

Contents

Chapter 1. Lithium Mineralization, Contributions of Paleoclimates and Orogens	1
Éric GLOAGUEN, Jérémie MELLETON, Blandine GOURCEROL and Romain MILLOT	
1.1. Properties and distribution of lithium in minerals and Earth reservoirs	1
1.1.1. Physicochemical properties of lithium.	1
1.1.2. Uses of lithium	3
1.1.3. Lithium minerals	5
1.1.4. Distribution of lithium in Earth's reservoirs	6
1.2. Lithium metallogeny and geology	8
1.2.1. Lithium behavior in geological processes.	8
1.2.2. Lithium geology and metallogeny: geological settings and types of mineralization	21
1.2.3. Geochemical cycle of lithium.	49
1.3. Acknowledgments.	51
1.4. References	51
Chapter 2. Metallogeny of the Abitibi Greenstone Belt, Canada	63
Patrick MERCIER-LANGEVIN, Benoît DUBÉ, Michel G. HOULÉ, Valérie BÉCU, Anne-Aurélien SAPPIN, Jean-Luc PILOTE and Sébastien CASTONGUAY	
2.1. Introduction.	63
2.2. Mining history	64

2.3. Geological context	65
2.3.1. Volcanic rocks	68
2.3.2. Sedimentary rocks	73
2.3.3. Intrusive rocks	74
2.3.4. Deformation and metamorphism	75
2.4. Mineral resources and metallogeny	77
2.4.1. Auriferous deposits	77
2.4.2. Cu-Zn-(Au-Ag-Pb) volcanogenic massive sulfide deposits	94
2.4.3. Ni-Cu-(PGE)-Cr-V deposits associated with mafic and ultramafic rocks	104
2.4.4. Fe deposits associated with Algoma-type iron formations	111
2.4.5. Miscellaneous types of deposits	113
2.4.6. Post-Archean deposits	116
2.5. An evolving industry: technical and scientific challenges, and innovations in the mineral resources world	117
2.5.1. Underground 4G LTE mobile network, the example of the LaRonde mining complex (Quebec)	118
2.5.2. Use of electric vehicles in mining, the example of the Borden mine (Ontario)	118
2.5.3. Mine wastes used in the restoration of an abandoned mine site, the example of the Manitou project (Quebec)	120
2.6. An exceptional metallogenic context: a brief discussion	121
2.7. Conclusion	123
2.8. Acknowledgments	123
2.9. References	124
Chapter 3. The Unconformity-related Uranium Mineral System of the Athabasca Basin (Canada)	143
Patrick LEDRU, Antonio BENEDICTO, Guoxiang CHI, Charles KHAIRALLAH, Julien MERCADIER, Jonathan POH and John ROBBINS	
3.1. Introduction	143
3.2. Defining the critical elements of the unconformity-related uranium mineral system of the Athabasca Basin	147
3.2.1. The architecture of the Athabasca Basin and its basement at the regional scale	147
3.2.2. The fluid flow system	158
3.2.3. Fertility	176
3.2.4. Preservation	177

3.3. Implication of the mineral system concept applied to the exploration of unconformity-related uranium deposits	178
3.4. Conclusion	181
3.5. References	181

Chapter 4. North African Mississippi Valley-Type Deposit and Its Link with the Alpine Chain Evolution 195

Mohammed BOUABDELLAH

4.1. Introduction.	195
4.2. Geological settings of MVT deposits of the Atlasic system: main ore deposits and districts	199
4.2.1. Morocco	200
4.2.2. Algeria	213
4.2.3. Tunisia	219
4.3. Discussion	228
4.3.1. Physicochemical characteristics of the mineralizing fluids	228
4.3.2. Source and origin of fluid salinity	229
4.3.3. Origin(s) and source(s) of mineralizing fluids	230
4.3.4. Origin of sulfur and ore depositional processes	232
4.3.5. Sulfide ore controls	234
4.3.6. Role of organic matter	236
4.3.7. Metal source(s)	238
4.3.8. Timing of sulfide ore formation	241
4.3.9. Genetic model(s) – conclusions.	242
4.4. Supergene non-sulfide Pb-Zn mineralization associated with MVT deposits	246
4.4.1. Introduction	246
4.4.2. Supergene non-sulfide mineralization associated with MVT deposits of the Touissit-Bou Beker and Upper Moulouya districts	247
4.4.3. Non-sulfide mineralization associated with MVT deposits of the calamine-bearing province of Central and Eastern High Atlas	248
4.4.4. Supergene mineralization associated with MVT deposits of the Tunisian “Diapir Zone”	249
4.4.5. Discussion	250
4.5. Acknowledgments	250
4.6. References	251

Chapter 5. West African Leo-Man Shield Metallogenic Province . . .	265
Aurélien EGLINGER, Anne-Sylvie ANDRÉ-MAYER, Nicolas THÉBAUD and Quentin MASUREL	
5.1. Introduction.	265
5.1.1. Definition of a mineral system	265
5.1.2. Metallogenic period and province	266
5.2. Geology of LMS.	268
5.2.1. The Archean Kénéma-Man domain: genesis of a continental crust.	269
5.2.2. Columbia supercontinent: stabilization of LMS	271
5.2.3. The Paleoproterozoic Baoulé-Mossi domain	273
5.3. Spatiotemporal distribution of gold in LMS.	281
5.3.1. Introduction	281
5.3.2. Archean gold.	282
5.3.3. Paleoproterozoic gold	283
5.3.4. Alluvial and eluvial deposits	289
5.4. Spatiotemporal distribution of other LMS metallogenic systems	290
5.4.1. Iron	290
5.4.2. Nickel and chrome	292
5.4.3. Copper, zinc and lead	292
5.4.4. Diamond	293
5.4.5. Other mineral substances	293
5.5. Conclusion	294
5.6. References	294
 Appendix 1. Lithium Mineralization, Contributions of Paleoclimates and Orogens	 307
Éric GLOAGUEN, Jérémie MELLETON, Blandine GOURCEROL and Romain MILLOT	
 Appendix 2. Metallogeny of the Abitibi Greenstone Belt, Canada . . .	 309
Patrick MERCIER-LANGEVIN, Benoît DUBÉ, Michel G. HOULÉ, Valérie BÉCU, Anne-Aurélié SAPPIN, Jean-Luc PILOTE and Sébastien CASTONGUAY	
 List of Authors	 345
 Index	 349
 Summary of Volume 1	 353