Appendix 1

References used for determining the presence of TSM in individual porphyry systems for Figure 1:

Wendt 1938, Legge 1939, Kuhn 1941, Lynch 1967, Goossens & Hollister 1973, Sillitoe 1973, Hollister & Sirvas 1974, Spatz 1974, Gustafson & Hunt 1975, Panteleyev 1976, Ambrus 1977, Ashley *et al.* 1978, Coochey & Eckman 1978, Panteleyev 1978, Storey 1978, Kwong 1981, Schwartz 1981, Meinert 1982, Bashkirov 1983, Hunt *et al.* 1983, Parry *et al.* 1984, Taylor & Slack 1984, Warnaars *et al.* 1985, Carten 1986, Palacios *et al.* 1986, Robison 1987, King & Kerrich 1989, Clark 1990, Barr & Reid 1992, Dilles & Einaudi 1992, Lubis *et al.* 1994, Meldrum *et al.* 1994, Bower *et al.* 1995, Dirom *et al.* 1995, Kirkham & Margolis 1995, Arancibia & Clark 1996, Dugmore *et al.* 1996, Lynch & Ortega 1997, Hedenquist *et al.* 1998, Peng *et al.* 1998, Perea 1999, Palacios *et al.* 2001, Perello *et al.* 2001, Sotnikov *et al.* 2001, Landtwing *et al.* 2002, Morozumi 2003, Quang *et al.* 2003, Cannell 2004, Harris *et al.* 2004, Barra *et al.* 2005, Imai 2005, Kirwin *et al.* 2005, Volp 2005, Bouzari & Clark 2006, Norris 2006, Cooke *et al.* 2007, Ferrari *et al.* 2007, Franchini *et al.* 2007, Scott *et al.* 2008, Singer *et al.* 2008, Heberlein and Samson 2010, Lori 2010, Palacios *et al.* 2010, Zukowski 2010, Lefort *et al.* 2011, Baksheev *et al.* 2012, Dill *et al.* 2012, Djouka-Fonkwe *et al.* 2012, Herve *et al.* 2012, Mathur *et al.* 2012, Torro *et al.* 2012, Asadi *et al.* 2013, Del Rio Salas *et al.* 2013, Malla 2013, Pardo *et al.* 2015, Cao *et al.* 2016, Iveson *et al.* 2016, Oliveira *et al.* 2016, Bienko 2017, Maydagán *et al.* 2017, Ochoa-Landín *et al.* 2017, Gibbons 2018, Siddiqui *et al.* 2018, Byrne 2019, Salazar *et al.* 2019, Sokolović *et al.* 2019, Chaffee 2020, Kelley & Graham 2020, Meng *et al.* 2020, Moshefi *et al.* 2020, Skarmeta 2020, Warlo *et al.* 2020, Osatenko *et al.* 2021.

References

Ambrus, J. (1977) Geology of the La Abra Porphyry Cu deposit, Chile. *Economic Geology* **72**(6), 1062–1085. DOI: http://doi.org/10.2113/gsecongeo.72.6.1062

Arancibia, O.N. & Clark, A.H. (1996) Early magnetite-amphibole-plagioclase alteration-mineralization in the Island Copper porphyry copper-gold-molybdenum deposit, British Columbia. *Economic Geology* **91**(2), 402–438. DOI: http://doi.org/10.2113/gsecongeo.91.2.402

Asadi, S., Moore, F., Zarasvandi, A., & Khosrojerdi, M. (2013) First report on the occurrence of CO2-bearing fluid inclusions in the Meiduk porphyry copper deposit, Iran: Implications for mineralisation processes in a continental collision setting. *Geologos* **19**(4), 301–320. DOI: http://doi.org/10.2478/logos-2013-0019

Ashley, P.M., Billington, W.G., Graham, R.L., & Neale, R.C. (1978) Geology of the Coalstoun porphyry copper prospect Southeast Queensland Australia. *Economic Geology* **73**(5), 945–965. DOI: http://doi.org/10.2113/gsecongeo.73.5.945

Baksheev, I.A., Yu Prokof'ev, V., Zaraisky, G.P., Chitalin, A.F., Yapaskurt, V.O., Nikolaev, Y.N., Tikhomirov, P.L., Nagornaya, E.V., Rogacheva, L.I., Gorelikova, N.V., & Kononov, O.V. (2012) Tourmaline as a prospecting guide for the porphyry-style deposits. *European Journal of Mineralogy* **24**(6), 957–979. DOI: http://doi.org/10.1127/0935-1221/2012/0024-2241

Barr, J.M. & Reid, D.L. (1992) Hydrothermal alteration at the Haib porphyry copper deposit, Namibia: Stable isotope and fluid inclusion patterns. *Communs Geological Survey Namibia* **8**, 23–35.

Barra, F., Ruiz, J., Valencia, V.A., Ochoa-Landín, L.H., Chesley, J.T., & Zurcher, L. (2005) Laramide porphyry Cu-Mo mineralization in Northern Mexico: Age constraints from Re-Os geochronology in molybdenite. *Economic Geology* **100**(8), 1605–1616. DOI: http://doi.org/10.2113/gsecongeo.100.8.1605

Bashkirov, B.G. (1983) Explosion breccias in the Kounrad porphyry-copper deposit. *International Geology Review* **25**(4), 373–380. DOI: http://doi.org/10.1080/00206818309466714

Bienko, T. (2017) The Sierra Gorda porphyry Cu-Mo-(Au) deposit Chile. *Przeglad Geologiczny* **65**(9), 555–559.

Bouzari, F. & Clark, A.H. (2006) Prograde evolution and geothermal affinities of a major porphyry copper deposit: The Cerro Colorado hypogene protore, I Region, Northern Chile. *Economic Geology* **101**(1), 95–134. DOI: http://doi.org/10.2113/gsecongeo.101.1.95

Bower, B., Payne, J., DeLong, C., & Rebagliati, C.M. (1995) The oxide-gold, supergene and hypogene zones at the Casino gold-copper-molybdenum deposit, West Central Yukon. *In* Porphyry Copper Deposits of the Northwestern Cordillera of North America (T. Schroeter, ed.). Canadian Institute of Mining and Metallurgy and Petroleum, Montreal, Quebec, Canada (352–366).

Byrne, K. (2019) *Diagnostic Features of the Rocks and Minerals Peripheral to the Highland Valley Copper District, British Columbia, Canada: Implications for the Genesis of Porphyry Cu Systems and their Footprints.* PhD Thesis. University of Alberta, Edmonton, Canada.

Cannell, J. (2004) *Teniente Porphyry Copper-Molyndenum Deposit, Central Chile*. PhD Thesis. University of Tasmania, Australia.

Cao, M.J., Li, G.M., Qin, K.Z., Evans, N.J., & Seitmuratova, E.Y. (2016) Assessing the magmatic affinity and petrogenesis of granitoids at the giant Aktogai porphyry Cu deposit, Central Kazakhstan. *American Journal of Science* **316**(7), 614–668. DOI: http://doi.org/10.2475/07.2016.02

Carten, R.B. (1986) Sodium-calcium metasomatism; chemical, temporal, and spatial relationships at the Yerington, Nevada, porphyry copper deposit. *Economic Geology* **81**(6), 1495–1519. DOI: http://doi.org/10.2113/gsecongeo.81.6.1495

Chaffee, M.A. (2020) *Geochemical and Mineralogical Study of the Red Mountain Porphyry Copper-Molybdenum Deposit and Vicinity, Santa Cruz County, Arizona.* USGS Scientific Investigations Report 2019-5077. United States Geological Survey, Denver, Colorado, USA. DOI: http://doi.org/10.3133/sir20195077

Clark, A.H. (1990) The slump breccias of the Toquepala porphyry Cu (-Mo) deposit, Peru: Implications for fragment rounding in hydrothermal breccias. *Economic Geology* **85**(7), 1677–1685. DOI: http://doi.org/10.2113/gsecongeo.85.7.1677

Coochey, D.V. & Eckman, P. (1978) Geology of the La Verde Copper Deposits, Michoacan, Mexico. *In* Arizona Geological Society Digest XI, Tuscon, Arizona, USA (129–137).

Cooke, D.R., Wilson, A.J., House, M.J., Wolfe, R.C., Walshe, J.L., Lickfold, V., & Crawford, A.J. (2007) Alkalic porphyry Au-Cu and associated mineral deposits of the Ordovician to Early Silurian Macquarie Arc, New South Wales. *Australian Journal of Earth Sciences* **54**(2–3), 445–463. DOI: http://doi.org/10.1080/08120090601146771

Del Rio Salas, R., Ochoa-Landín, L., Ruiz, J., Eastoe, C., Meza-Figueroa, D., Zuñiga-Hernández, H., Mendívil-Quijada, H., & Quintanar-Ruiz, F. (2013) Geology, stable isotope, and U-Pb geochronology of the Mariquita porphyry copper and Lucy Cu-Mo deposits, Cananea District, Mexico: A contribution to regional exploration. *Journal of Geochemical Exploration* **124**, 140–154. DOI: http://doi.org/10.1016/j.gexplo.2012.08.016

Dill, H.G., Garrido, M.M., Melcher, F., Gomez, M.C., & Luna, L.I. (2012) Depth-related variation of tourmaline in the breccia pipe of the San Jorge porphyry copper deposit, Mendoza, Argentina. *Ore Geology Reviews* **48**, 271–277. DOI: http://doi.org/10.1016/j.oregeorev.2012.04.006

Dilles, J.H. & Einaudi, M. (1992) Wall-rock alteration and hydrothermal flow paths about the Ann-Mason porphyry copper deposit, Nevada-A 6-Km vertical reconstruction. *Economic Geology* **87**(8), 1963–2001. DOI: http://doi.org/10.2113/gsecongeo.87.8.1963

Dirom, G.E., Dittrick, M.P., McArthur, D.R., Orgryzlo, P.L., Pardoe, A.J., & Stothart, P.G. (1995) Bell and Granisle porphyry copper-gold mines, Babine region, west-central British Columbia. *In* Porphyry Copper Deposits of the Northwestern Cordillera of North America (T. Schroeter, ed.). Canadian Institute of Mining and Metallurgy and Petroleum, Montreal, Quebec, Canada (256–289).

Djouka-Fonkwe, M.L., Kyser, K., Clark, A.H., Urqueta, E., Oates, C.J., & Inlenfeld, C. (2012) Recognizing propylitic alteration associated with porphyry Cu-Mo deposits in lower greenschist facies metamorphic terrain of the Collahuasi District, Northern Chile—implications of petrographic and carbon isotope relationships. *Economic Geology* **107**(7), 1457–1478. DOI: http://doi.org/10.2113/econgeo.107.7.1457

Dugmore, M.A., Leaman, P.W., & Philip, R. (1996) Discovery of the Mt. Bini porphyry copper-gold-molybdenum deposit in the Owen Stanley Ranges, Papua New Guinea – A geochemical case history. *Journal of Geochemical Exploration* **57**(1–3), 89–100. DOI: http://doi.org/10.1016/s0375-6742(96)00018-0

Ferrari, L., Valencia-Moreno, M.n., & Bryan, S. (2007) Magmatism and tectonics of the Sierra Madre Occidental and its relation with the evolution of the western margin of North America. *In* Geology of Mexico: Celebrating the Centenary of the Geological Society of Mexico. Geological Society of America, Boulder, Colorado, USA (433–458). DOI: http://doi.org/10.1130/2007.2422(01)

Franchini, M., Impiccini, A., Meinert, L., Grathoff, G., & Schalamuk, I.B.A. (2007) Clay mineralogy and zonation in the Campana Mahuida Porphyry Cu Deposit, Neuquén, Argentina: Implications for porphyry Cu exploration. *Economic Geology* **102**, 27–34.

Gibbons, J. (2018) *Magmatic-Hydrothermal Evolution of the Pampa Escondida Porphyry Copper Deposit Northern Chile*. PhD Thesis. University of Arizona, Tucson, Arizona, USA.

Goossens, P.J. & Hollister, V.F. (1973) Structural control and hydrothermal alteration patter of Chaucha porphyry copper, Ecuador. *Mineralium Deposita* **8**(4), 321–331. DOI: http://doi.org/10.1007/bf00207515

Gustafson, L.B. & Hunt, J.P. (1975) The porphyry copper deposit at El Salvador, Chile. *Economic Geology* **70**(5), 857–912. DOI: http://doi.org/10.2113/gsecongeo.70.5.857

Harris, A.C., Allen, C.M., Bryan, S.E., Campbell, I.H., Holcombe, R.J., & Palin, J.M. (2004) LA-ICP-MS U-Pb zircon geochronology of regional volcanism hosting the Bajo de la Alumbrera Cu-Au deposit: Implications for porphyry-related mineralization. *Mineralium Deposita* **39**(1), 46–67. DOI: http://doi.org/10.1007/s00126-003-0381-0

Heberlein, D.R. & Samson, H. (2010) *An Assessment of Soil Geochemical Methods for Detecting Copper-Gold Porphyry Mineralization through Quaternary Glaciofluvial Sediments at the Kwanika Central Zone, North-Central British Columbia.* Geoscience BC, Report 2010-03. Geoscience BC, Vancouver, BC, Canada.

Hedenquist, J.W., Arribas Jr, A., & Reynolds, T.J. (1998) Evolution of an intrusion-centered hydrothermal system: Far Southeast-Lepanto porphyry and epithermal Cu-Au deposits, Philippines. *Economic Geology* **93**(4), 373–404. DOI: http://doi.org/10.2113/gsecongeo.93.4.373

Herve, M., Sillitoe, R.H., Wong, C., Fernandez, P., Crignola, F., Ipinza, M., & Urzua, F. (2012) Geologic Overview of the Escondida Porphyry Copper District, Northern Chile. *In* Geology and Genesis of Major Copper Deposits and Districts of the World: A Tribute to Richard H. Sillitoe (J.W. Hedenquist, M. Harris, & F. Camus, eds.). Society of Economic Geologists, Littleton, Colorado, USA (55–78). DOI: http://doi.org/10.5382/sp.16.03

Hollister, V.F. & Sirvas, E.B. (1974) The Michiquillay porphyry copper deposit *Mineralium Deposita* **9**(3), 261–269. DOI: http://doi.org/10.1007/bf00204000

Hunt, J.P., Bratt, J.A., & Marquardt, J.C. (1983) Quebrada-Blanca, Chile – An enriched porphyry copper-deposit. *Mining Engineering* **35**(6), 636–644.

Imai, A. (2005) Evolution of hydrothermal system at the Dizon porphyry Cu-Au deposit, Zambales, Philippines. *Resource Geology* **55**(2), 73–90. DOI: http://doi.org/10.1111/j.1751-3928.2005.tb00230.x

Iveson, A.A., Webster, J.D., Rowe, M.C., & Neill, O.K. (2016) Magmatic–hydrothermal fluids and volatile metals in the Spirit Lake pluton and Margaret Cu-Mo porphyry system, SW Washington, USA. *Contributions to Mineralogy and Petrology* **171**(3), 1–32. DOI: http://doi.org/10.1007/s00410-015-1224-6

Kelley, K.D. & Graham, G.E. (2020) Hydrogeochemistry in the Yukon-Tanana upland region of east-central Alaska: Possible exploration tool for porphyry-style deposits. *Applied Geochemistry* **124**, 104821. DOI: http://doi.org/10.1016/j.apgeochem.2020.104821

King, R.W. & Kerrich, R.W. (1989) Strontium isotope compositions of tourmaline from lode gold deposits of the Archean Abitibi Greenstone-Belt (Ontario Quebec, Canada) – Implications for source reservoirs. *Chemical Geology* **79**(3), 225–240. DOI: http://doi.org/10.1016/0168-9622(89)90031-6

Kirkham, R.V. & Margolis, J. (1995) Overview of the Sulphurets area, northwestern British Columbia. *In* Porphyry Copper Deposits of the Northwestern Cordillera of North America (T. Schroeter, ed.). Canadian Institute of Mining and Metallurgy and Petroleum, Montreal, Quebec, Canada (473–483).

Kirwin, D.J., Turmagnai, W.D., & Wolfe, R. (2005) Exploration history, geology, and mineralisation of the Kharmagtai gold-copper porphyry district, south Gobi region, Mongolia. *In* Geodynamics and Metallogeny of Mongolia with a Special Emphasis on Copper and Gold Deposits (R. Seltmann, O. Gerel, & D. Kirwin, eds.). SEG-IAGOD field trip. Economic Geology, USA.

Kuhn, T.H. (1941) Pipe deposits of the copper creek area, Arizona. *Economic Geology* **36**(5), 512–538. DOI: <http://doi.org/10.2113/gsecongeo.36.5.512>

Kwong, Y.-T.J. (1981) *A New Look at the Afton Copper Mine in Light of Mineral Distributions, Host Rock Geochemsitry and Irreversible Mineral-Solution Interactions.* PhD Thesis University of British Columbia, Vancouver, British Columbia, Canada.

Landtwing, M., Dillenbeck, E.D., Leake, M.H., & Heinrich, C.A. (2002) Evolution of the breccia-hosted porphyry Cu-Mo-Au deposit at Agua Rica, Argentina: Progressive unroofing of a magmatic hydrothermal system. *Economic Geology* **97**(6), 1273–1292. DOI: http://doi.org/10.2113/gsecongeo.97.6.1273

Lefort, D., Hanley, J.J., & Guillong, M. (2011) Subepithermal Au-Pd mineralization associated with an alkalic porphyry Cu-Au deposit, Mount Milligan, Quesnel Terrane, British Columbia, Canada. *Economic Geology* **106**(5), 781–808. DOI: http://doi.org/10.2113/econgeo.106.5.781

Legge, J.A. (1939) *Paragenesis of the Ore Minerals of the Miami Mine Arizona.* MSc Thesis. University of Arizona, Tucson, Arizona, USA.

Lori, J.D.L. (2010) *Investigations of Grade Control, Macarthur Mine, Yerrington, Nevada: An Oxidized Porphyry Copper System.* MSc Thesis. University of Texas, Austin, Texas, USA.

Lubis, H., Prihatmoko, S., & James, L.P. (1994) Bulagidun prospect: A copper, gold and tourmaline bearing porphyry and breccia system in northern Sulawesi, Indonesia. *Journal of Geochemical Exploration* **50**(1–3), 257–278. DOI: http://doi.org/10.1016/0375-6742(94)90027-2

Lynch, D.W. (1967) *The Geology of the Esperanza Mine and Vicinity Pima County, Arizona.* MSc Thesis. University of Arizona, Tucson, Arizona, USA.

Lynch, G. & Ortega, S. (1997) Hydrothermal alteration and tourmaline-albite equilibria at the Coxheath porphyry Cu-Mo-Au deposit, Nova Scotia. *The Canadian Mineralogist* **35**(1), 79–94.

Malla, F.P.O. (2013) *Estudio de Geologia, Mineralizacion y Alteraciones en la Concesion Minera Cascabel Pronvincia de Imbabura*. BSc Thesis. Escuela Politecnica Nacional, Quito, Ecuador.

Mathur, R., Ruiz, J., Casselman, M.J., Megaw, P., & van Egmond, R. (2012) Use of Cu isotopes to distinguish primary and secondary Cu mineralization in the Cañariaco Norte porphyry copper deposit, Northern Peru. *Mineralium Deposita* **47**(7), 755–762. DOI: http://doi.org/10.1007/s00126-012-0439-y

Maydagán, L., Franchini, M., Chiaradia, M., Bouhier, V., Di Giuseppe, N., Rey, R., & Dimieri, L. (2017) Petrogenesis of Quebrada de la Mina and Altar North porphyries (Cordillera of San Juan, Argentina): Crustal assimilation and metallogenic implications. *Geoscience Frontiers* **8**(5), 1135–1159. DOI: http://doi.org/10.1016/j.gsf.2016.11.011

Meinert, L. (1982) Skarn, manto, and breccia pipe formation in sedimentary rocks of the Cananea Mining District, Sonora, Mexico. *Economic Geology* **77**(4), 919–949. DOI: http://doi.org/10.2113/gsecongeo.77.4.919

Meldrum, S.J., Aquino, R.S., Gonzales, R.I., Burke, R.J., Suyadi, A., Irianto, B., & Clarke, D.S. (1994) The Batu Hijau porphyry copper-gold deposit, Sumbawa Island, Indonesia. *Journal of Geochemical Exploration* **50**(1–3), 203–220. DOI: http://doi.org/10.1016/0375-6742(94)90025-6

Meng, X., Richards, J., Mao, J., Ye, H., DuFrane, S.A., Creaser, R., Marsh, J., & Petrus, J. (2020) The Tongkuangyu Cu Deposit, Trans-North China Orogen: A metamorphosed Paleoproterozoic porphyry Cu deposit. *Economic Geology* **115**(1), 51–77. DOI: http://doi.org/10.5382/econgeo.4693

Morozumi, H. (2003) Geochemical characteristics of granitoids of the Erdenet porphyry copper deposit, Mongolia. *Resource Geology* **53**(4), 311–316. DOI: http://doi.org/10.1111/j.1751-3928.2003.tb00180.x

Moshefi, P., Hosseinzadeh, M.R., Moayyed, M., & Lentz, D.R. (2020) Distinctive geochemical features of biotite types from the subeconomic Sonajil porphyry-type Cu deposit, northwestern Iran: Implications for analysis of porphyry copper deposit mineralization potential. *Journal of Geochemical Exploration* **214**, 1–26. DOI: http://doi.org/10.1016/j.gexplo.2020.106543

Norris, J.R. (2006) *Evolution of Alteration and Mineralization at the Red Chris Cu-Au Porphyry Deposit East Zone, Northwestern British Columbia, Canada.* MSc Thesis. University of British Columbia, Vancouver, British Columbia, Canada.

Ochoa-Landín, L.H., Valencia-Moreno, M., Calmus, T., Del Rio-Salas, R., Mendívil-Quijada, H., Meza-Figueroa, D., Flores-Vásquez, I., & Zúñiga-Hernández, L.G. (2017) Geology and geochemistry of the Suaqui Verde deposit: A contribution to the knowledge of the Laramide porphyry copper mineralization in south central Sonora, Mexico. *Ore Geology Reviews* **81**, 1158–1171. DOI: http://doi.org/10.1016/j.oregeorev.2016.10.011

Oliveira, C.G.d., Oliveira, F.B.d., Giustina, M.E.S.D., Marques, G.C., Dantas, E.L., Pimentel, M.M., & Buhn, B.M. (2016) The Chapada Cu-Au deposit, Mara Rosa magmatic arc, Central Brazil: Constraints on the metallogenesis of a Neoproterozoic large porphyry-type deposit. *Ore Geology Reviews* **72**, 1–21. DOI: http://doi.org/10.1016/j.oregeorev.2015.06.021

Osatenko, M., Riedell, K.B., & Lang, J.R. (2021) Characteristics of porphyry copper and porphyry molybdenum deposits in the northwestern Cordillera: A comprehensive compilation. *In* Porphyry Deposits of the Northwestern Cordillera of North America: A 25-Year Update (E.R. Sharman, J.R. Lang, & J.B. Chapman, eds.). The Canadian Institue Of Mining, Metallurgy and Petroleum, Montmagny, Quebec, Canada (27–67).

Palacios, C., Hein, U.F., & Dulski, P. (1986) Behaviour of rare earth elements during hydrothermal alteration at the Buena Esperanza copper-silver deposit, northern Chile. *Earth and Planetary Science Letters* **80**(3–4), 208–216. DOI: http://doi.org/10.1016/0012-821x(86)90105-6

Palacios, C., Herail, G., Townley, B., Maksaev, V., & Sepulveda, F. (2001) The composition of gold in the Cerro Casale gold-rich porphyry deposit, Maricunga belt, Northern Chile. *The Canadian Mineralogist* **39**(3), 907–915. DOI: http://doi.org/10.2113/gscanmin.39.3.907

Palacios, C., Rouxel, O., Reich, M., Cameron, E.M., & Leybourne, M.I. (2010) Pleistocene recycling of copper at a porphyry system, Atacama Desert, Chile: Cu isotope evidence. *Mineralium Deposita* **46**(1), 1–7. DOI: http://doi.org/10.1007/s00126-010-0315-6

Panteleyev, A. (1976) *Geologic Setting, Mineralization, and Aspects of Zoning at the Berg Porphyry Copper-Molybdenum Deposit, Central British Columbia.* PhD Thesis. University of British Columbia, Vancouver, British Columbia, Canada.

Panteleyev, A. (1978) Gnat Pass Deposit. *In* Geological Fieldwork 1977 Reports of Project Geologists Metallic Investigations Northwest BC (A.S. Brown & N.C. Carter, ed.). British Columbia Geological Survey, Vnacouver, Bristish Columbia, Canada (43–45).

Pardo, A.R., Ausburn, K., Aguilera, M., & Rubio, M. (2015) Implications of expansive mineralogy on the production process in the Fortuna de Cobre mine. Lomas Bayas, II Region of Antofagasta, Chile. Conference: XIV Congreso Geologico Chileno, La Serena, Chile. October 2015.

Parry, W.T., Ballantyne, J.M., & Jacobs, D.C. (1984) Geochemistry of hydrothermal sericite from Roosevelt Hot Springs and the Tintic and Santa Rita porphyry copper systems. *Economic Geology* **79**(1), 72–86. DOI: http://doi.org/10.2113/gsecongeo.79.1.72

Peng, Z., Watanabe, M., Hoshino, K., Sueoka, S., Yano, T., & Nishido, H. (1998) The Machangqing copper-molybdenum deposits, Yunnan, China – An example of Himalayan porphyry-hosted Cu-Mo mineralization. *Mineralogy and Petrology* **63**(1–2), 95–117. DOI: http://doi.org/10.1007/bf01162770

Perea, V.J.E. (1999) *Magmatic Evolution and Geochemistry of the Piedras Verdes Deposit, Sonora, Mexico*. MSc Thesis. University of Arizona, Arizona, USA.

Perello, J., Cox, D.F., Garamjav, D., Sanjdorj, S., Diakov, S., Schissel, D., Munkhbat, T.-O., & Oyun, G. (2001) Oyu Tolgoi, Mongolia: Siluro-Devonian porphyry Cu-Au-(Mo) and high-sulfidation Cu mineralization with a Cretaceous chalcocite Blanket. *Economic Geology* **96**(6), 1407–1428. DOI: http://doi.org/10.2113/gsecongeo.96.6.1407

Quang, C.X., Clark, A.H., Lee, J.K.W., & Guillen B, J. (2003) 40Ar-39Ar Ages of hypogene and supergene mineralization in the Cerro Verde-Santa Rosa porphyry Cu-Mo cluster, Aequipa, Peru. *Economic Geology* **98**, 1683–1696. https://doi.org/10.2113/gsecongeo.98.8.1683

Robison, L.C. (1987) *Geology and Geochemistry of Proterozoic Volcanic Rocks Bearing Massive Sulfide Ore Deposits, Bagdad, Arizona*. MSc Thesis. University of Arizona, Arizona, USA.

Salazar, E., Barra, F., Reich, M., Simon, A., Leisen, M., Palma, G., Romero, R., & Rojo, M. (2019) Trace element geochemistry of magnetite from the Cerro Negro Norte iron oxide−apatite deposit, northern Chile. *Mineralium Deposita* **55**(3), 409–428. DOI: http://doi.org/10.1007/s00126-019-00879-3

Schwartz, M.O. (1981) The porphyry copper deposit at La Granja, Peru. *Economic Geology* **77**(2), 482–488. DOI: http://doi.org/10.2113/gsecongeo.77.2.482

Scott, J.E., Richards, J.P., Heaman, L.M., Creaser, R.A., & Salzar, G.A. (2008) The Schaft Creek porphyry Cu-Mo-(Au) deposit, Northwestern British Columbia. *Exploration and Mining Geology* **17**(3–4), 163–196. DOI: http://doi.org/10.2113/gsemg.17.3-4.163

Siddiqui, R.H., Aftab, S.M., & Chaudhry, A.H. (2018) Hydrothermal Alteration in Porphyry Cu-Mo-Au Mineralizations of the Chagai Arc, Balochistan, Pakistan. *Institute of Physics Conference Series: Materials Science and Engineering* **414**, 012033. DOI: http://doi.org/10.1088/1757-899x/414/1/012033

Sillitoe, R.H. (1973) Geology of the Los Pelambres porphyry copper deposit, Chile. *Economic Geology* **68**(1), 1–10. DOI: http://doi.org/10.2113/gsecongeo.68.1.1

Singer, D.A., Berger, V.I., & Moring, B.C. (2008) *Porphyry Copper Deposits of the World: Database and Grade and Tonnage Models*. USGS Open-File Report 2008-1155. United States Geological Survey, Reston, Virginia, USA. DOI: http://doi.org/10.3133/ofr20081155

Skarmeta, J. (2020) Structural controls on alteration stages at the Chuquicamata copper-molybdenum deposit, Northern Chile. *Economic Geology* **116**(1), 1–28. DOI: http://doi.org/10.5382/econgeo.4769

Sokolović, J., Stanojlović, R., Andrić, L., Štirbanović, Z., & Ćirić, N. (2019) Flotation studies of copper ore Majdanpek to enhance copper recovery and concentrate grade with different collectors. *Journal of Mining and Metallurgy A: Mining* **55**(1), 53–65. DOI: http://doi.org/10.5937/jmma1901053s

Sotnikov, V., Berzina, A.N., Economou-Eliopoulos, M., & Eliopoulos, D.G. (2001) Palladium, platinum and gold distribution in porphyry Cu±Mo deposits of Russia and Mongolia. *Ore Geology Reviews* **18**(1–2), 95–111. DOI: http://doi.org/10.1016/s0169-1368(01)00018-x

Spatz, D.M. (1974) *Geology and Alteration-Mineralization Zoning of the Pine Flat Porphyry Copper Occurrence, Yavapai County, Arizona*. MSc Thesis. University of Arizona, Tucson, Arizona, USA.

Storey, L.O. (1978) Geology and mineralization fo the lights creek stock plumas country, California. *Arizona Geological Survey Digest* **11**, 49–58.

Taylor, B. & Slack, J. (1984) Tourmalines from Appalachian-Caledonian massive sulfide deposits: Textural, chemical, and isotopic relationships. *Economic Geology* **79**(7), 1703–1726. DOI: http://doi.org/10.2113/gsecongeo.79.7.1703

Torro, L., Proenza, J.A., Melgarejo, J.C., Carrasco, C., Dominguez, H., & Lewis, J.F. (2012) Tourmaline composition near a diorite intrusive body under La Cuaba Lithocap (Ampliación Pueblo Viejo District, Dominican Republic). *Sociedad Española de Mineralogía* **16**, 1–2.

Volp, K.M. (2005) The Estrela Copper Deposit, Carajás, Brazil: Geology and implications of a Proterozoic copper stockwork. *In* Mineral Deposit Research: Meeting the Global Challenge (J. Mao & F.P. Bierlein, eds.). Springer Berlin Heidelberg, Berlin, Heidelberg, Germany (1085–1088).

Warlo, M., Wanhainen, C., Martinsson, O., & Karlsson, P. (2020) Mineralogy and character of the Liikavaara Östra Cu-(W-Au) deposit, northern Sweden. *GFF* **142**(3), 169–189. DOI: http://doi.org/10.1080/11035897.2020.1753807

Warnaars, F.W., Holmgren, C., & Barassi, S. (1985) Porphyry copper and tourmaline breccias at Los-Bronces-Rio-Blanco, Chile. *Economic Geology* **80**(6), 1544–1565. DOI: http://doi.org/10.2113/gsecongeo.80.6.1544

Wendt, C.J. (1938) Geology, Alteration, and Mineralization of the Batamote Ranch Area, Northern Sonora, Mexico. MSc Thesis. University of Arizona, Tucson, Arizona, USA.

Zukowski, W. (2010) *Geology and Mineralisation of the Endeavour 41 Gold Deposit, Cowal District, NSW, Australia*. PhD Thesis. University of Tasmania, Hobart, Tasmania.