DISTRIBUTION OF THE Au-Ag TELLURIDE MINERAL FAMILY: FACTS AND LIMITATIONS

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Unlike many chemically related mineral groups or families, gold-silver tellurides (GSTs) occur always together, forming as a rule fine intergrowths and showing various paragenetic relationships. Other tellurides such as frohbergite, weissite, rickardite, montbrayite, coloradoite, tellurantimony and native tellurium may also be present in minor amounts within the GST dominated assemblages. As against other tellurides, GSTs occur mostly under hydrothermal conditions at relatively low temperatures. The Bi tellurides are typically associated with skarn deposits, whereas the PGE tellurides are restricted to magmatic deposits of Sudbury–Norilsk type.

In many books GSTs are presented together, mainly due to the late solving of their crystal structures, but also to their strong tendency to occur together, not dispersed in other types of ores (except hessite). The approach to group together the GSTs could be still accepted as in this case the chemical link is stronger than the structural one. KOSTOV & MINCEVA-STEFANOVA (1981) include all the GSTs into the "Au-Ag-Te assemblages" either in the planar type (krennerite, sylvanite, nagyagite) or in the (pseudo-) isometric type (hessite, petzite, stuetzite, empressite, calaverite).

As shown by ZEMANN (1994), the mineralogy of gold and silver tellurides is grossly different, i.e. in the gold rich part of the ternary diagram Au-Ag-Te dominate the Te rich phases, while in the silver rich part Te poor phases are dominant. The phase relations in the Ag-Au-Te system or parts thereof are quite well known from experiments carried out by MARKHAM (1960), SHTCHERBINA & ZARYAN (1964), CABRI (1965), KRACEK *et al.* (1966) and LEGENDRE *et al.* (1980). Among other facts the experimental data showed that (1) krennerite is a single mineral entity rather than a polymorph of $AgTe_2$, (2) there is a continuous solid solution between the highest polymorphs of hessite and petzite, (3) there exists a new phase, the "*x*" phase, stable along the hessite-petzite join from about 2.3 to 14.5 wt% gold within the temperature interval from 50 to 415 °C, (4) a phase of composition Au_2Te_3 does not exist in the pure Ag-Au-Te system (CABRI, 1965) (montbrayite occurs only if stabilized by Sb).

AFIFI *et al.* (1988) and ŞIMON *et al.* (1996, 1997) gave pertinent insights into the formation conditions and the limiting factors governing the telluride (and selenide) occurrences, i.e. the Te_2, S_2. and O_2 fugacities. However, "the reason for enrichment of some systems with tellurium are open to speculations" (AFIFI *et al.*, 1988, p. 402). In addition, tellurium abundancy anomalies should also be taken into consideration (COHEN, 1984), as well as the different valencies, i.e. Te^{-2}, Te^{+4} and Te^{+6}, tellurium can possess, as a part of a generalized explanation for the restricted occurrences of GSTs.

Among the GSTs hessite is the most "wandering" mineral species, occurring as the sole telluride in some massive sulphide deposits, e.g. Porz-Mellec, France; sometimes in association with gold and altaite (Jabal Say'id, Saudi Arabia; Mattagami Lake, Quebec), to which petzite sometimes is added (Noranda, Quebec). Hessite also seems to be common in some skarn deposits, e.g. Dawson City, Yukon, Canada; Tsumo, Japan; Hedley, British Columbia (associated with petzite), or in magmatic deposits such as Kambalda, Australia; Sudbury, Ontario, where altaite is also known.

Such a different behaviour of hessite (and altaite, too) is perhaps related to a high affinity of Te for Ag and Pb at relatively low tellurium fugacity. It is thus reasonable to consider that the affinity of Te for the GST forming elements decreases in the following sequence: Ag, Pb, Au, Sb, Fe, Cu, Hg, which at least formally explains the scarcity of Hg, Cu, Fe, Sb tellurides, as well as of the complex sulphotelluride, nagyagite.