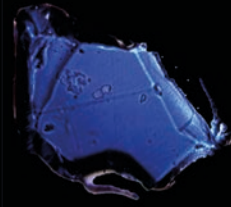
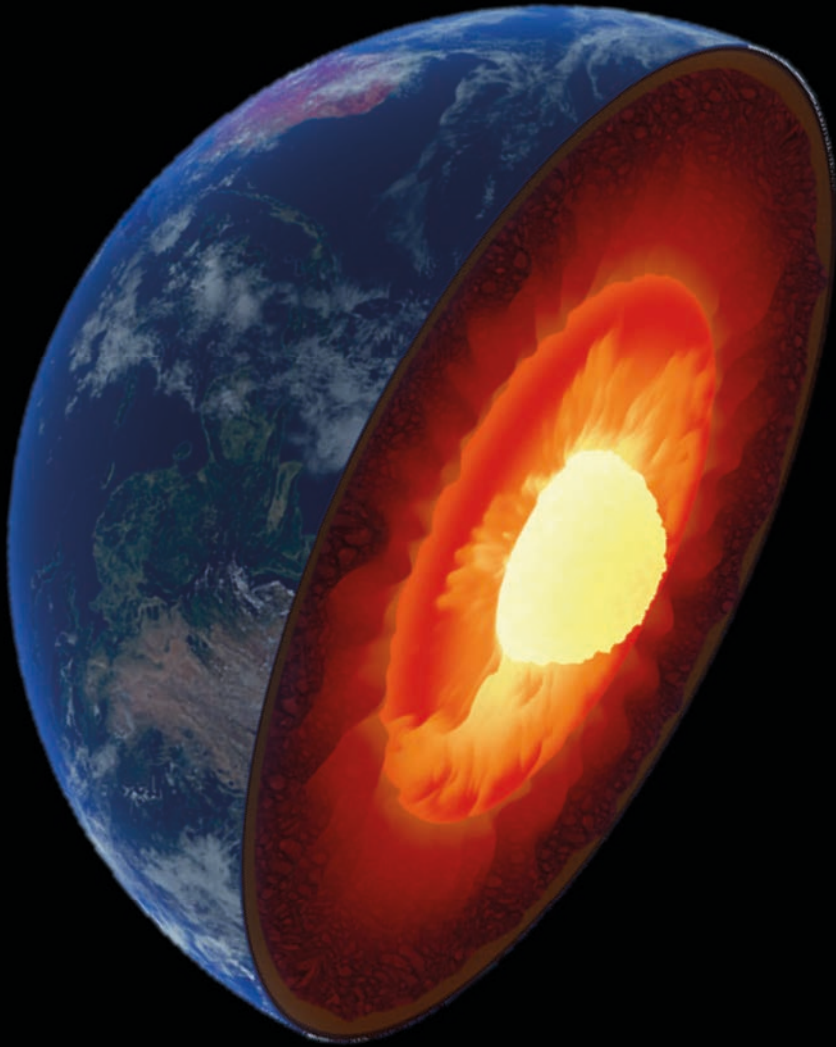


Petrologia, parte A: Esperimenti di laboratorio e modelli teorici

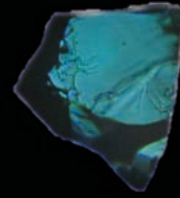


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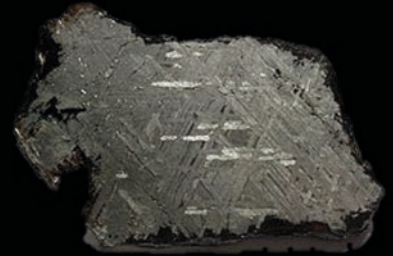


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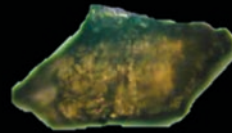
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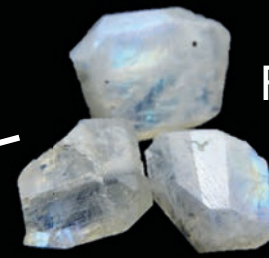
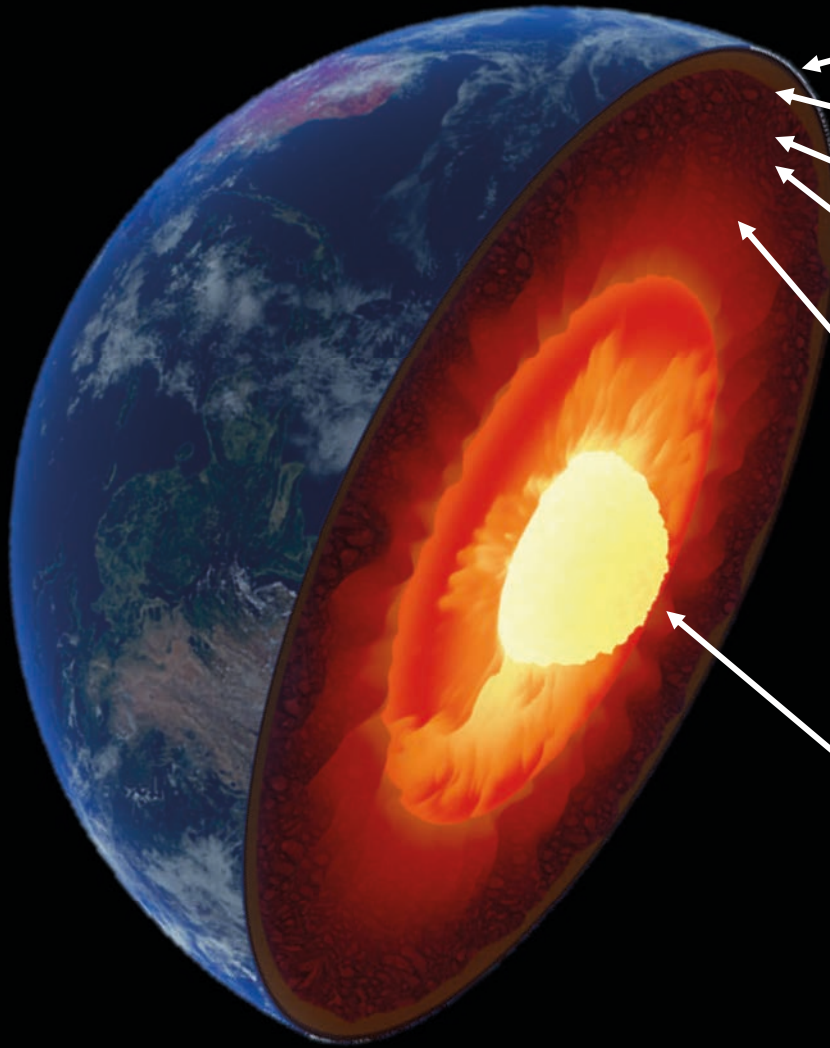


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Alcuni minerali principali

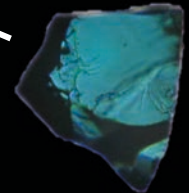


Feldspati

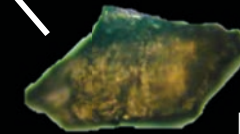


Olivina

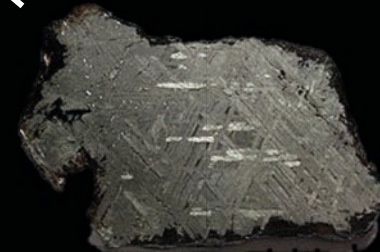
Wadsleyite



Ringwoodite



Bridgmanite



Fe-Ni

Sommario delle lezioni

(preliminare)

Introduzione

Cosa e sono e a cosa servono la petrologia
sperimentale e la termodinamica
Concetti importanti

Metodi sperimentali

*Gas-mixing furnaces, Autoclavi,
Piston cylinder, Multi-anvil
Diamond-anvil cell*

Termodinamica

Concetti di termodinamica
applicata alla petrologia

Modellazione termodinamica inversa

Esempi di geotermometri e geobarometri

Modellazione termodinamica diretta

MELTS, Perple_x, THERMOCALC

Lecture consigliate

Libri e articoli:

D'Amico C. et al. 1987 (ristampato nel 2004). *Magmatismo e Metamorfismo*. UTET. Pag. 89–96, Pag. 439–454.

Wood B.J. & Fraser D.G. 1977. **Elementary Thermodynamics for Geologists**. *Oxford University Press*.

Powell R. 1978. **Equilibrium Thermodynamics in Petrology**. *Harper & Row Publisher*.

Keppler H. & Frost D.J. 2005. **Introduction to minerals under extreme conditions**. *EMU Notes in Mineralogy*, 7, 1–30.

Shaw C.S. 2018. **Experimental petrology: Methods, Examples and Applications**. *Geoscience Canada*, 45, 67–84.

Risorse online:

Termodinamica in petrologia:

https://serc.carleton.edu/research_education/equilibria/thermodynamics.html

<http://www.earth.ox.ac.uk/~davewa/pt/index.html>

Software per modellizzazioni termodinamiche (solo per gli interessati all'argomento):

<http://www.perplex.ethz.ch>

<https://hpxeosandthermocalc.org>

<http://melts.ofm-research.org/index.html>

Come facciamo a studiare l'interno terrestre, quali sono le sue proprietà chimico-fisiche e quali sono i processi che lo caratterizzano?



Come facciamo a studiare l'interno terrestre, quali sono le sue proprietà chimico-fisiche e quali sono i processi che lo caratterizzano?

Record geologico
in superficie

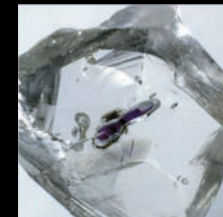
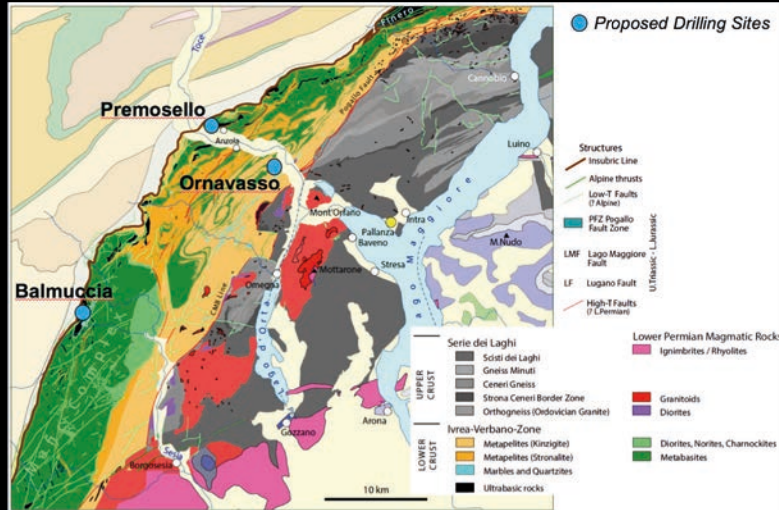
Esperimenti di
laboratorio

Indagini geofisiche

Modelli teorici

Record geologico in superficie

Il record geologico (e.g., studio delle strutture a grande scala e dei campioni naturali) va caratterizzato e interpretato ed è l'unico metodo di indagine diretto



Scientists help families search for Mexico's disappeared p. 1267

Clustering of extreme tornado outbreaks p. 1419

Roads fragment the world p. 1621

Science

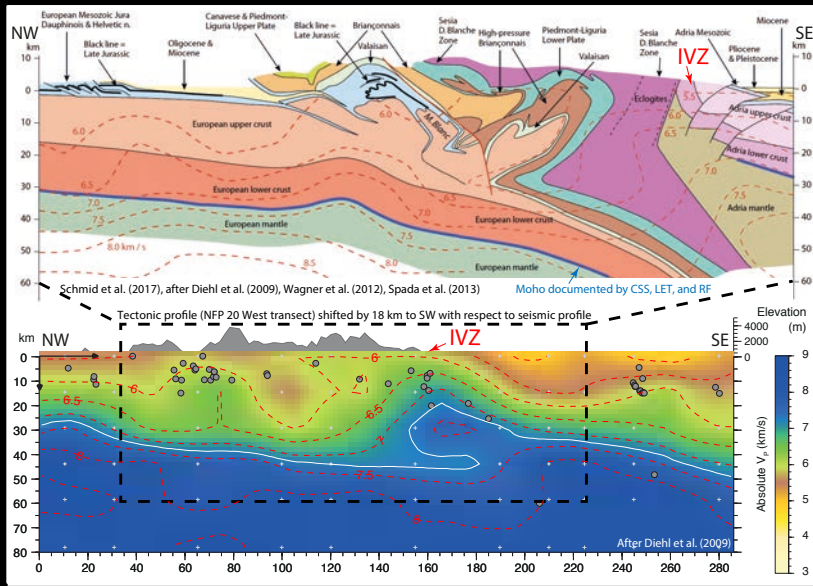
155
16 DECEMBER 2016
sciencemag.org
AAAS

A GEOLOGIST'S
BEST FRIEND
Mantle chemistry and massive diamond formation tie the knot p. 1603

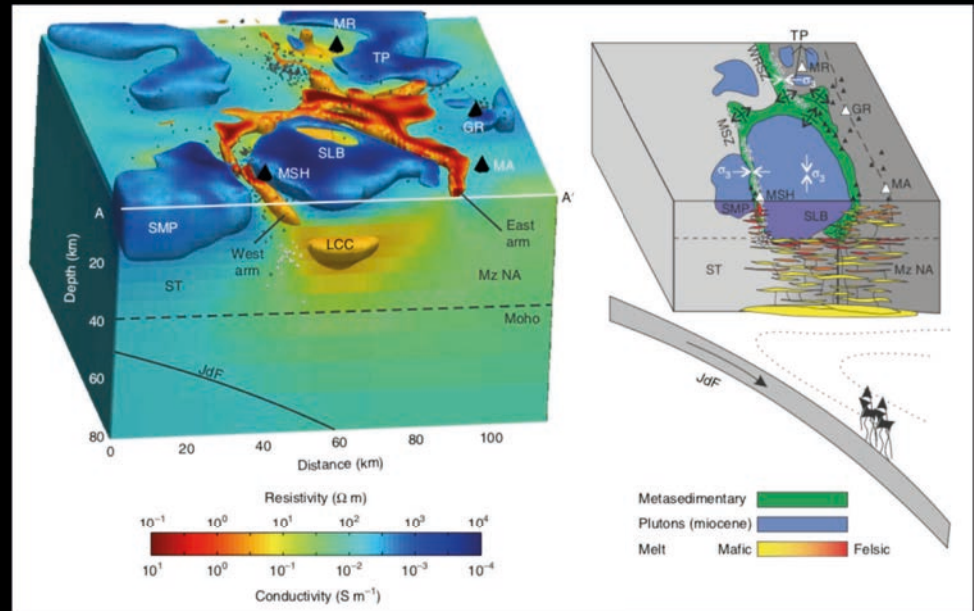


Indagini geofisiche

Le indagini geofisiche (e.g., propagazione delle onde sismiche, anomalie di gravità, conduttività elettrica, magnetismo) sfruttano i contrasti delle proprietà fisiche delle rocce



Seismic tomography along a profile through the Western Alps
Diehl et al. (2009), Schmid et al. (2008)



Resistivity model of Mount St. Helen
Bedrosian et al. (2018)

Esperimenti di laboratorio

Gli esperimenti di laboratorio ad alte pressioni e temperature vengono fatti per studiare le proprietà termodinamiche di minerali e fluidi e riprodurre i processi che avvengono all'interno dei pianeti



Modelli teorici

I modelli teorici (e.g., modelli termodinamici, simulazioni numeriche) predicono le proprietà chimico-fisiche di minerali, fluidi e rocce e i processi che avvengono all'interno dei pianeti

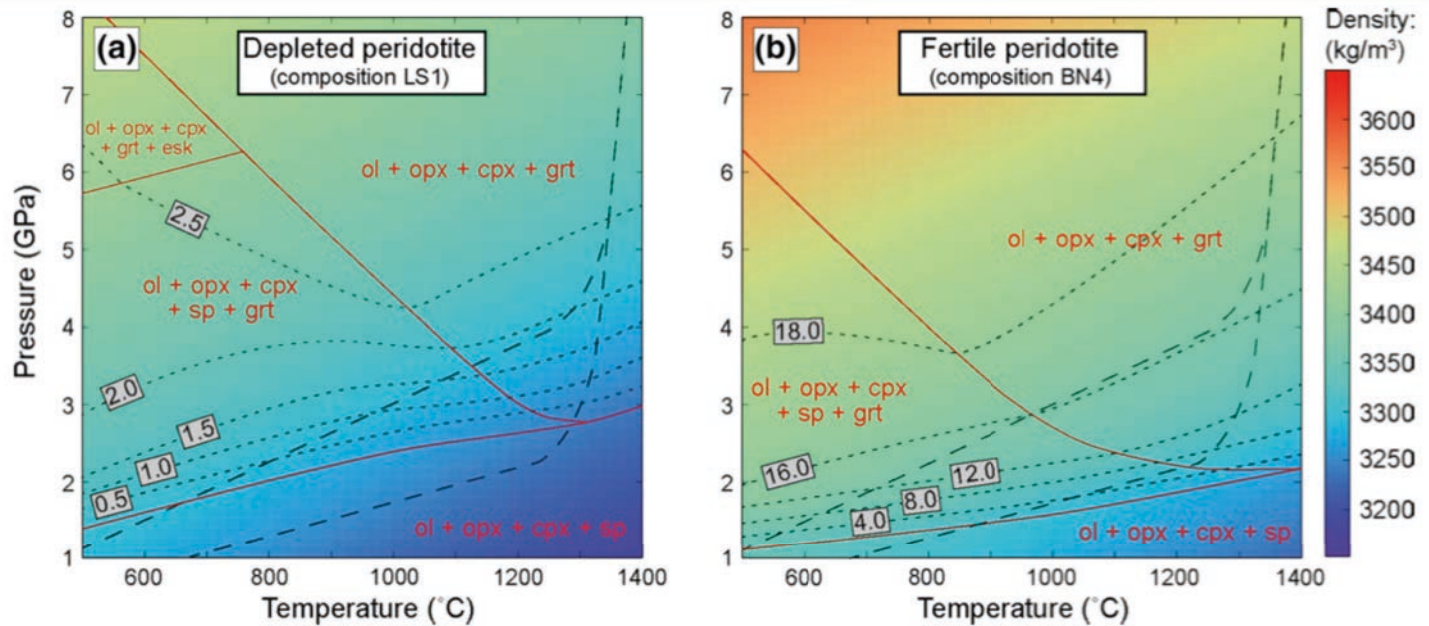


Fig. 3 Pressure–temperature diagram showing a colour map of the calculated density for the compositions **a** LS1 and **b** BN4 (mantle xenoliths from Pali-Aike, Stern et al. 1999). The two dashed curves represent a 50 (*higher curve*) and a 70 mW/m² (*lower curve*) conductive geotherms both joining the 1300 °C adiabat (Hasterok and Chapman 2011). The solid red curves delimit the stability fields predicted by the thermodynamic model (*ol* olivine, *opx* orthopyroxene, *cpx*

clinopyroxene, *grt* garnet, *sp* spinel, *esk* eskolaite). It is worth noting that garnet modes (*isopleths marked by grey squares*) have the major control on density variations across the spinel–garnet transition. The smoother density variation at the spinel–garnet transition in (a) is indeed related to the very low modes of garnet (<3.0 wt%) for composition BN4 (see text)

Modelli teorici

I modelli teorici (e.g., modelli termodinamici, simulazioni numeriche) predicono le proprietà chimico-fisiche di minerali, fluidi e rocce e i processi che avvengono all'interno dei pianeti

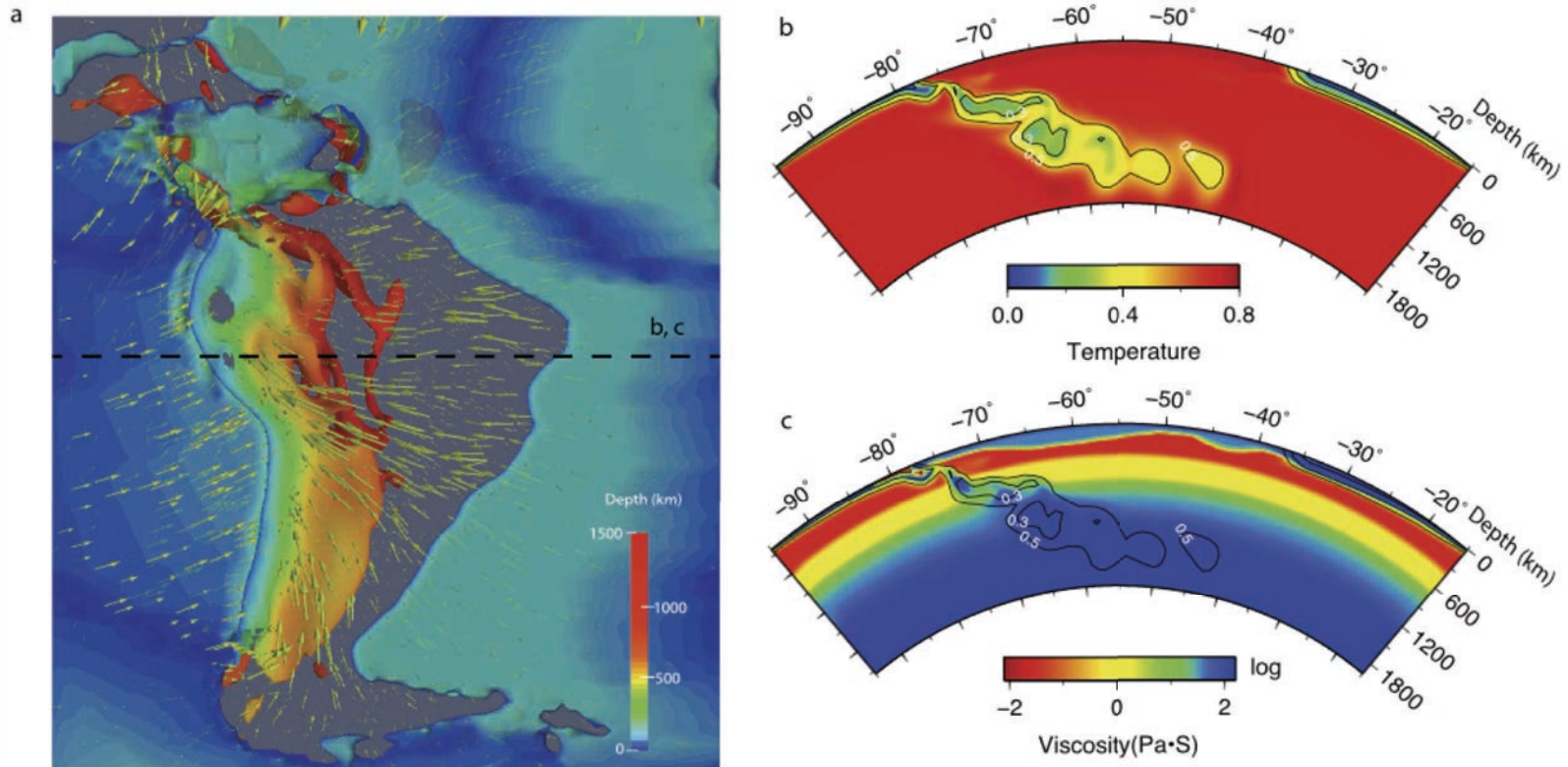
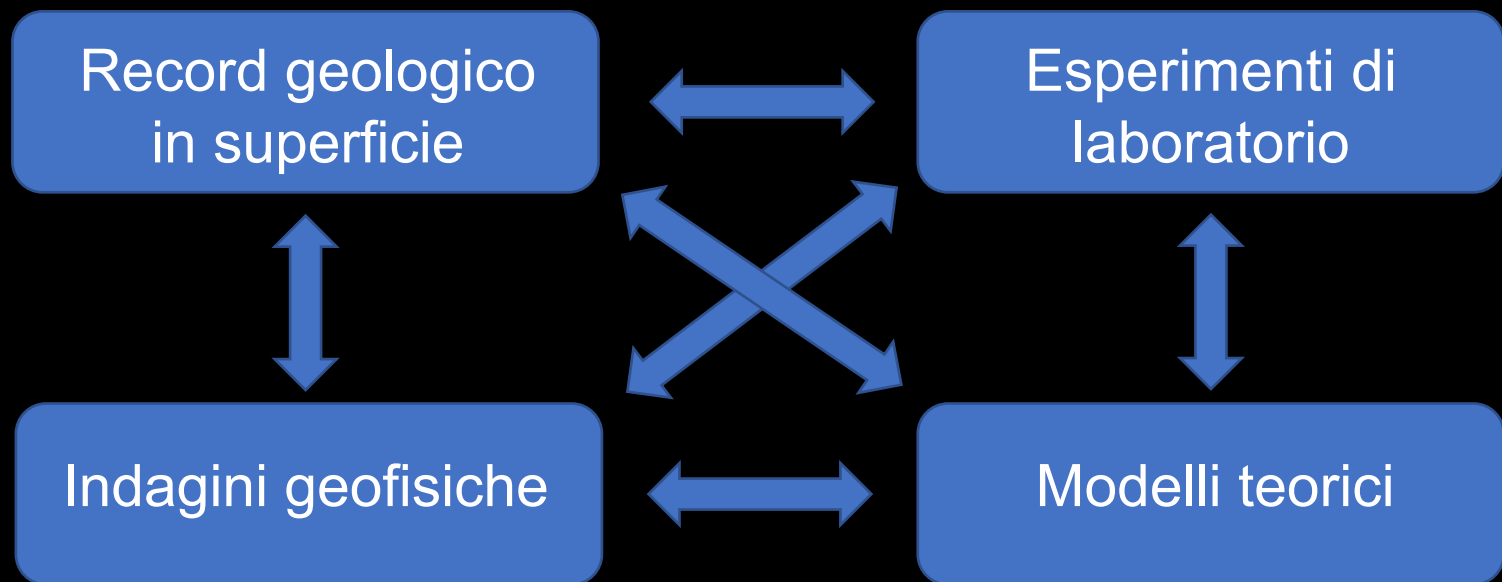


Fig. 2. Predicted slab geometry and mantle flow from the time-dependent model with the plate reconstruction of Müller et al. (2008). (a) 3D representation of the geodynamic model at present day. The 3D isosurface with a non-dimensional temperature of 0.4 is shown with color representing depth. Oceanic plates and slabs are semi-transparent, while continents are entirely transparent. Green arrows represent velocity vectors in the mantle. The dashed line marks the location of the cross-section showing temperature (b) and viscosity (c). In (b), temperature is shown as the background color. Temperature contours are annotated with non-dimensional values. Continents have a similar temperature as the ambient mantle. In (c), both the depth-dependence and lateral variation of viscosity are shown. Continents are assumed to be compositionally strong. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

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