

References cited in the supporting information

- Akoh, J.U., Ogunleye, P.O., and Ibrahim, A.A. (2015) Geochemical evolution of micas and Sn-, Nb-, Ta- mineralization associated with the rare metal pegmatite in Angwan Doka, central Nigeria. *Journal of African Earth Sciences*, 112, 24–36.
- Alva-Jimenez, T. (2011) Variation in hydrothermal muscovite and chlorite composition in the Highland Valley Porphyry Cu-Mo District, British Columbia, Canada, master's thesis, The University of British Columbia.
- Araujo, F.P., Martins, L., Pereira, G. de S., and Janasi, V. de A. (2020) Inhandjara topaz leucogranite: A late rare metal-mineralized stock within the A-type Itu batholith, SE Brazil. *Journal of South American Earth Sciences*, 101, 102623.
- Barrière, M., and Cotten, J. (1979) Biotites and associated minerals as markers of magmatic fractionation and deuteritic equilibration in granites. *Contributions to Mineralogy and Petrology*, 70(2), 183–192.
- Bea, F., Pereira, M.D., and Stroh, A. (1994) Mineral/leucosome trace-element partitioning in a peraluminous migmatite (a laser ablation-ICP-MS study). *Chemical Geology*, 117(1–4), 291–312.
- Bigi, S., and Brigatti, M.F. (1994) Crystal chemistry and microstructures of plutonic biotite. *American Mineralogist*, 79, 63–72.
- Breiter, K., Ďurišová, J., Hrstka, T., Korbelová, Z., Vašinová Galiová, M., Müller, A., Simons, B., Shail, R.K., Williamson, B.J., Davies, J.A. (2018) The transition from granite to banded aplite-pegmatite sheet complexes: An example from Megiligar Rocks, Tregonning topaz granite, Cornwall. *Lithos*, 302–303, 370–388.
- Brigatti, M.F., and Davoli, P. (1990) Crystal-structure refinements of 1M plutonic biotites. *American Mineralogist*, 75(3–4), 305–313.
- Campany, M., Kamenetsky, V.S., Melgarejo, J.C., Mangas, J., Manuel, J., Alfonso, P., Kamenetsky, M.B., Bambi, A.C.J.M., Gonçalves A.O. (2015) Carbonatitic lavas in Catanda

- (Kwanza Sul, Angola): Mineralogical and geochemical constraints on the parental melt. *Lithos*, 232, 1–11.
- Černý, P., and Trueman, D.L. (1985) Polyolithionite from the rare-metal deposits of the Blachford Lake alkaline complex, N.W.T., Canada. *American Mineralogist*, 70(11–12), 1127–1134.
- Černý, P., Rieder, M., and Povondra, P. (1970) Three polytypes of lepidolite from Czechoslovakia. *Lithos*, 3, 319–325.
- Černý, P., Staněk, Novák, M., Baadsgaard, H., Rieder, M., Ottolini, L., Kavalová, M., and Chapman, R. (1995) Geochemical and structural evolution of micas in the Rožná and Dobrá Voda pegmatites, Czech Republic. *Mineralogy and Petrology*, 55, 177–201.
- Chaudhry, M.N., and Howie, R.A. (1973) Lithium tourmalines from the Meldon aplite, Devonshire, England. *Mineralogical Magazine*, 39, 289–296.
- Codeço, M.S., Weis, P., Trumbull, R.B., Glodny, J., Wiedenbeck, M., and Romer, R.L. (2019) Boron isotope muscovite-tourmaline geothermometry indicates fluid cooling during magmatic-hydrothermal W-Sn ore formation. *Economic Geology*, 114(1), 153–163.
- Codeço, M.S., Weis, P., Trumbull, R.B., van Hinsberg, V., Pinto, F., Lecumberri-Sanchez, P., and Schleicher, A.M. (2020**b**): Trace element contents in white mica and tourmaline from the Panasqueira W-Sn-Cu deposit (Portugal). GFZ Data Services.
<https://doi.org/10.5880/GFZ.3.1.2020.002>
- Cooper, A.F., Paterson, L.A., and Reid, D.L. (1995) Lithium in carbonatites— consequence of an enriched mantle source? *Mineralogical Magazine*, 59(396), 401–408.
- Deveaud, S., Millot, R., and Villaros, A. (2015) The genesis of LCT-type granitic pegmatites, as illustrated by lithium isotopes in micas. *Chemical Geology*, 411, 97–111.
- du Bray, E.A. (1994) Compositions of micas in peraluminous granitoids of the eastern Arabian shield-Implications for petrogenesis and tectonic setting of highly evolved, rare-metal enriched granites. *Contributions to Mineralogy and Petrology*, 116(4), 381–397.

- Fabre, C., Boiron, M.C., Dubessy, J., Chabiron, A., Charoy, B., and Martin Crespo, T. (2002) Advances in lithium analysis in solids by means of laser-induced breakdown spectroscopy: An exploratory study. *Geochimica et Cosmochimica Acta*, 66(8), 1401–1407.
- Fitzpayne, A., Giuliani, A., Hergt, J., Phillips, D., and Janney, P. (2018) New geochemical constraints on the origins of MARID and PIC rocks: Implications for mantle metasomatism and mantle-derived potassic magmatism. *Lithos*, 318–319, 478–493.
- Foord, E.E., Černý, P., Jackson, L.L., Sherman, D.M., and Eby, R.K. (1995) Mineralogical and geochemical evolution of micas from miarolitic pegmatites of the anorogenic pikes peak batholith, Colorado. *Mineralogy and Petrology*, 55(1–3), 1–26.
- Fritschle, T., Prelević, D., Foley, S.F., and Jacob, D.E. (2013) Petrological characterization of the mantle source of Mediterranean lamproites: Indications from major and trace elements of phlogopite. *Chemical Geology*, 353, 267–279.
- Giuliani, A., Phillips, D., Kamenetsky, V.S., and Goemann, K. (2016) Constraints on kimberlite ascent mechanisms revealed by phlogopite compositions in kimberlites and mantle xenoliths. *Lithos*, 240–243, 189–201.
- Grew, E.S., Chernosky, J.V., Werding, G., Abraham, K., Marquez, N., and Hinthorne, J.R. (1990) Chemistry of kornorupine and associated minerals, a wet chemical, ion microprobe, and X-ray study emphasizing Li, Be, B and F contents. *Journal of Petrology*, 31(5), 1025–1070.
- Grew, E.S., Hiroi, Y., Motoyoshi, Y., Kondo, Y., Jayatileke, S.J.M., and Marquez, N. (1995) Iron-rich kornorupine in sheared pegmatite from the Wann Complex, at Homagama, Sri Lanka. *European Journal of Mineralogy*, 7(3), 623–636.
- Gu, L.X., Zhang, Z.Z., Wu, C.Z., Gou, X.Q., Liao, J.J., and Yang, H. (2011) A topaz- and amazonite-bearing leucogranite pluton in eastern Xinjiang, NW China and its zoning. *Journal of Asian Earth Sciences*, 42(5), 885–902.

- Hawthorne, F.C., Sokolova, E., Agakhanov, A.A., Pautov, L.A., and Karpenko, V.Y.U. (2019) The crystal structure of polyolithionite-1M from Darai-Pioz, Tajikistan: The role of short-range order in driving symmetry reduction in 1M Li-rich mica. *Canadian Mineralogist*, 57(4), 519–528.
- Heinrich, E.W. (1967) Micas of the brown Derby pegmatites, Cunnison County, Colorado. *The American Mineralogist*, 52, 1110–1121.
- Hou, J.L., Li, J.K., Wang, D.H., Chen, Z.Y., Dai, H.Z., and Liu, L.J. (2017) Geochemical Characteristics and Geological Significance of Biotite in Granite Bodies of Jiajika Lithium Mine, Sichuan Province. *Gold Science and Technology*, 25(6), 1–8.
- Jacob, D.E., Viljoen, K.S., and Grassineau, N.V. (2009) Eclogite xenoliths from Kimberley, South Africa - A case study of mantle metasomatism in eclogites. *Lithos*, 112, 1002–1013.
- Jolliff, B.L., Papike, J.J., and Shearer, C.K. (1987) Fractionation trends in mica and tourmaline as indicators of pegmatite internal evolution: Bob Ingersoll pegmatite, Black Hills, South Dakota. *Geochimica et Cosmochimica Acta*, 51(3), 519–534.
- Li, J., Huang, X.L., Wei, G.J., Liu, Y., Ma, J.L., Han, L., and He, P.L. (2018) Lithium isotope fractionation during magmatic differentiation and hydrothermal processes in rare-metal granites. *Geochimica et Cosmochimica Acta*, 240, 64–79.
- Liu, C., Wang, R.C., Wu, F.Y., Xie, L., Liu, X.C., Li, X.K., Yang, L., Li, X.J. (2020) Spodumene pegmatites from the Pusila pluton in the higher Himalaya, South Tibet: Lithium mineralization in a highly fractionated leucogranite batholith. *Lithos*, 358–359, 105421.
- Liu, Y., Xie, L., Wang, R.C., Hu, H., Che, X.D., Tian, E.N., and Xiang, L. (2018) Comparative study of petrogenesis and mineralization characteristics of Nb-Ta-bearing and W-bearing granite in the Dahutang deposit, Northern Jiangxi Province. *Acta Geologica Sinica*, 92(10), 2120–2137 (in Chinese).
- Luecke, W. (1981) Lithium pegmatites in the Leinster Granite (southeast Ireland). *Chemical Geology*, 34(3–4), 195–233.

- Miyawaki, R., Shimazaki, H., Shigeoka, M., Yokoyama, K., Matsubara, S., and Yurimoto, H. (2011) Yangzhumingite, $\text{KMg}_{2.5}\text{Si}_4\text{O}_{10}\text{F}_2$, a new mineral in the mica group from Bayan Obo, Inner Mongolia, China. *European Journal of Mineralogy*, 23(3), 467–473.
- Monier, G., Charoy, B., Cuney, M., Ohnenstetter, D. and Robert, J.L. (1987) Évolution spatiale et temporelle de la composition des micas du granite albitique à topaze-lépidolite de Beauvoir. *Géologie de la France*, 2–3, 179–188.
- Müller, G. (1966) Die Beziehungen zwischen der chemischen Zusammensetzung, Lichtbrechung und Dichte einiger koexistierender Biotite, Muskowite und Chlorite aus granitischen Tiefengesteinen. *Contributions to Mineralogy and Petrology*, 12(2), 173–191.
- Neiva, A.M.R., and Gomes, M.E.P. (1991) Geochemistry of the granitoid rocks and their minerals from Lixa do Alvão-Alfarela de Jales-Tourencinho (Vila Pouca de Aguiar, northern Portugal). *Chemical Geology*, 89(3–4), 305–327.
- Neiva, A.M.R., Silva, M.M.V.G., Gomes, M.E.P., and Campos, T.F.C. (2002) Geochemistry of coexisting biotite and muscovite of Portuguese peraluminous granitic differentiation series. *Chemie Der Erde*, 62(3), 197–215.
- Pérez-Soba, C., and Villaseca, C. (2019) Li-Na-metasomatism related to I-type granite magmatism: A case study of the highly fractionated La Pedriza pluton (Iberian Variscan belt). *Lithos*, 344–345, 159–174.
- Pesquera, A., Torres-Ruiz, J., Gil-Crespo, P.P., and Velilla, N. (1999) Chemistry and genetic implications of tourmaline and Li-F-Cs micas from the Valdeflores area (Caceres, Spain). *American Mineralogist*, 84(1–2), 55–69.
- Petrík, I., Čík, Š., Miglierini, M., Vaculovič, T., Dianiška, I., and Ozdín, D. (2014) Alpine oxidation of lithium micas in Permian S-type granites (Gemeric unit, Western Carpathians, Slovakia). *Mineralogical Magazine*, 78(3), 507–533.
- Qu, K., Sima, X., Li, G., Fan, G., Shen, G., Liu, X., Xiao, Z., Guo, H., Qiu, L., and Wang, Y. (2020) Fluorluanshiweiite, $\text{KLiAl}_{1.5}\square_{0.5}(\text{Si}_{3.5}\text{Al}_{0.5})\text{O}_{10}\text{F}_2$, a new mineral of the mica group

from the Nanyangshan LCT pegmatite deposit, North Qinling Orogen, China. *Minerals*, 10(2), 1–12.

Rieder, M., Huka, M., Kučerová, D., Minařík, L., Obermajer, J., and Povondra, P. (1970) Chemical composition and physical properties of lithium-iron micas from the Krušné hory Mts. (Erzgebirge) - Part A: Chemical composition. *Contributions to Mineralogy and Petrology*, 27(2), 131–158.

Rieder, M., Haapala, I., and Povondra, P. (1996) Mineralogy of dark mica from the Wiborg rapakivi batholith, southeastern Finland. *European Journal of Mineralogy*, 8(3), 593–606.

Rinaldi, R., Černý, P., and Ferguson, R.B. (1972) The Tanco pegmatite at Bernic Lake, Manitoba. VI. Lithium-Rubidium-Cesium micas. *Canadian Mineralogist*, 11, 690–707.

Roda, E., Pesquera, A., and Velasco, F. (1995) Micas of the muscovite-lepidolite series from the Fregeneda pegmatites (Salamanca, Spain). *Mineralogy and Petrology*, 55, 145–157.

Rosing-Schow, N., Müller, A., and Friis, H. (2018) A comparison of the mica geochemistry of the pegmatite fields in southern Norway. *Canadian Mineralogist*, 56(4), 463–488.

Savage, D., Cave, M.R., Milodowski, A.E., and George, I. (1987) Hydrothermal alteration of granite by meteoric fluid: an example from the Carnmenellis Granite, United Kingdom. *Contributions to Mineralogy and Petrology*, 96, 391–405.

Scordari, F., Dyar, M.D., Schingaro, E., Lacalamita, M., and Ottolini, L. (2010) XRD, micro-XANES, EMPA, and SIMS investigation on phlogopite single crystals from Mt. Vulture (Italy). *American Mineralogist*, 95(11–12), 1657–1670.

Sharygin, V.V. (2017) Tainiolite From Chuktukon Carbonatite Massif, Chadobets. Paper presented at 34th International conference “Magmatism of the Earth and related strategic metal deposits”, Vernadsky Institute of Geochemistry and Analytical Chemistry of Russian Academy of Sciences, Miass.

- Shearer, C.K., Papike, J.J., Simon, S.B., and Laul, J.C. (1986) Pegmatite-wall-rock interactions, Black Hills, South Dakota: interaction between pegmatite-derived fluids and quartz-mica schist wall-rock. *American Mineralogist*, 71(3–4), 518–539.
- Simons, B., Andersen, J.C.Ø., Shail, R.K., and Jenner, F.E. (2017) Fractionation of Li, Be, Ga, Nb, Ta, In, Sn, Sb, W and Bi in the peraluminous Early Permian Variscan granites of the Cornubian Batholith: Precursor processes to magmatic-hydrothermal mineralisation. *Lithos*, 278–281, 491–512.
- Sun, K., Chen, B., and Deng, J. (2019) Biotite in highly evolved granites from the Shimensi W–Cu–Mo polymetallic ore deposit, China: Insights into magma source and evolution. *Lithos*, 350–351, 105245.
- Taylor, R.P. (1992) Petrological and geochemical characteristics of the pleasant ridge zinnwaldite-topaz granite, southern New Brunswick, and comparisons with other topaz-bearing felsic rocks. *Canadian Mineralogist*, 30, 895–921.
- Villaros, A., and Pichavant, M. (2019) Mica-liquid trace elements partitioning and the granite-pegmatite connection: The St-Sylvestre complex (Western French Massif Central). *Chemical Geology*, 528, 119265.
- Wang, Z.J., Xie, L., Wang, R.C., Zhu, J.C., Che, X.D., and Zhao, X. (2018) The Petrogenesis and Mineralization of the Laiziling Greisen, Xianghualing District, Hunan Province, South China. *Geological Journal of China Universities*, 24(4), 467–480.
- Wei, B., Wang, C.Y., Zhao, Z., and Bao, H. (2020) Columbite-group minerals and mica of peraluminous granite record the magmatic-hydrothermal processes that formed the Zhaojinggou Ta-Nb deposit in the North China Craton. *Lithos*, 370–371, 105648.
- Weidendorfer, D., Schmidt, M.W., and Mattsson, H.B. (2016) Fractional crystallization of Si-undersaturated alkaline magmas leading to unmixing of carbonatites on Brava Island (Cape Verde) and a general model of carbonatite genesis in alkaline magma suites. *Contributions to Mineralogy and Petrology*, 171, 43.

- Whalen, J.B. (1985) Geochemistry of an Island-arc plutonic suite: The Uasilau-Yau Yau intrusive complex, New Britain, P.N.G. *Journal of Petrology*, 26(3), 603–632.
- Xie, L., Wang, R.C., Che, X.D., Huang, F.F., Erdmann, S., and Zhang, W.L. (2016) Tracking magmatic and hydrothermal Nb-Ta-W-Sn fractionation using mineral textures and composition: A case study from the late Cretaceous Jiepailing ore district in the Nanling Range in South China. *Ore Geology Reviews*, 78, 300–321.
- Xie, L., Liu, Y., Wang, R., Hu, H., Che, X., and Xiang, L. (2019) Li–Nb–Ta mineralization in the Jurassic Yifeng granite-aplite intrusion within the Neoproterozoic Jiuling batholith, south China: A fluid-rich and quenching ore-forming process. *Journal of Asian Earth Sciences*, 185, 104047.
- Xie, L., Tao, X., Wang, R., Wu, F., Liu, C., Liu, X., Li, X., and Zhang, R. (2020) Highly fractionated leucogranites in the eastern Himalayan Cuonadong dome and related magmatic Be–Nb–Ta and hydrothermal Be–W–Sn mineralization. *Lithos*, 354–355, 105286.
- Xing, F.M., and Xu, X. (1991). Biotite in Mesozoic intermediate-acidity intrusions from south Anhui and its tectonic significance. *Mineralogy and Petrology*, 11(1), 29–36.
- Xue, R., Wang, R.C., Chen, G.H., Che, X.D., Xie, L., and Zhu, Z.Y. (2019) Compositional constraints of mica and wolframite on hydrothermal ore-forming process of the Songshugang Ta-Sn deposit, northeastern Jiangxi. *Acta Petrologica et Mineralogica*, 38(4), 507–520 .
- Yang, P., and Rivers, T. (2000) Trace-element partitioning between coexisting biotite and muscovite from metamorphic rocks, Western Labrador: Structural, compositional and thermal controls. *Geochimica et Cosmochimica Acta*, 64(8), 1451–1472.
- Zhou, Q.F., Qin, K.Z., Tang, D.M., Ding, J.G., and Guo, Z.L. (2013) Mineralogy and significance of micas and feldspars from the koktokay no. 3 pegmatitic rare-element deposit, altai. *Acta Petrologica Sinica*, 29(9), 3004–3022 (in Chinese).