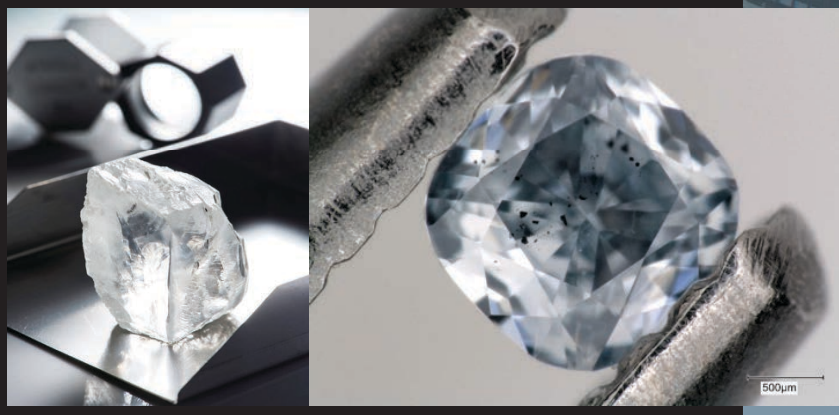
IMPMC seminars "Speciation and cycle of volatile elements"

Super-deep diamonds: a journey to the center of the Earth

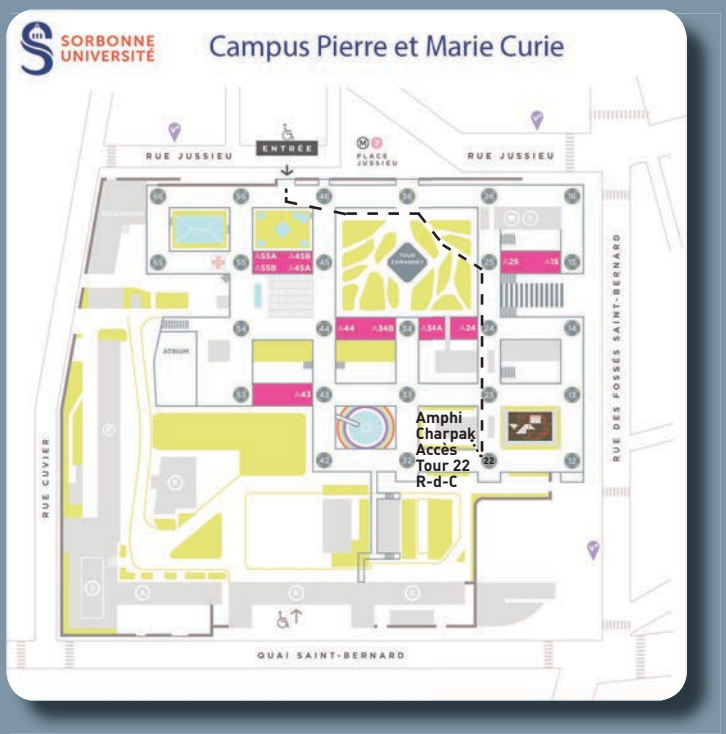


Fabrizio Nestola

Department of Geosciences,
University of Padova, Italy

Monday
November 5
2018
10:30

Sorbonne Université
4 place Jussieu - 75005 Paris
Amphi Charpak
Tower 22 - Grownd Floor



Super-deep diamonds: a journey to the center of the Earth

Fabrizio Nestola

Department of Geosciences, University of Padova, Italy
E-mail address: fabrizio.nestola@unipd.it

Super-deep diamonds (SPD) are a rare category (about 1%), which represents those stones crystallizing much deeper within the mantle with respect to the so-called lithospheric diamonds (LD). LD constitute about 99% of the entire diamond population and are considered to form at depths between 120/130 and 200/220 km depth under cratons. SPD instead originate much deeper between about 300 and 800 km depth (Figure 1).

LD usually show high nitrogen content, regular crystal shape, a low degree of plastic deformation and mineral inclusions typical of the shallow upper mantle conditions (i.e. olivines, pyroxenes, garnets, magnesiochromites, sulfides, etc.). SPD show very low nitrogen contents, irregular crystal shape, high-degree of plastic deformation and mineral inclusions, which are very typical of such diamond category like Fe-rich periclases, $CaSiO_3$-walstromites, $CaSi_2O_5$-titanites, larnites, jeffbenites, and many others which are much rarer. It is evident that SPD recently attracted much attention because such diamonds can sample fragments of very deep Earth and transport them to us almost uncorrupted over time and space. Therefore, they represent a unique way to study the inner parts of our Planet nearly directly.

The seminar will provide an overview of the most recent advances in super-deep diamond research from the hydrous ringwoodite found within a Brazilian diamond [1] to the discovery of $CaSiO_3$-perovskite [2] within a diamond from the Cullinan mine to the discovery of iron metal in super-giant diamond from Lesotho [3] and finally to the discovery that boron-bearing diamonds (blue diamonds), surprisingly resulted to be super-deep diamonds [4].

References

[1] Pearson, Brenker, Nestola et al. (2014) Nature, 507, 221;
[2] Nestola, Korolev, Kopylova et al. (2018) Nature, 555, 237.
[3] Smith, Shirey, Nestola et al. (2016) Science, 354, 1403;
[4] Smith, Shirey, Richardson, Nestola et al. (2018) Nature, 560, 84.

Figure 1. A 232-carats super-deep diamond from the Cullinan mine (courtesy image Petra Diamonds). Photo by Fabrizio Nestola
Figure 2. Blue boron-bearing diamond, with dark inclusions of ferropericlase. This gem weighs 0.03 carats (Photo by Evan M. Smith/GIA).