

Contents

Part I Structure: Tectonics and Magmatic Activities in Northern Vietnam

1 An Overview on the Structures, Tectonics and Magmatic Activities in North Vietnam.....	3
1.1 Vietnam in the Southeast Asian Tectonic Framework.....	3
1.2 Major Structural Factors in Northern Vietnam.....	5
1.3 Magmatic Activities in Northern Vietnam	8
References.....	11

Part II Permian: Triassic Magmatic Activity

2 Permian – Triassic Magmatic Activity in the Song Da Structure	17
2.1 Song Da Permian – Triassic Mafic and Ultramafic Pluton – Volcanic Formations.....	18
2.1.1 Magma Classification.....	18
2.1.2 Komatiite – Basalt Associations in Nam Muoi and Ta Khoa Areas	20
2.1.3 High-Ti Basalt Associations	42
References.....	54
3 Plutonic: Volcanic Associations in the Tu Le Basin and Phan Si Pan Uplift, Northwest Vietnam	59
3.1 Problem of Permian: Triassic Age for Volcanic and Sub-volcanic Magmas in the Tu Le Basin and Alkaline Granites in the Phan Si Pan Uplift	59
3.2 Mafic- Felsic Pluton-Volcanic Associations in the Tu Le Basin	60
3.2.1 Geological Characteristics	62
3.2.2 Petrologic, Mineralogical and Geochemical Characteristics.....	63
3.2.3 Isotopic Characteristics.....	71

3.3	Permian Granitoids in the Phan Si Pan Uplift.....	74
3.3.1	Geology, Petrology and Mineralogy	74
3.3.2	Elemental and Isotopic Geochemistry	78
3.4	Magmatic Formation and Tectonic Settings.....	95
	References.....	100
4	Permian – Triassic Pluton – Volcanic Magmatic Associations in the Song Hien Structure, Northeast Vietnam	103
4.1	Basalt – Rhyolite Associations.....	105
4.1.1	Geology, Age and Petrologic and Mineralogical Characteristics.....	105
4.1.2	Geochemistry and Isotope.....	109
4.2	Gabbro-Dolerite and Gabbro-norite – Lherzolite Associations.....	122
4.2.1	Gabbrodolerite (and Congadiabase)	122
4.2.2	Gabbro-norite – Lherzolite Intrusions.....	131
4.3	Geodynamics	147
	References.....	149
5	Gabbro and Syenite Intrusions in the Lo Gam Structure, Northeast Vietnam	153
5.1	Gabbro-Granite Series	154
5.1.1	Layered Gabbro-Peridotite Intrusions.....	154
5.1.2	Phia Bioc-Type High-Al Granites.....	173
5.2	Gabbro-Syenite Intrusive Formations in the Lo Gam Structure.....	180
5.2.1	Geology and Formation Age of the Gabbro and Syenite.....	180
5.2.2	Mineralogy	184
5.2.3	Geochemical and Isotopic Characteristics	198
5.2.4	Formation Condition and Geodynamic Setting	205
	References.....	206
6	Permian – Triassic Metallogeny.....	209
6.1	PGE-Cu-Ni and V-Ti-Fe Mineralization Complexes	212
6.1.1	Komatiite-Basalt Related PGE-Cu-Ni Mineralization Complex in Song Da Rift.....	212
6.1.2	(PGE)-Cu-Ni Sulfide Ore Mineralization in Song Hien Pl-Peridotite	226
6.1.3	Cu-Ni-PGE and Ti-Fe-V Mineralization Related to Nui Chua- Type Layered Gabbro – Peridotite in Phu Ngu – Lo Gam Structures	233
6.1.4	Fe-Skarn Ore Complexes	236
6.2	Au-Sulfide and Sn-Sulfide Complexes	236
6.2.1	Au-Cu Mineralization	236
6.2.2	Au-As Mineralization Type	237

6.2.3	Antimony – Gold (Sb – Au), Antimony – Mercury (Sb – Hg) and Mercury – Gold (Hg – Au) Ore Types	239
6.2.4	Sn-Sulfide Mineralization	245
6.3	Summary on the Permian – Triassic Mineralization Stage	247
	References	250

Part III India – Eurasian Collision – Related Cenozoic Magmatic Activities

7	Paleogene Potassic and Ultra-potassic Volcano-Plutonic Associations in the Song Da Rift.....	257
7.1	Geological Features	258
7.2	Petrography and Mineralogy	261
7.3	Geochemistry and Isotopes.....	274
7.4	Magma Origin, P-T Parameters and Geodynamic Settings.....	284
	References	289
8	Magmatic Activities in the Phan Si Pan Uplift and Red River Zone	291
8.1	Cenozoic Ye Yen Sun Granite Complex in the Phan Si Pan Uplift....	292
8.1.1	Geological, Petrological and Mineralogical Characteristics...	292
8.1.2	Geochemical Characteristics.....	297
8.1.3	Magma Source and Geodynamic Setting.....	302
8.2	Peridotite – Gabbro Associations in the Red River Shear Zone.....	305
8.2.1	Summary on the Red River Shear Zone.....	305
8.2.2	Mafic and Ultramafic Magmatism in the Red River Fault Zone	306
8.2.3	Distribution and Geological Structure Characteristics.....	307
8.2.4	Petrological and Mineralogical Characteristics	315
8.2.5	Geochemical Characteristics.....	325
8.2.6	Formation Age and Geodynamic Settings	332
8.3	Granite Formations in the Red River Shear Zone	334
8.3.1	Biotite Granite and Leucogranite Associations	335
8.3.2	Petrologic, Mineralogical and Geochemical Characteristics	335
8.3.3	Isotopic Characteristics	338
8.3.4	Formation Ages	340
8.3.5	Source Origin and Formation Conditions	342
8.4	Summary on Cenozoic Magmatic Activities.....	343
	References	345
9	Metallogeny in the Cenozoic	349
9.1	TR – F – Ba Ore Complex.....	350
9.2	Au-Cu Complex.....	351

9.3 Mo-(Cu-Au) Complex	351
9.3.1 Mo-(Cu-Au) Mineralization of O Quy Ho.....	352
9.3.2 Mineralization at Suoi Lanh (Ban Khoang).....	352
9.3.3 Mineralogical, Geochemical and Isotopic Characteristics	354
9.4 Ruby – Sapphire Mineralization.....	357
References.....	357
Conclusions	359
Index	363

Intraplate Magmatism and Metallogeny of North
Vietnam

Tran, T.-H.; Polyakov, G.V.; Tran, T.-A.; Borisenko, A.S.;
Izokh, A.E.; Balykin, P.A.; Ngo, T.-P.; Pham, T.-D.
2016, XII, 372 p. 169 illus. in color., Hardcover
ISBN: 978-3-319-25233-9