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Preface
Diamonds, the mantle petrologist's best friends

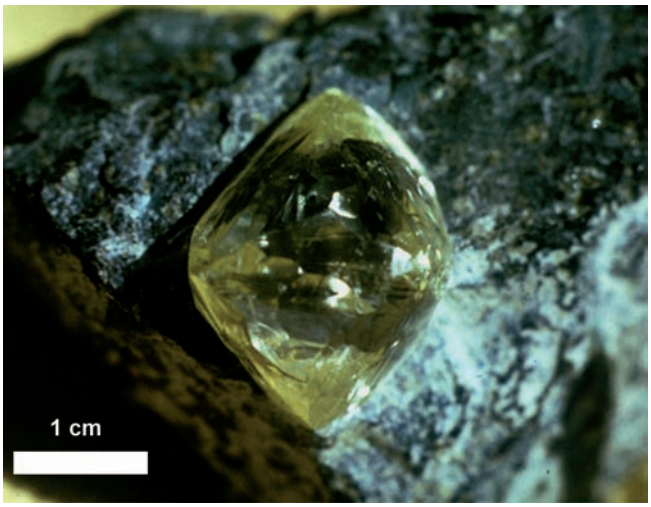

Fig. 1. An 8 carat yellow rounded dodecahedral diamond in kimberlite, recovered from the Dutoitspan mine, Kimberly, South Africa. The photograph was taken by Jeff Harris, Glasgow University, in the DeBeers sorting offices at Harry Oppenheimer House, Kimberly in August 1974.

The issue is dedicated to the International School ''Diamonds, the mantle petrologist's best friends'' held at Bressanone/Brixen (Italy) on February 21–26, 2011. The school was organized by the Department of Geosciences of University of Padua, the Department of Earth Sciences of University College of London, the European Mineralogical Union (EMU) and the Italian Society of Mineralogy and Petrology (SIMP). The main sponsors were the Deep Carbon Observatory (DCO), the European Geosciences Union (EGU), and the University of Padua. Their economic support allowed us to cover the costs of several international speakers and to greatly reduce the registration fees for the participants.

*The school was aimed at students and young researchers in diamonds and mantle mineralogy, petrology and geochemistry, as well as at economic geologists who needed an authoritative review of both the basics and the latest advances in diamond science. The invited speakers were some of the eminent scientists in the field (*i.e.*, Jeff Harris, Nick Sobolev, Steve Shirey, Mike Walter, Graham Pearson, Pierre Cartigny, Dan Frost, Dan Howell, Thomas Gernon). Additional lectures were provided by three of the organizers (A. Jones, P. Nimis and F. Nestola). A total of 62 people coming from more than 20 countries took part in the school, including 10 international speakers, 5 local organizers, 20 Ph.D. students, 8 permanent researchers, 6 master students, 6 employees in diamond companies, 4 post-docs and 3 undergraduate students (see Fig. 1).*

The school was organized with both lectures and practical sessions. The lectures covered the following topics: diamonds in History; Mantle mineralogy; Diamond formation and distribution in the Earth's mantle; Trace elements and mantle metasomatism; Radiogenic isotopes; Mantle sulphides and Re–Os isotopes; Chemical thermobarometry of mantle rocks and diamond inclusions; Non-destructive analysis of diamonds and their inclusions (XRD, Raman, FTIR, birefringence); Kimberlite petrogenesis; Kimberlite volcanology; Mantle redox conditions and diamonds; Stable isotopes and the origin of diamond; Sublithospheric diamonds: the role of subduction; Mantle and diamonds: the Yakutia case study; Diamond morphology, colour and surface features: a southern African case study. The practical sessions were conducted by Jeff Harris and Adrian Jones. With the aid of 15 stereoscopic microscopes that were made available by the Department of Geosciences (University of Padua), all participants had a chance, in many cases for the first time in their life, to observe selected samples of kimberlites and more than 150 natural diamonds with and without inclusions. A special students' session with short talks and posters was also organized.

Besides providing participants with reviews of diamond-related science, the school provided an excellent opportunity for expert and young scientists to interact and set up new scientific networks. This special issue is a collection of papers on diamond and diamond-related subjects written by some of the lecturers and participants in the school. It is intended to provide to a far wider audience reviews and specific research articles on some of the themes that were covered by the school and were in part further developed during and after the school itself. Particular emphasis is given to the study of inclusions in diamonds, to the development of non-destructive analytical techniques, and to the role of metasomatism in the formation and resorption of diamond and other carbon-bearing phases.

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Fig. 2. The participants in the international diamond school.

The inclusions trapped in diamonds provide many of the constraints we have on the formation conditions of the diamonds themselves, so many of the papers here focus on the characterisation of these phases, and their elastic interaction with their diamond hosts. The first review article by Howell and co-authors is focused on the determination of the remnant pressure on inclusions in diamonds and provides a comparative assessment of several different analytical techniques, namely, X-ray diffractometry, Raman spectrometry and birefringence analysis; specific issues related to the calculations of the formation pressures from remnant pressure data are discussed for two important minerals included in diamonds, i.e.*, olivine and coesite. The second review article by Howell is more specifically dedicated to the causes of birefringence in diamond, which are reviewed and considered in the context of a modern understanding of diamond as well as the modern analytical techniques available to study them. Continuing the theme of inclusions, Armstrong and Walter discuss the constraints on the origin and evolution in transition zone and upper mantle of the tetragonal almandine pyrope phase (TAPP), one of the minerals included in super-deep diamonds. Determining the pressure–temperature–time history of diamonds is extremely difficult, but Princivalle and co-authors discuss the kinetics of cation distribution in synthetic* $Mg(Al, Fe^{3+})_2O_4$ *spinels and its possible use for constraining the exhumation history of diamond–spinel pairs, while the X-ray diffraction techniques required for such a study are illustrated by Nestola and co-authors who report the first* in-situ *X-ray diffraction determination of the crystal structure of an eclogitic garnet still included in a diamond; the results are used to obtain its chemical composition with a totally non-destructive approach.*

The interaction between diamonds and their source rocks is represented by two further papers. Zhang and Fedortchouk provide a systematic study of the morphology, internal textures and nitrogen defects of diamond populations from kimberlites in the central Slave craton (Canada) in order to investigate relationship between the growth, resorption, and deformation history of diamond crystals with similar mantle-derived resorption features. Malaspina and Tumiati present a review of three case studies of subduction-zone garnet peridotites, focusing on the relationships between redox conditions (as constrained by Fe^{3+} *contents in garnet), carbon-bearing minerals, and composition of C–O–H fluids during metasomatism of mantle rocks. Together, we hope that this suite of papers provides a good overview of the breadth of mineralogical research on diamonds and can act as a reference source for readers interested in understanding the methodologies now employed in the characterisation of diamonds and especially their inclusions.*

The Guest Editors
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