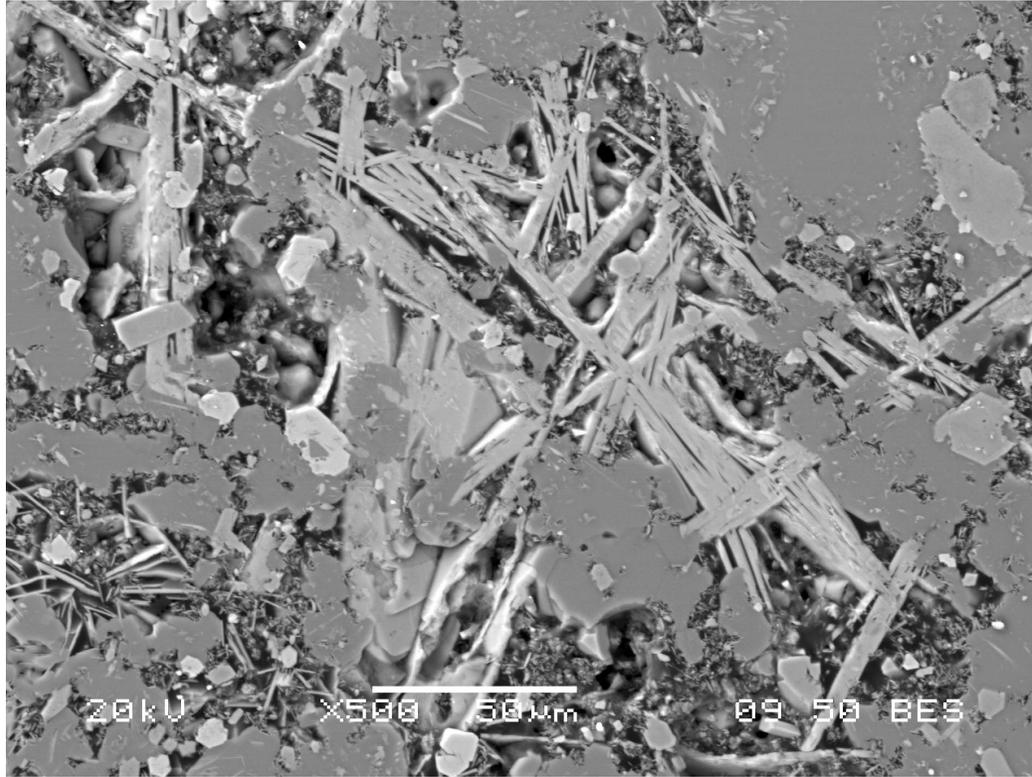
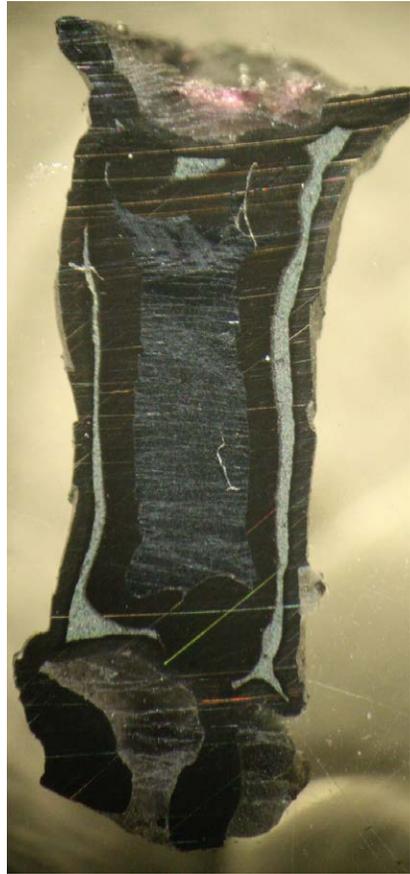
Il mondo in una capsula (...meglio se saldata)



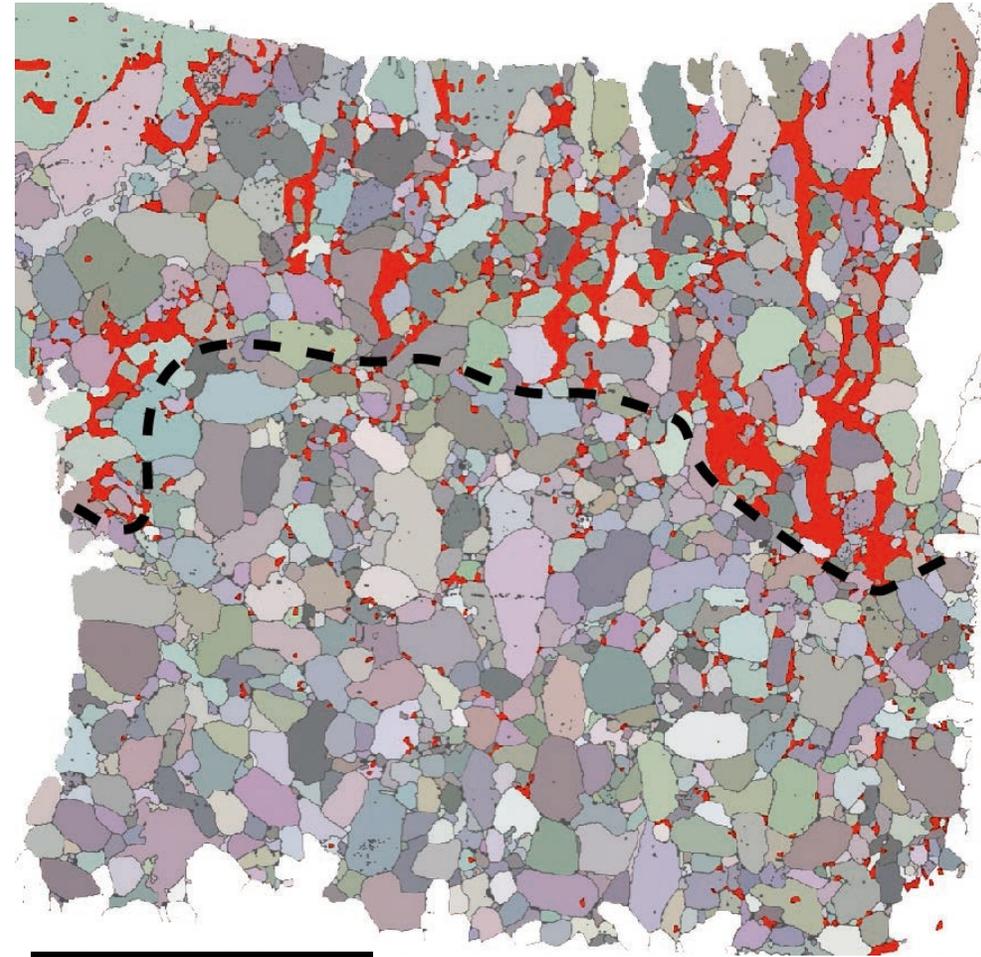
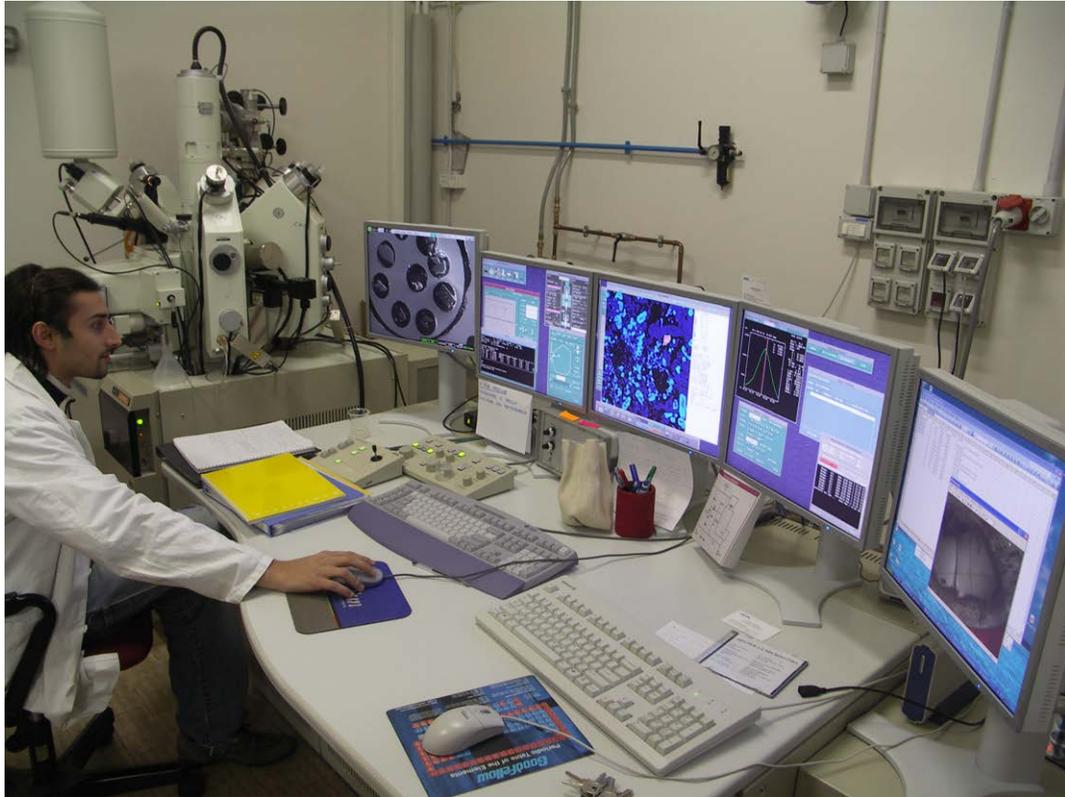
Il laboratorio di petrologia sperimentale @ UniMI



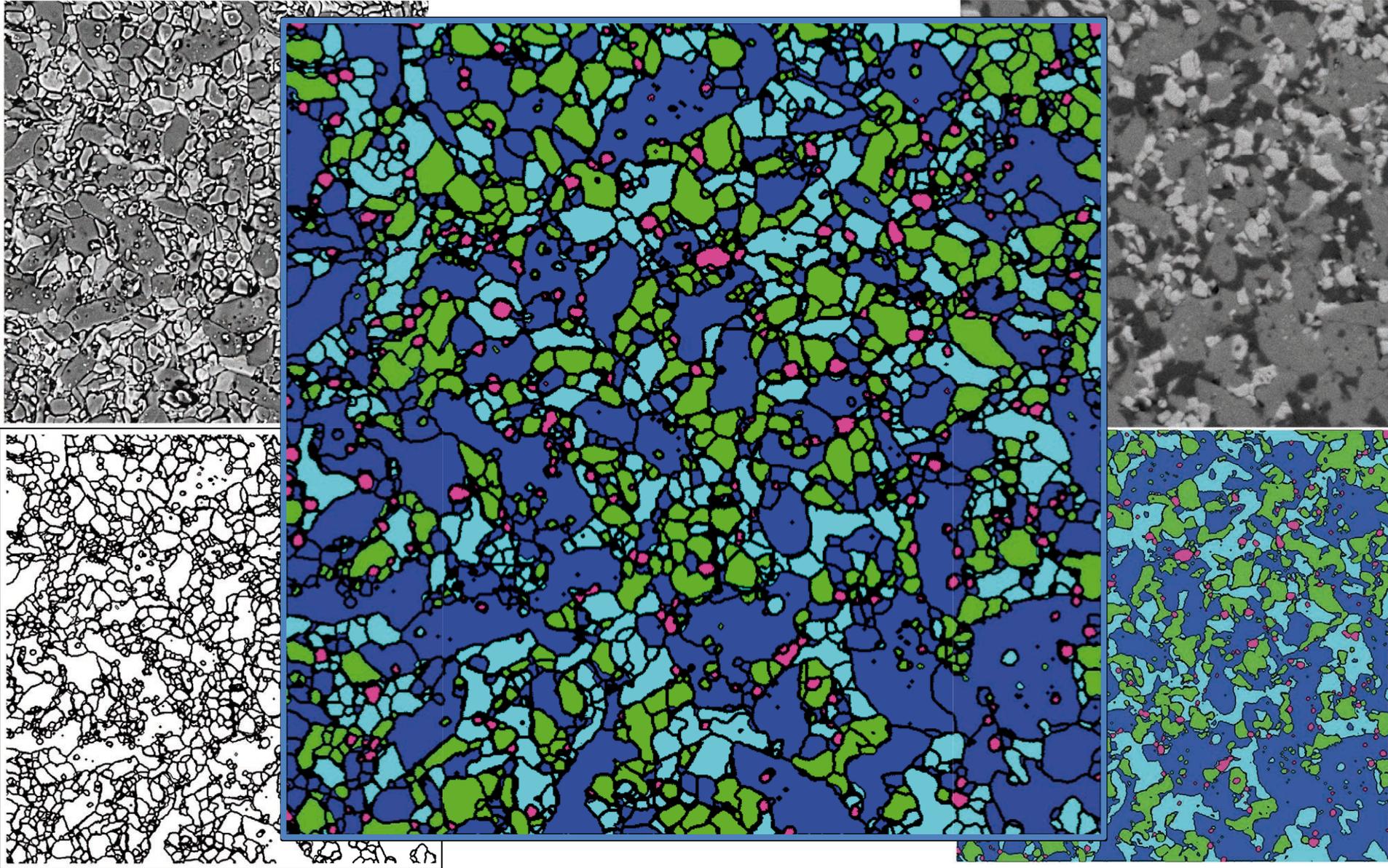
Com'è la zuppa dopo la cottura?



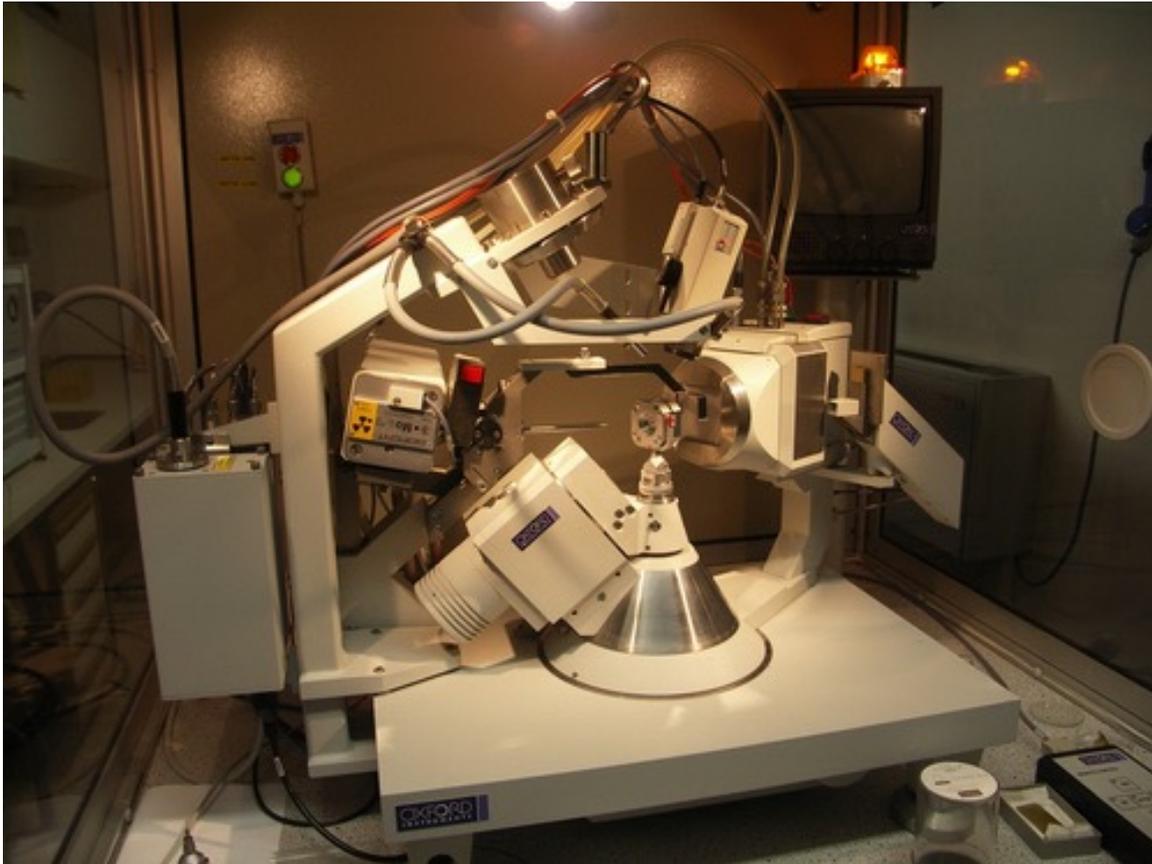
Caratterizzazione analitica «ex-situ»: es. analisi microchimica



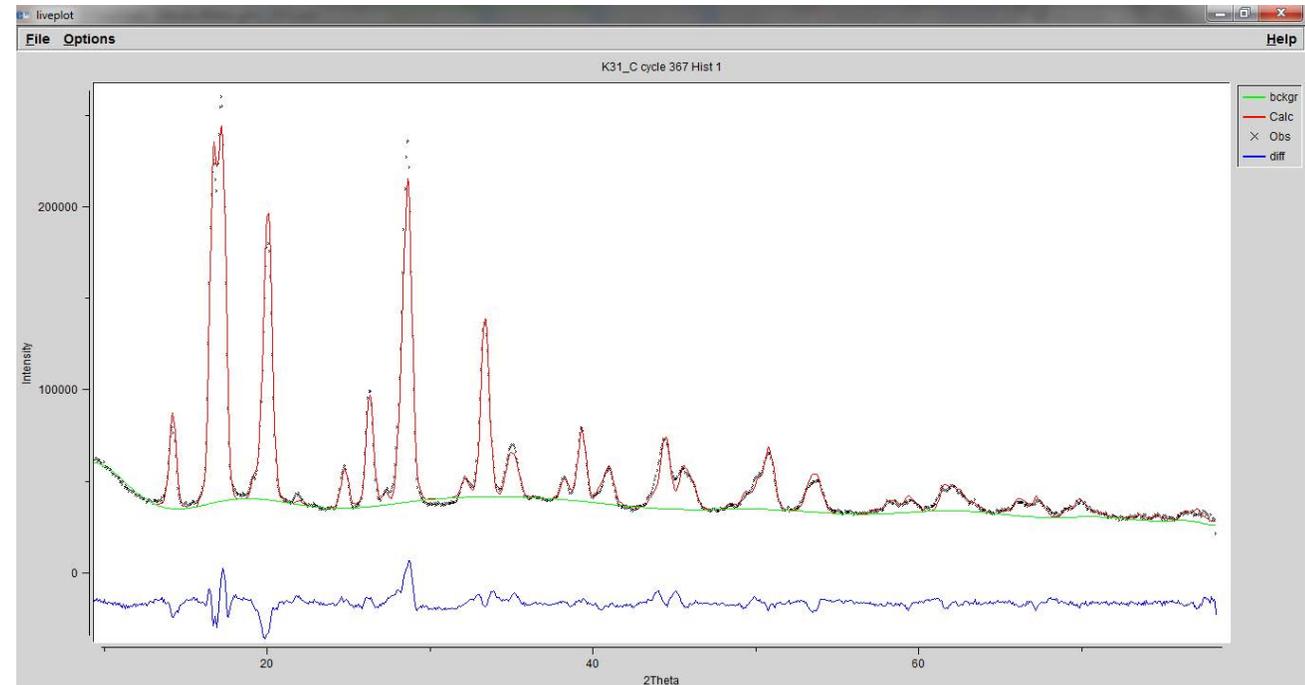
1 mm



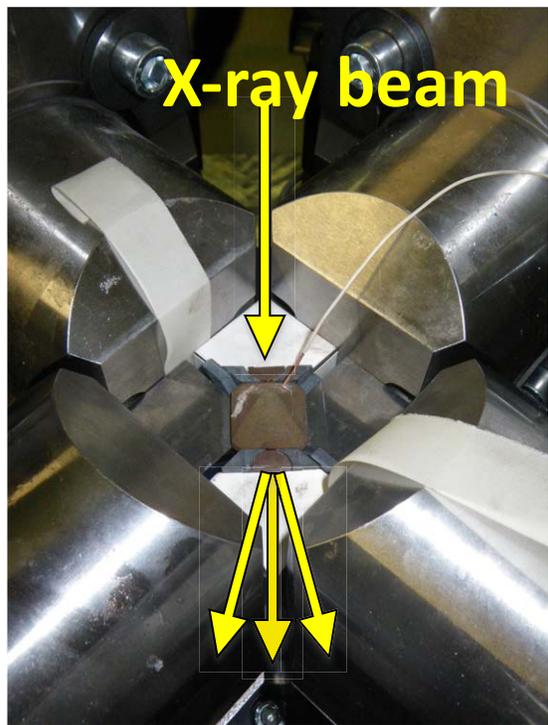
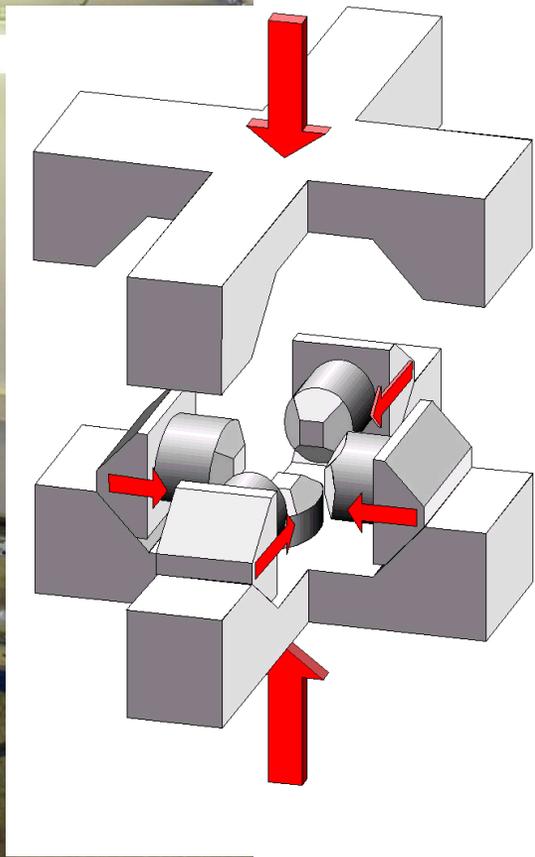
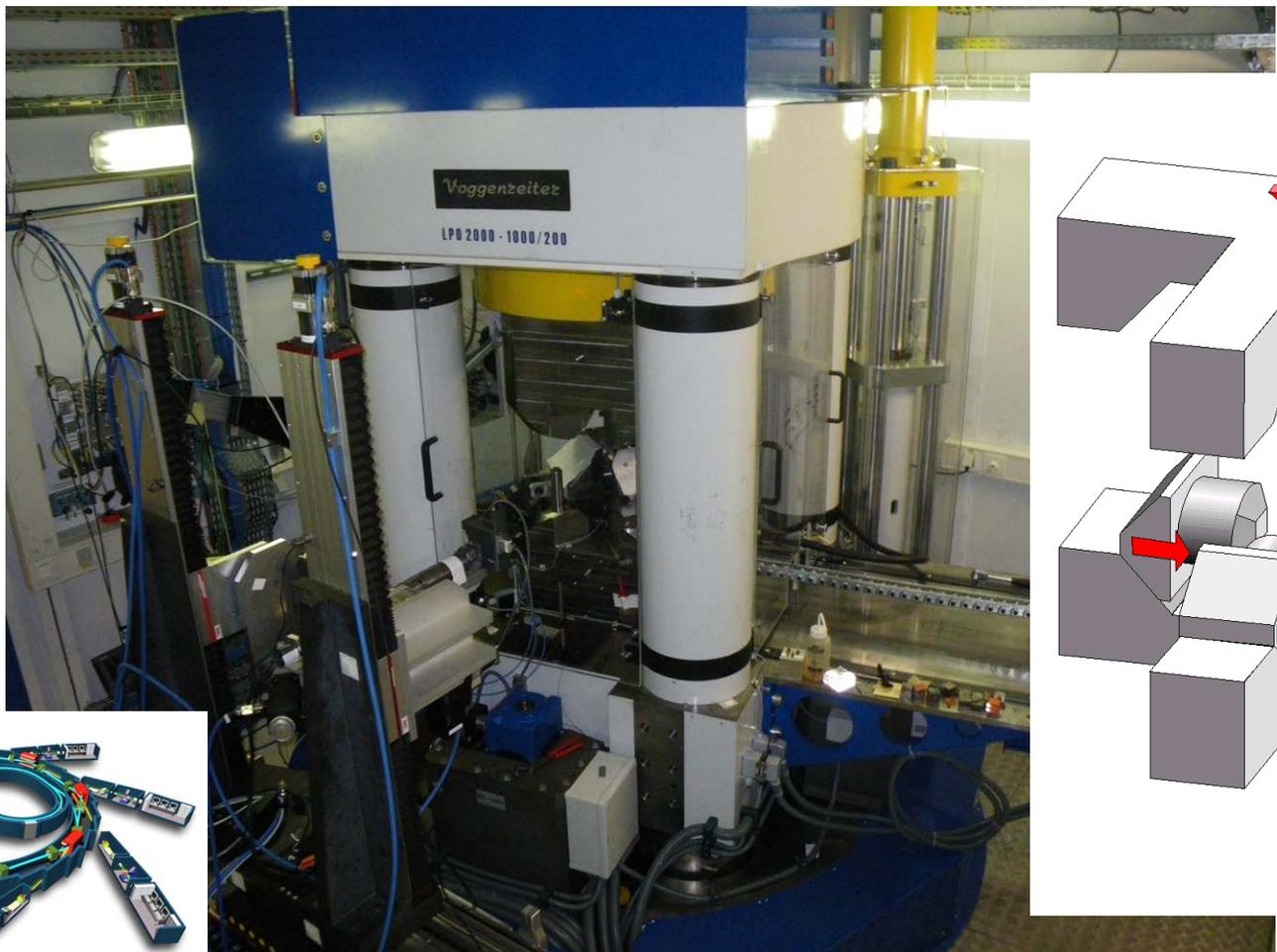
Caratterizzazione analitica «ex-situ»: analisi strutturale ai raggi-X



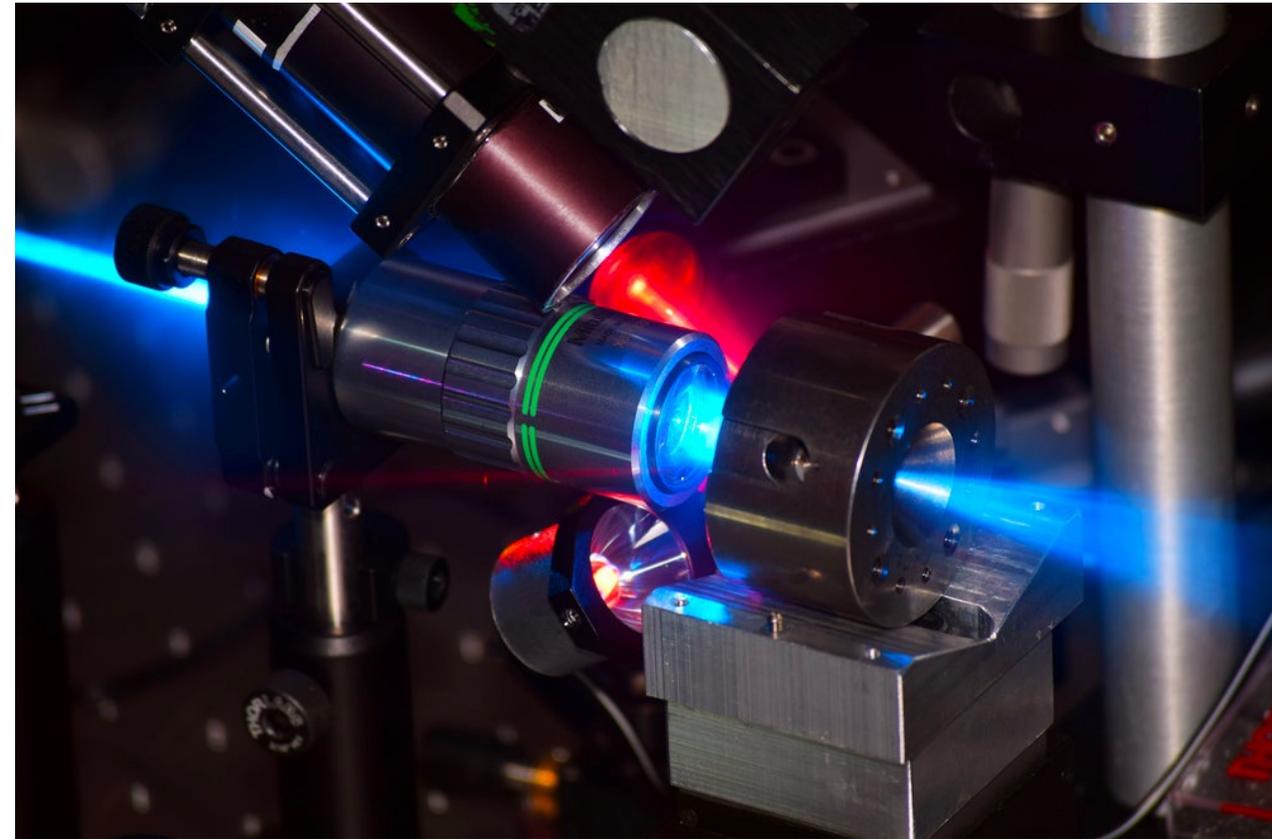
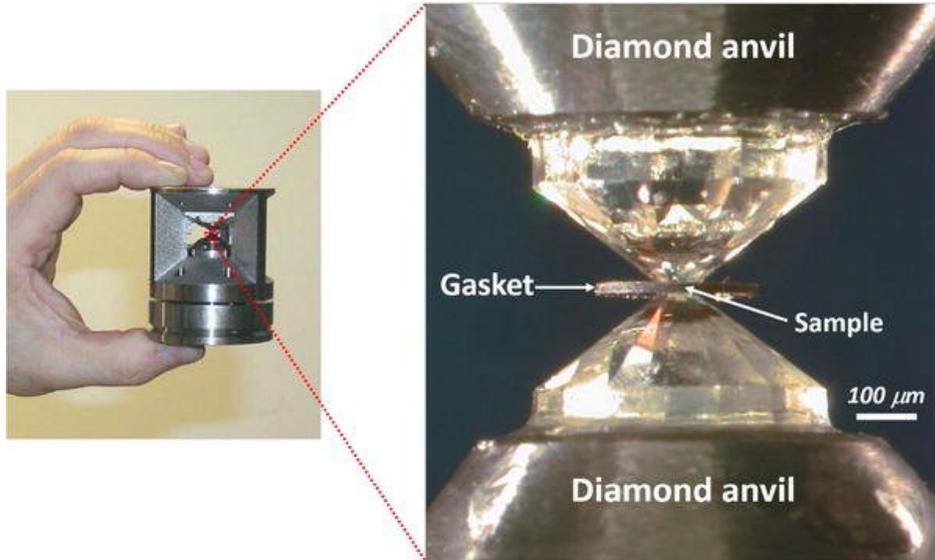
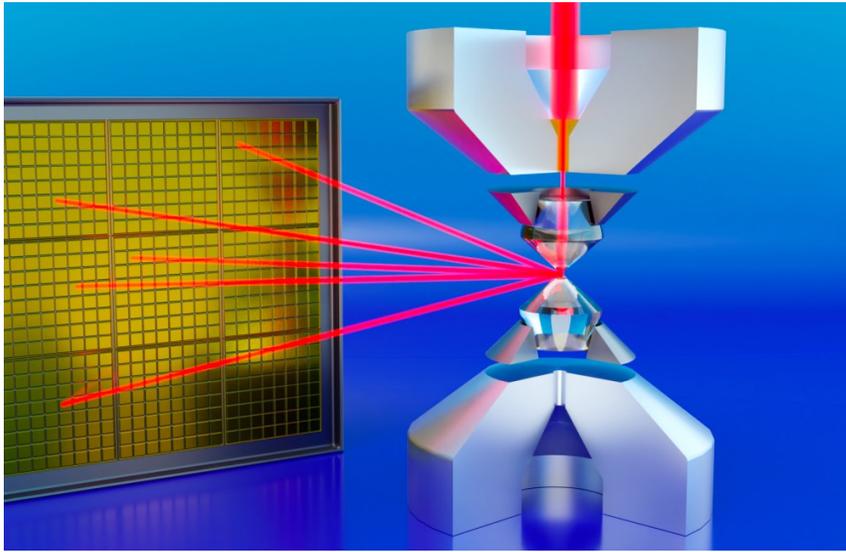
Ringwoodite, sintesi 18 GPa 1100 °C



Caratterizzazione «in-situ» durante esperimenti HT-HP

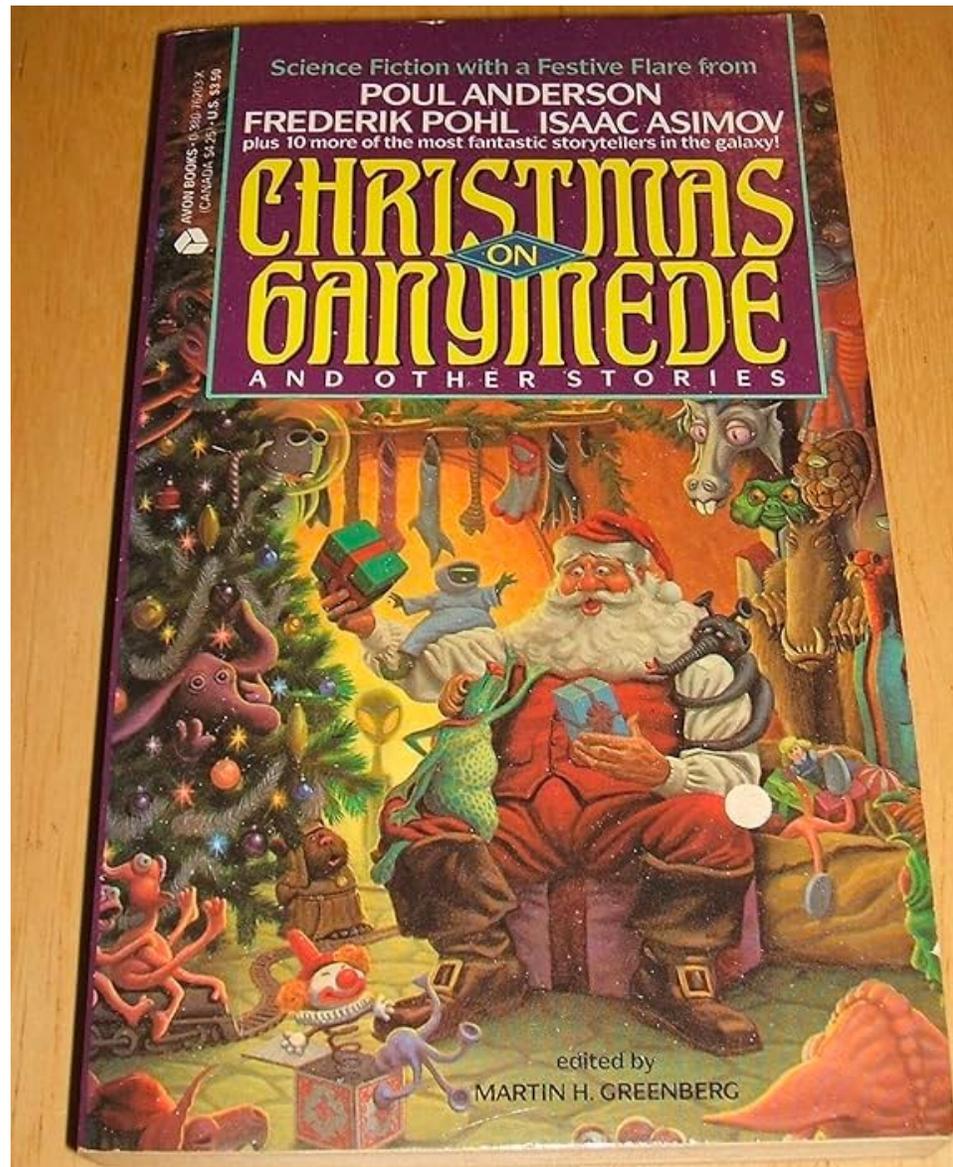


Verso il nucleo terrestre, la «Diamond Anvil Cell» con riscaldamento laser (fino a oltre 6000 °C!)

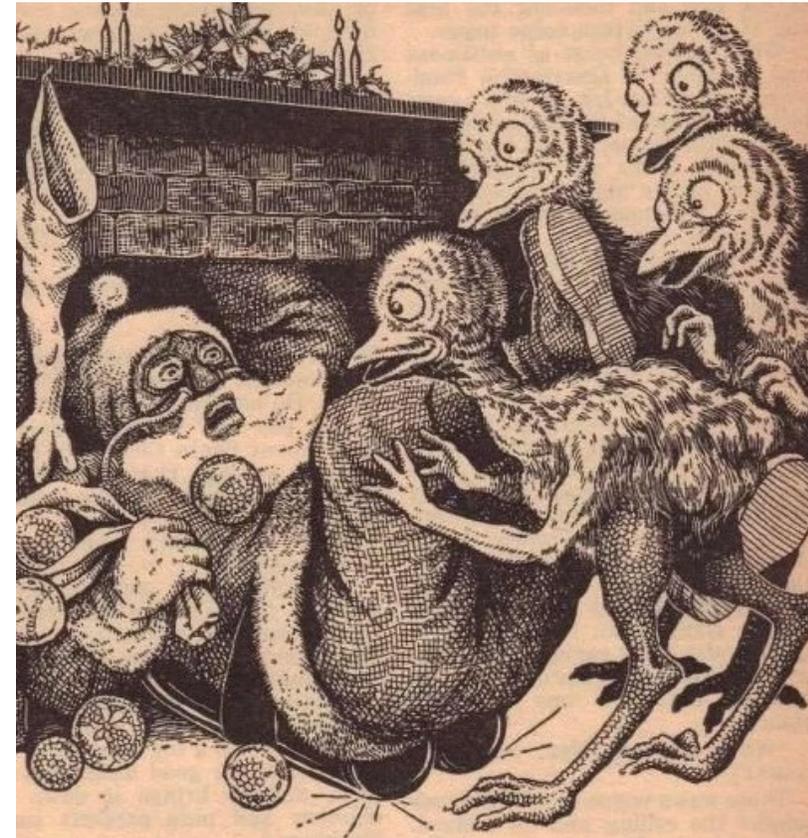




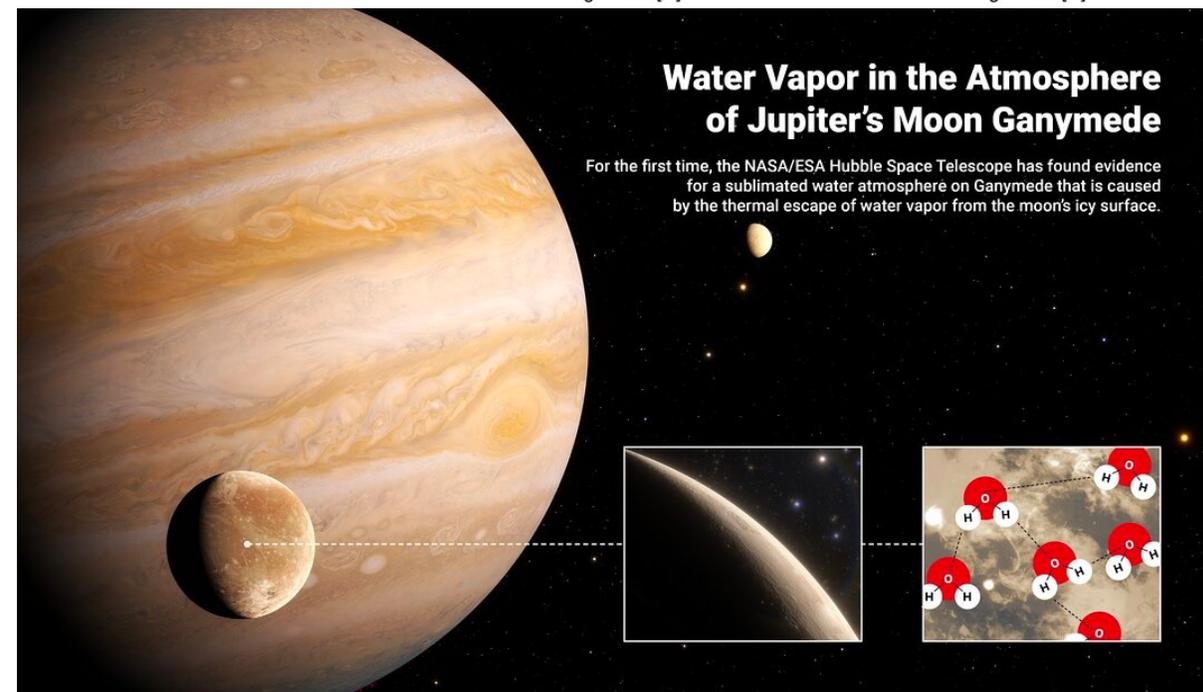
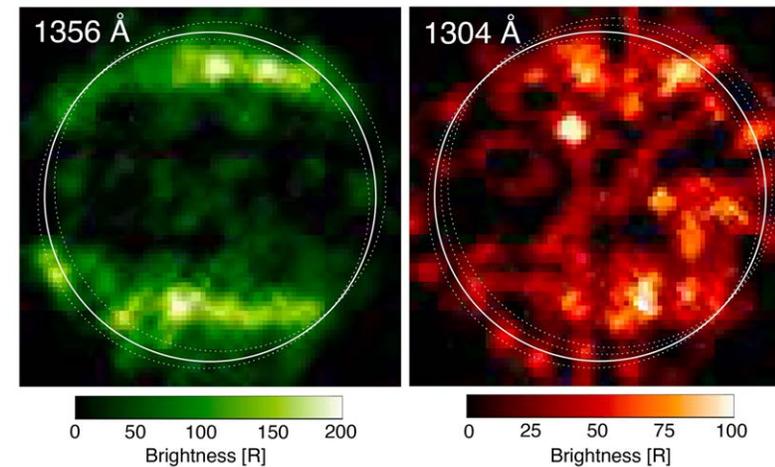
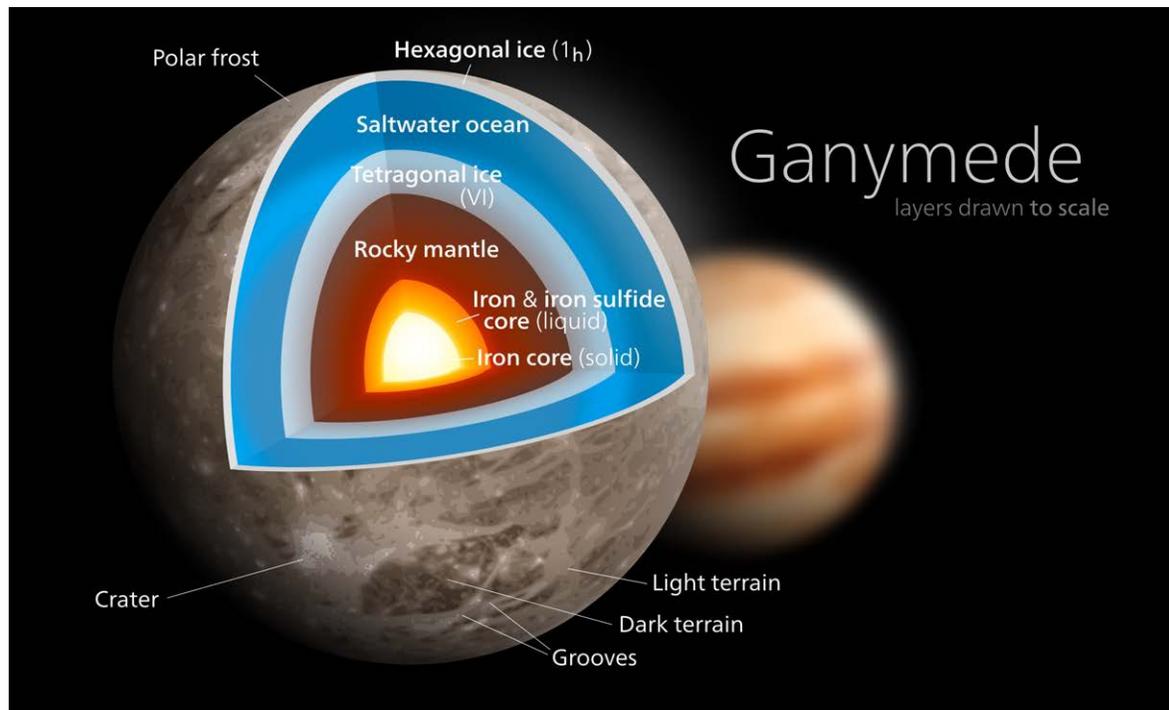
Ri-costruiamo la Terra:
alla scoperta delle profondità del nostro pianeta e di altri mondi.

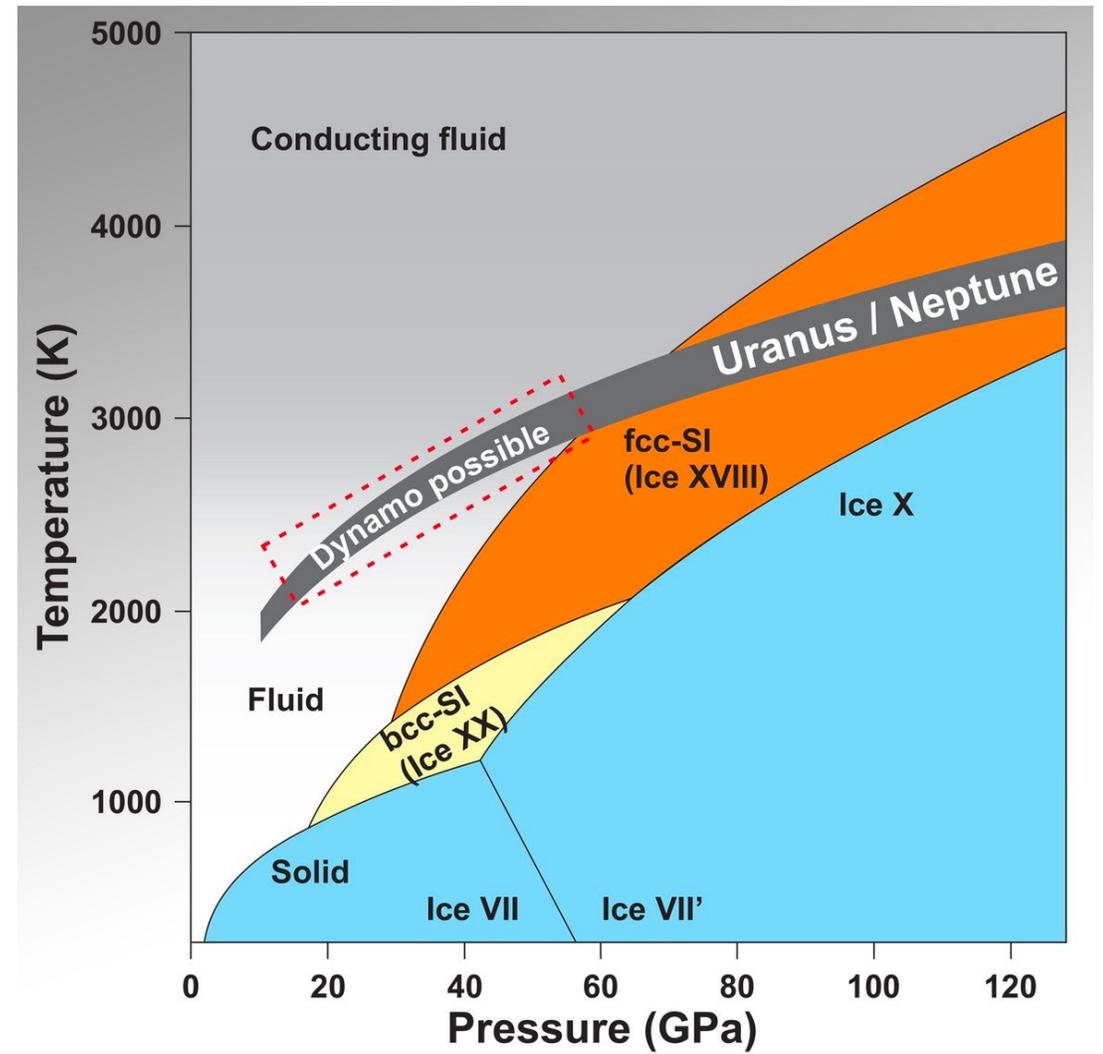
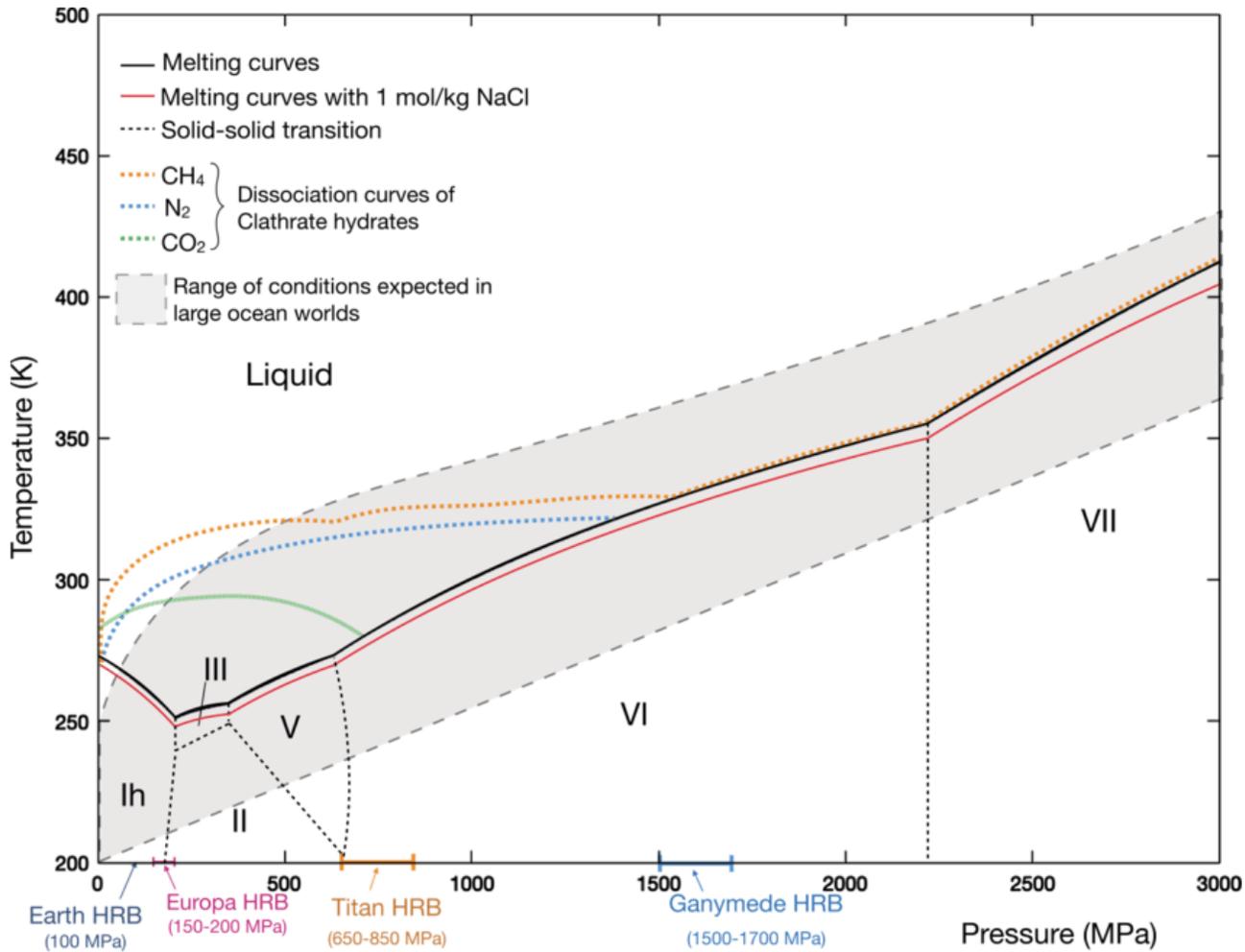


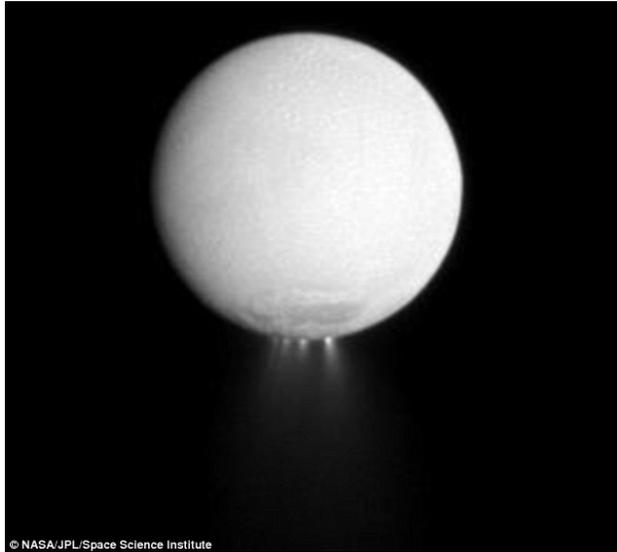
Gli Ossies



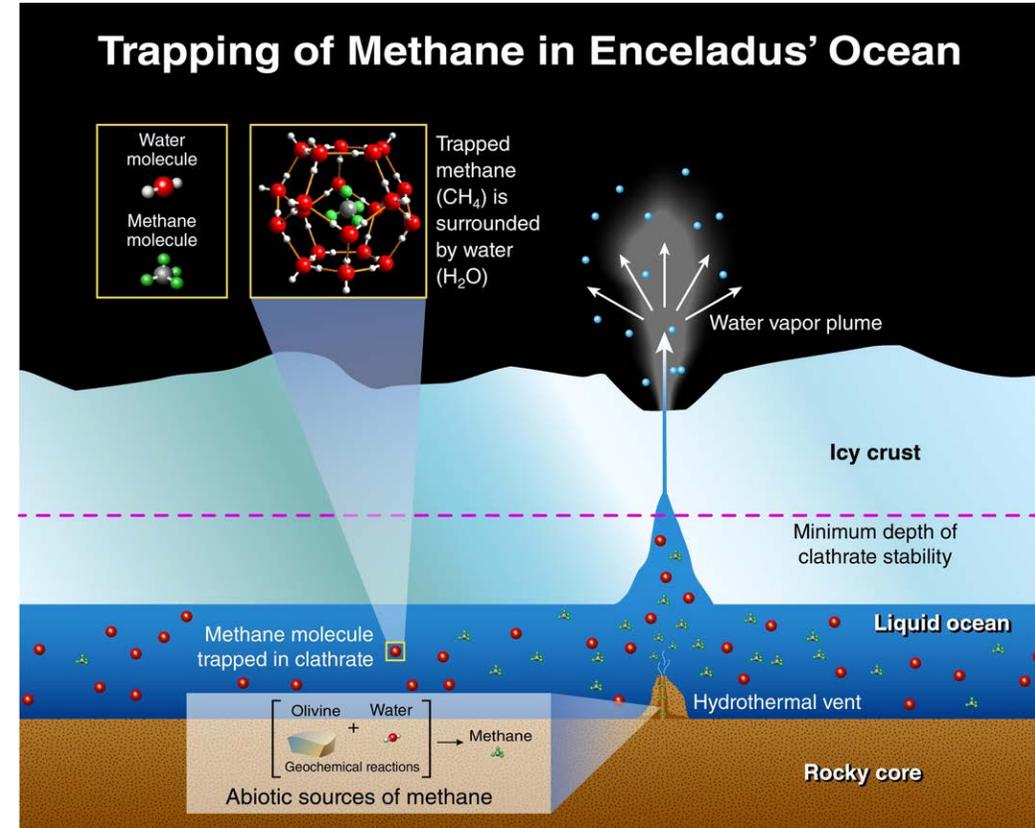
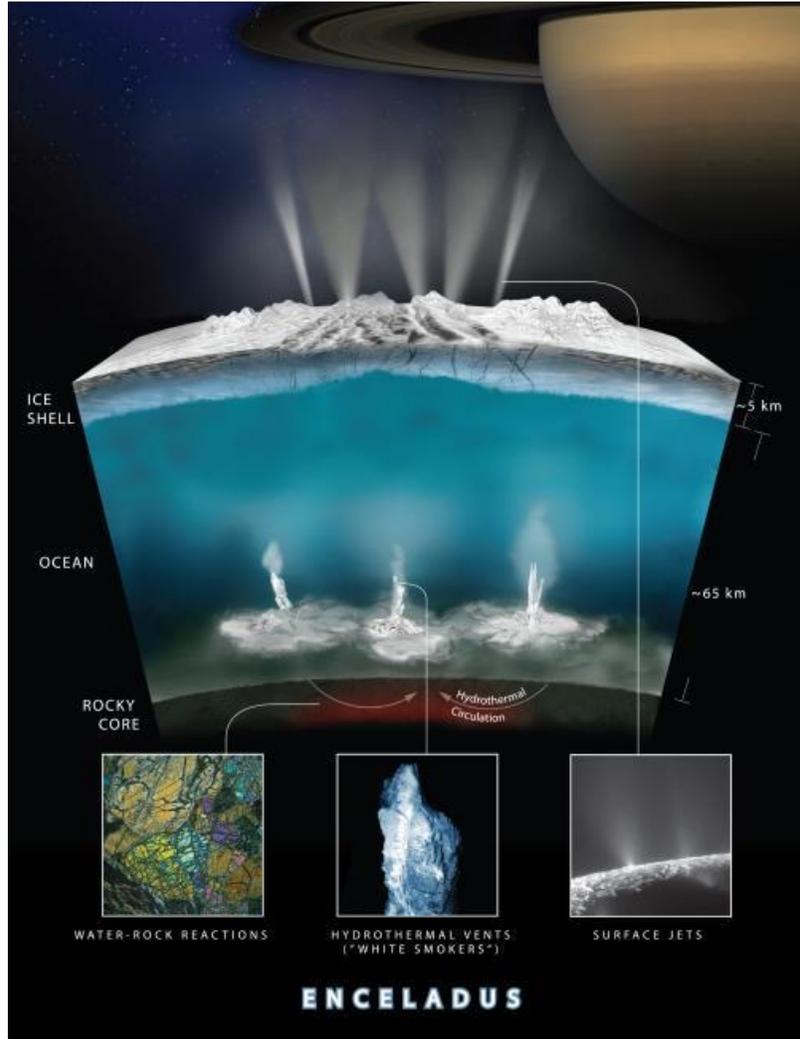
Vapor d'acqua, ossigeno e ozono su Ganymede

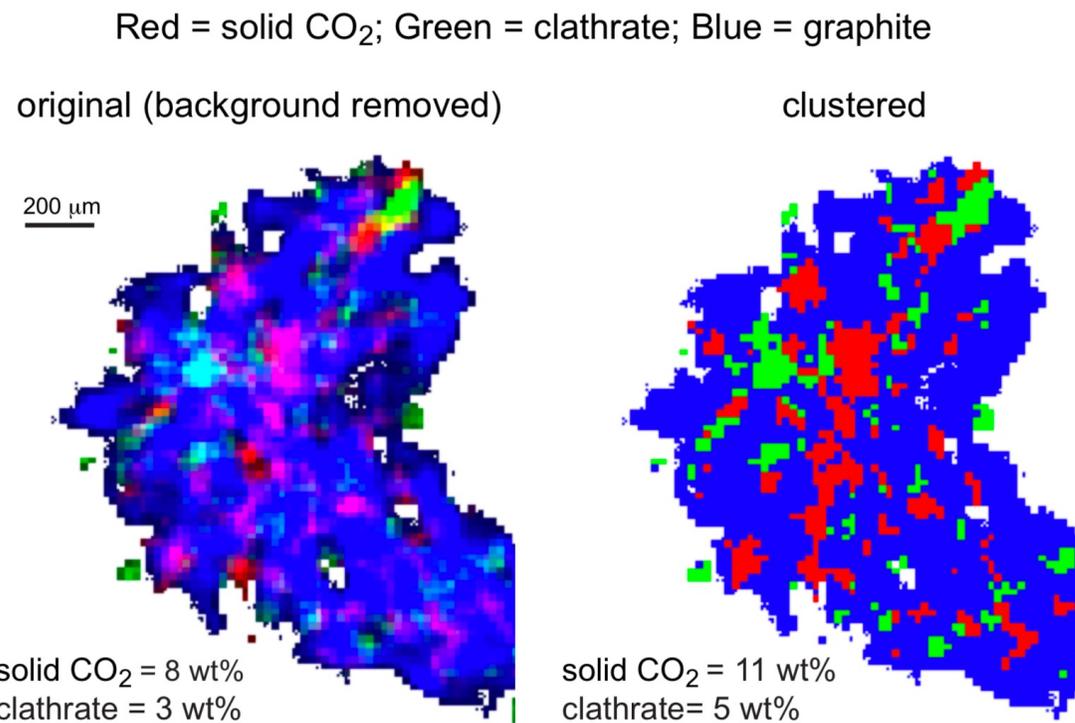
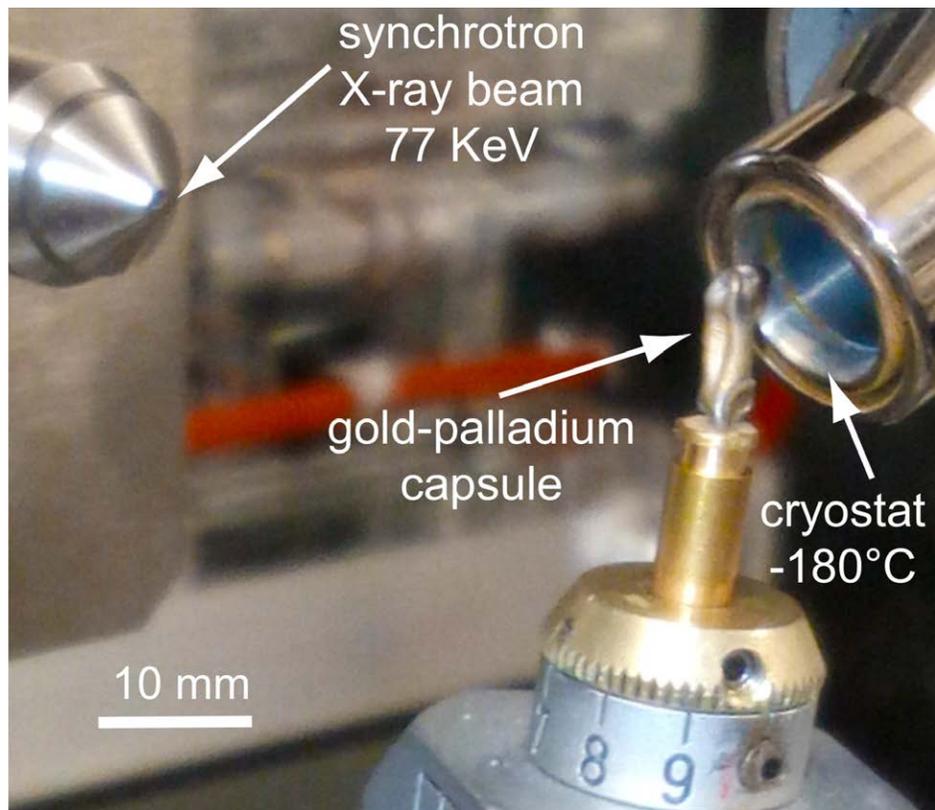






© NASA/JPL/Space Science Institute





Tumiati, Merlini, Amalfa, Di Michiel, Toffolo (2022)

Le moderne sfide per la conoscenza della composizione e struttura interna della Terra richiedono tecnologie che permettano di indagare volumi sempre maggiori alle pressioni estreme e l'integrazione dei modelli petrologici e geofisici con la fenomenologia naturale