## Contents

1 **Introduction: Physico-Chemical Experiments as the Key to Diamond Genesis Problems** ........................................ 1  
   1.1 Diamond-Hosted Inclusions as a “Window” into the Mantle Diamond-Parental Media ........................................ 1  
   1.2 General Composition of Diamond-Producing System from Syngenetic Inclusions ........................................ 3  
   1.3 Principal Problems in Genesis of Diamond and Associated Phases ................................................................. 4  
   1.4 Physico-Chemical Experiments in Study of Diamond Origin ................................................................. 4  
   1.5 Early Assumptions for Diamond-Parental Medium ............... 6  

2 **Mantle Rocks and Diamond-Associated Phases: Role in Diamond Origin** ......................................................... 7  
   2.1 Xenoliths of Native Upper-Mantle Rocks in Kimberlites ........ 8  
   2.2 Transition-Zone and Lower-Mantle Petrology from High-Pressure Experiments ........................................ 11  
   2.3 Primary Mineral Inclusions in Upper-Mantle Diamonds ........ 13  
   2.4 Primary Mineral Inclusions in Transition-Zone and Lower-Mantle Diamonds ........................................ 16  
   2.5 Xenoliths of Diamond-Bearing Rocks in Kimberlites ........... 20  
   References ........................................................................ 23  

3 **Strongly Compressed Carbonate Systems in Diamond Genesis** .......... 31  
   3.1 Congruent Melting of Carbonate Minerals at High Pressure .... 32  
   3.2 Melting of Multicomponent Carbonate Systems as to Mantle Geothermal Regime ........................................ 38  
   3.3 Complete Liquid Miscibility in Silicate-(±Oxide)-Carbonate Systems ......................................................... 41
3.4 Diamond Solubility and Carbon-Oversaturated Carbonate-Bearing Melts-Solutions ................. 42
References ................................................ 49

4 Upper-Mantle Diamond-Parental Systems in Physico-Chemical Experiment .............................................. 55
4.1 Syngensis Criterion for Parental Melts of Diamonds and Associated Minerals ................................. 56
4.2 Concentration Barrier of Diamond Nucleation ................ 63
4.3 Physico-Chemical Mechanisms of Syngensis of Diamonds and Associated Phases .............................. 67
4.4 Xenogenetic Upper-Mantle Minerals in Diamond-Producing Processes .............................................. 74
4.5 Principles of Genetic Classification of Syngenetic Inclusions in Upper-Mantle Diamonds ................................. 81
References ................................................ 83

5 Physico-Chemical Features of Lower-Mantle Diamond-Parental Systems .................................. 87
5.1 Paradoxical Assemblage of Stishovite and Oxide Inclusions in Lower-Mantle Diamonds ......................... 87
5.2 Physico-Chemical Mechanism of Stishovite Paradox by Experimental Evidence ............................... 89
5.3 Parental Melts and Genetic Mechanisms for Lower-Mantle Diamonds and Inclusions .......................... 94
5.4 Some Remarks on Genetic Classification of Syngenetic Inclusions in Lower-Mantle Diamonds ................. 96
References ................................................ 96

6 Ultrabasic-Basic Fractionating of Mantle Magmas and Diamond-Parental Melts .................. 99
6.1 Peritectic Reactions of Orthopyroxene and Olivine in Upper-Mantle Magma Evolution ...................... 99
6.2 Olivine Garnetization and Evolution of Upper-Mantle Diamond-Parental Melts ............................... 102
6.3 Fractionary Syngenesis Diagram for Upper-Mantle Diamonds and Associated Phases ....................... 107
6.4 Fractionary Evolution of Lower-Mantle Magmas and Diamond-Parental Melts ............................... 110
References ................................................ 112
7 Mantle-Carbonatite Conception of Diamond and Associated Phases Genesis ............................... 115
  7.1 Generalized Composition Diagram of Upper-Mantle Diamond-Parental Medium ............................... 115
  7.2 Generalized Composition Diagrams of Lower-Mantle and Transition-Zone Diamond-Parental Media .......... 118
  7.3 Basics of the Mantle-Carbonatite Theory of Diamond Genesis ............................................. 121
  7.4 Experimental TE Partition Coefficients for Diamond-Parental Systems ........................................ 123
  7.5 Formation and Evolution of the Mantle Reservoirs of Silicate-Oxide-Carbonate-Carbon Melts Parental for Diamonds and Associated Phases ......................... 129
References ........................................................................................................................................... 133
Genesis of Diamonds and Associated Phases
Litvin, Y.A.
2017, XIV, 137 p. 45 illus., 4 illus. in color., Hardcover
ISBN: 978-3-319-54542-4