THE RIES IMPACT DIAMONDS: THEIR SPECTROSCOPY, CO-EXISTING PHASES AND ORIGIN. N. Palchik[1], S. Vishnevsky[1], [1]Inst. Geol. & Mineral., Novosibirsk, 630090, RUSSIA (svish@uiggm.nsc.ru).

Introduction: Ries impact diamonds, RIDs, and their apographitic paramorphs, AGPs, in first turn, are described in [1]. Other RIDs features are summarized here. Origin conditions and open or still poor-studied questions of RIDs are also presented.

Data on Raman-spectroscopy: Most (~90%) of the AGPs are Raman-invisible due to a strong optical fluorescence irrespective of their color. The rest show 2 broad bands at 1305-1334 (see the frequency shift of the main diamond band, MDB) and 1560-1575 cm^{-1} [2]. The shift, extra 1560-1575 cm^{-1} band and broadening of the both may reflect the nanosize of the diamond domains. Alternatively, the MDB broadening may be due to lonsdaleite [3], and the band 1560-1575 cm^{-1} may indicate for the diamond-like amorphous carbon or chaoite [2]. Some AGPs contain local (2-4 μ in size) irregularities exhibiting intense broad band at 1400-1460 cm^{-1}, attributed to diamond-like amorphous carbon or chaoite [2]. Surprisingly (a lack of lonsdaleite?), the MDB at 1332 cm^{-1} on in situ AGPs from shocked gneisses [4] has no broadening and is narrow; these diamonds contain also strongly-disordered graphite domains evident from the broad Raman bands of low intensity at 1350 and 1580 cm^{-1} frequencies. Description of co-existing carbon minerals see below.

Other spectral and EPR-data: These data reflect AGPs phase composition, structural features and dislocations. Yellow to orange (depending on grain color) AGPs ultraviolet luminescence spectra contain 590 nm and broad 625-775 nm bands showing lonsdaleite (>20 %) [5]. Electron Paramagnetic Resonance revealed in a single g-line 2.003 at ΔH~250 A/m indicative for the crystal defects and lonsdaleite impurity [5]. Infra-red data [6] show defect-induced vibrations referable to symmetric+asymmetric C-H stretching modes (bands 2852 and 2925 cm^{-1}) and to other H-related features (bands at 1650, 1555, 1405 and 1390 cm^{-1}) but no defects of Nitrogen-reach types IaA to Ib diamond. Cathodoluminescence, CL, [7] shows a lot of bands (at 2.8-2.9 eV, 443-427 nm, and 1.8 eV, 688 nm) related to dislocations and their vibronic effects and, possibly, to amorphous carbon (peaks at 2.23 eV, 556 nm, 2.32 eV, 534 nm, and 2.39 eV, 519 nm). The bands at 1.8, 2.23 & 2.32 eV are typical for the impact diamonds only. Data on CVD-diamonds [1] are very scarce.

***Association with other carbon phases*:** The Ries AGPs, especially dark-colored ones, show a close association with other carbon phases. Parental or new-generated graphite, G, is the most common here, forming X-ray detectable impurities and lamellae (often with chaoite [5, 8]) or Raman-detected nanocrystalline domains [2]. Diamond-like amorphous carbon, AC, or chaoite is also found in some AGPs [2]. In situ AGPs from shocked gneisses contain highly-disordered and fine-grained Gs and dense hard carbon phase (AC or an unknown crystalline species?) [4]. CL-detectable AC is also found in Ries AGPs [7]. To this we can add that Popigai AGPs from shocked gneisses also contain X-ray detectable strongly-disordered G together with chaoite, cubic diamond and lonsdaleite [9]. Skeletal CVD-RIDs show epitaxial intergrowth with SiC [10].

Origin conditions of RIDs: Following to experiments (by De-Carli, Hannemann, et al.) and observations in astroblemes, the P-T origin range for AGPs is from ~30 GPa (in shocked gneisses) to 140 GPa (in partially-vaporized impact melt) and from ~700 to 4000 K [3, 4, 11]. Due to a prolonged natural shock, the P-T conditions are valid in origin of both the cubic and hexagonal diamonds. They arise by the martensitic (in a solid state) or diffusion (in liquid/amorphous state of the shocked graphite) way [12]. Chaoite (natural carbine) is supposed to form at high, >2500 K, temperatures [11]. A number of high P-T carbon phases, both confirmed and supposed, is listed in [11]; some of the phases can be of shock origin. Recent data [4] contribute in this promising but still poor-studied field of carbon shock mineralogy. Data on CVD-RIDs are scarce.

The brief review on RIDs made here and in [1] is filled up by a number of still open/poorly-studied questions on the topic we shall present at Annual Meteoritical Society Meeting, July 26-30, 2010, New York.

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