XXIst CENTURY METALS Li, Te, Se, Nb-Ta NATIONAL SITUATION

Grigore BUIA, Csaba LORINȚ***

Key words: lithium, tellurium, selenium, niobium, tantalum, national resource / reserve

Introduction

As noted in the previous article "Li, Te, Se, Nb-Ta - XXI CENTURY METALS?", beginning of the third millennium placed under the sign of the new information era, is dependent on new mineral resources. Thus, metals such as Li, Te, Se, Nb-Ta, through their properties and uses of modern technology, generate a increasingly large demand on the market, is also a challenge for the mining industry. With this new approach, the authors aim to highlight the national potential with regard to these new resources.

Commonnesses, History, Breviary

Lithium

Lithium was discovered in 1817 by Johan August Arfvedson Stockholm, Sweden. The metal itself was isolated in 1821 by William T. Brande. The first lithium minerals discovered were spodumen and petalit and have been found on the Swedish island of Uto by the mineralogy Joze Bonifacio Andrada e Silva, during a tour made in Europe in 1790. [5].

In 1817, Arfvedson analyzed petalit and realized that it contained a previously unknown metal, calling it lithium because he came from a stone. He announced the discovery in 1818, identifying lithium as a new alkali metal and alkaline version lighterr than sodium. Will discover later that lepidolite and spodumen also contain lithium [5].

Lithium is found in reservoirs evaporative and pegmatic, small amounts of lithium are found in ocean water and some living organisms. The main use is in the manufacture of lithium batteries and Li-Ion batteries, considered the most durable, reliable and environmentally friendly. Lithium is also used as alloys in aerospace engineering and nuclear physics: the lithium atoms fission was the first nuclear reaction carried out by the mankind, and lithium deuterit is fuel for thermonuclear weapons [4].

* *Prof.eng. Ph.D. – University of Petroșani*
** *Asist.eng. Ph.D – University of Petroșani*

Tellurium

Tellurium has been discovered in Romania in 1782 by Austrian scientist Franz-Joseph Müller von Reichenstein. Tellurium is relatively rare (Clarke 0.0018 ppm.) and is usually found in combination with other elements (gold, silver), forming telluride. Tellurium appears as isomorphic placeholder for lead, Tellurium as selenium, focuses exclusively in magmatic deposits belonging to hydrothermal phase.

Tellurium as selenium, is concentrating exclusively in magmatic deposits, belonging hydrothermal phase.

Just because of the rarity, pure, tellurium is very expensive. Estimated, the minimum exploitable gold-silver telluride is about 15 ppm. [6].

Tellurium is a silver semi-metal with hexagonal crystal structure. It is considered to be of relatively low toxicity, but it is recommended to avoid long exposure to tellurium, in particular to prevent inhalation exposure. Among the many uses of tellurium, can be mentioned: energy industry (thermoelectric devices), steel processing, coloring glass and plastics, metal alloys (due to its ductility), solar panels and semiconductor manufacturing, etc.. [4].

Selenium

Selenium was discovered by Berzelius in 1817, and studied further by other researchers. Chemically speaking, selenium is very close to the sulfur, which it greatly resembles. Origin of the name derives from the Greek word Selene (moon). It forms its own minerals but not exploitable accumulations. Selenium is found predominantly in galena and chalcopyrite, where it appears as isomorphic substitute of sulfur.

Estimative, the minimum exploitable. is about 20 ppm [6].

Selenium increases its conductivity easily a thousand times when it is moved from darkness to strong sunlight, which is used to build it luxmeter. It is also used in the manufacture of photoelectric cells, cameras, copiers, and electric current recovery, etc..

Salts (ex. mercury selenite) were used in laboratories for medical analysis, for determination of total nitrogen in the blood / serum [4].

Niobium

Niobium or columbium is a rare metal, hard, flexible, light gray color, shiny, highly resistant to corrosion. Niobium is used in the manufacture of stainless steel in electrical engineering, in radio electronics, etc.., niobium alloys, are currently enjoying particular attention due to a remarkable resistance to high temperatures. The best results are obtained by alloying niobium with hafnium, molybdenum, vanadium and zirconium.

Thus, for the engine combustion chambers of the rocket C-103 alloy is used, containing 88.3% niobium, hafnium 10%, 1% 0.7% titanium and zirconium. In the case of the spacecraft with slow reentry into the atmosphere, control surfaces are made from alloy B-66 mark, with the following chemical composition: 89.5% niobium, molybdenum 5%, 5% vanadium and 0.5% tantalum.

Tantalum

Tantalum is used for weights for scales and vacuum tube filaments. Appears in the form of compounds and is solid at room temperature. Tantalum alloys are intended for aerospace construction. Tantalum alloys with hafnium, niobium, titanium, vanadium presents very good mechanical properties at high temperatures. As an example is tantalum-hafnium alloy, which contains 20% Hf, which owns the 1.2000C, tensile breaking strength of 42 daN/mm2. For the construction of cosmic rockets it is used T-222 alloy which contains: 87.5% tantalum 10% tungsten and 2.5% hafnium.

According to data presented in the first report made so far in the EU, published on 17 June 2010 concerning access to mineral raw materials, niobium and tantalum are also part of a list of 14 raw materials that are considered to be "critical" for the European industry, with antimony (antimony), beryllium, cobalt, fluorine, gallium, germanium, graphite, indium, manganese, platinum metals, rare earths, tungsten (tungsten). [3].

National situation

Telurium

Telurium is present as a minor element in galenea, chalcopyrite and pyrite associated with laramic and neogen deposits in particular in: Băița Bihor, Coranda, Ilba, Cavnic-Bolduț etc., where it appears in average content of between 40-120 ppm. [6]

Tellurium also appears in neogene sulfosalt volcanoes from Băiuț (As, Cd, Ga, Tl ± Se, Ge, Te, Co, Ni, Cr, Ti) [1], and Văratec (As, Cd, Bi, Te, Co, Ni, V, Ti, W) (Borcoş M., 1984) [10] from Gutai Mountains and Țibleş (Cd, Mn, Ti, F, I) [9], where it can be recovered along with other elements.

At Sacaramb, together with gold-silver telluride, was also revealed in sulfosalts (As, As, Bi, St, Te, Co, Ni). [2].

In mineral form in România this element was identified at Săcărâmb, Cordurea, Musariu Nou, Fața Băii şi Vâlcoi, as it follows:

At Sacaramb in the Metaliferi Mountains, in Brad-Sacaramb neogene volcanoes,in sarmatian - Sacaramb Sarmatian series, with Au and Ag, together with Pb and Zn in hydrothermal deposits of Miocene age.

Host rock is composed from andesite and biotite quartz with hornblende, propilitic, adularitic, argilitic in venis deposit oriented to NE and NW and which form a network in the middle area of the central volcanic device. The chemical composition is: Au, Ag, Te ± Pb, Zn, Cu and secondary Cd, Ga, In, As, Sb, Bi, Se, Sn, Co, Ni, and the mineralogical composition is: pyrite mispichel, blend, galen, chalcopyrite + nagyagite ($Pb_5A(Te,Sb)_4S_{5\text{-}8}$), krenerite ($(Au,Ag)Te_2$) sylvanite ($(Au,AgTe_4)$), altaite, frohbergite ($FeTe_2$), hessite (Ag_2Te), petzite (Ag_3AuTe_2), tellurium, tetrahedron, boulangerite, jamesonite, antimonite, native arsenic distributed differentiated on groups of seams, the mentioned association being dominant in their lower parts. [8].

At Cordura in the Metaliferi Mountains, in the Brad-Sacaramb neogene volcanoes in neogene andesitic volcanic complex structure in cretaceous sedimentary formations, from a complex of Mesozoic alkaline rocks.

Host rock is composed from quarztifere andesitic with hornblende and biotite, sarmatian-panoniene, propilitizate, argilizate, sericitizate, adularizate, silicifiate. The deposit presents as veins with Au, Ag ± Pb, Zn, Cu, Te, Cd, Sb, Hg, Ti, Mn, As of hydrothermal origin. From the mineralogical point of view, the deposit contains pyrite, tetraedrite, bornite, bournonite, calcopyrite, galene, nagygite (Pb_5A $(Te,Sb)_4S_{5\text{-}8}$), hessite, gold, marcasite, realgar, cinnabar (Berbeleac I., 1984) [10].

At Musariu Nou in the Metaliferi Mountains, in the neogene volcanoes in the Brad-Sacaramb area, in a subvolcanic body neogene andesitic. Host rock is composed from andesite - andesite-cuarțifere Badenian-Sarmatian, propilitizate, cloritizate, adularizate, sericitizate, argilizate, silicified, sandstone marl, etc. The deposit form is also veins with impregnations. From the elementary point of view are distinguished Au, Ag ± Pb, Zn, Cu, As, Cd, Mn, Ti, Se, Te, Tl, Sn, Ga, Co, Ni, V ± Bi, Sb, Mo, Cr, B minerals such as pyrite, mispichel, chalcopyrite, blend, tetraedrite, galena, frohbergite ($FeTe_2$), weisite, sylvanite ($(Au,AgTe_4)$), nagyagite (Pb_5A (Te, Sb)$_4$ S_{5-8}), krenerite (Au, Ag)Te_2), calaverite ($AuTe_2$), montbrayte ((Au,Sb)$_2Te_3$), telur, petzite (Ag3AuTe_2), hessite (Ag_2Te), empressite (AgTe), altaite (PbTe) etc. in associations characteristic of gold-telluride (M. Borcea, 1984) [10].

At Fața Băii in the Metaliferi Mountains, in Zlatna-Stănija volcanic area in the veins of hydrothermal origin with nagyagit (Pb_5A (Te, Sb) $_4$ S_{5-8}) and tellurium.

At Vâlcoi in the Metaliferi Mountains, Rosia Montana-volcanic area Bucium Baia de Aries, stationed in Cretaceous sedimentary formations are hydrothermal veins with Au, Ag ± Te, Pb, Zn, Cu (M. Borcea, 1984) [10].

Selenium

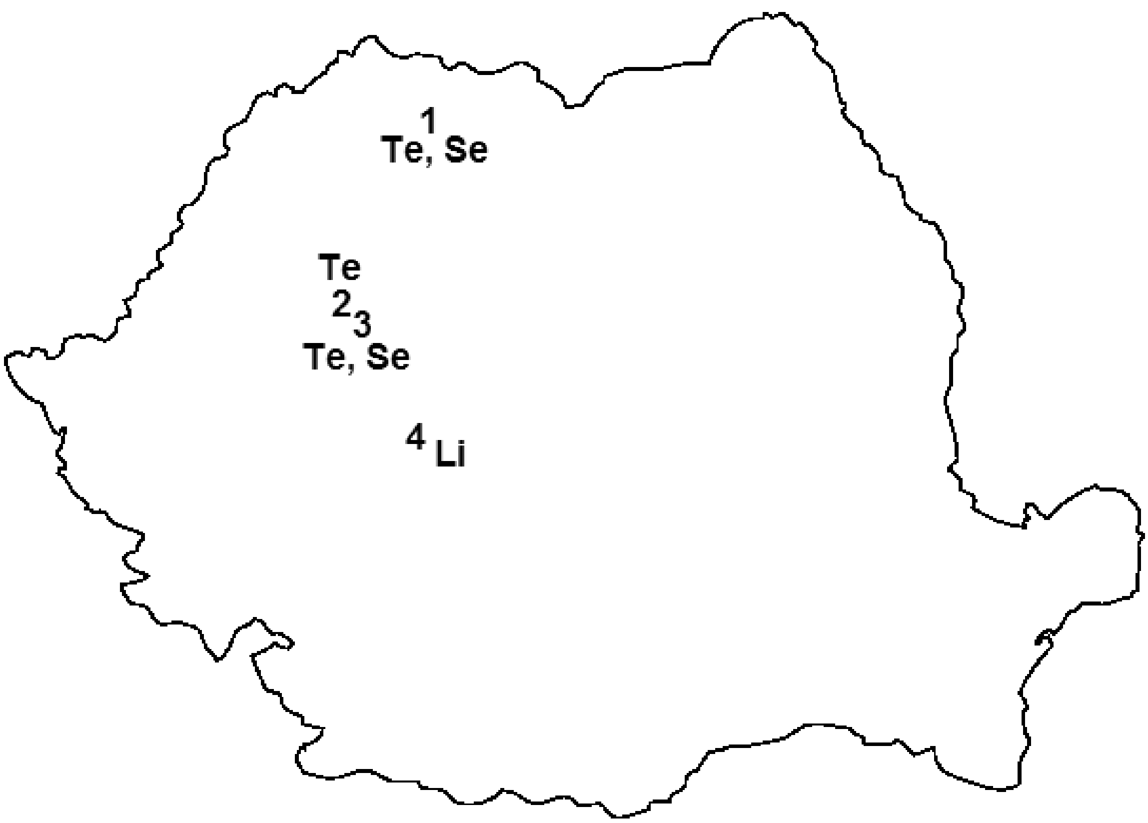
Selenium in its elementary form was notified as a minor component in the sulfosari* associated to the hydrothermal volcanism from Baia Mare area (Nistru, Cavnic, Heja and Băiuț) and the South Apuseni (Pârâul lui Avram, Deva, Valea Morii-Barza), with levels ranging from 42-65 ppm average. [6]

In mineral form, this element was identified in Romania in Certej and Sacaramb selenide in as: eucairit (CuAgSe), Naumannite (Ag $_2$Se) and klockmannite (CuSe), hydrothermal veins in quartzite of gold-silver telluride associated to andesites belonging to the Neogene calc-alkaline magmatism from Metaliferi Mountains [7]

Lithium

Lithium has been reported in Romania Getic area in Sebeş-Lotru group form Sebes Mountains, in metamorphic pegmatite at Conțu Superior-Orata. Deposits of Proterozoic age environment with biotite paragneiss, kyanite, gneiss and schist anfibolice, have veins with spodumen pegmatit (LiAl [Si_2O_6]). Chemical analysis revealed the Li_2O content (0.84%), K_2O (2.02%), Na_2O (4.17%), minerals such as oligoclas, microcline, pertite, albite, spodumen, quartz, muscovite, biotite, apatite, garnet, epidote, zeolites (Hârtopanu I., 1984) [10].

Niobium and tantalum have not been reported in Romania neither mineral or elemental form.



Areas of economic interest for the elements Li, Te, Se
1 – Gutâi-Țibleş Mountains (by minor elements);
2 – Metaliferi Mountains (by minor elements);
3 – Metaliferi Mountains (by own minerals);
4 – Sebeşului Mountains

Conclusions

The beginning of the third millennium, placed under the sign of the new information era, is dependent on new mineral resources. Thus, metals such as Li, Te, Se, Nb-Ta, through their properties and uses of modern technology, generate a demand increasingly large market, being also a challenge for the mining industry.

In the current world situation, Romania could be a leading provider of tellurium and selenium from minerals, concentrates and quartered in mining waste ponds and waste dumps of old mines associated with them.

Regarding lithium occurrence in Romania remains a potential source requiring detailed exploration works, while niobium and tantalum have not been reported in our country neither mineral or elemental form.

References

1. **Borcoş M., Gheorghiță I.**
Revue roumain de geologie et geophysique, Geography, Geology, 20, 2, Bucureşti, 1976;

2. **Ciobanu C., Cook N., Damian Gh., Damian F., Buia Gr.**
Telluride and sulphosalt associations at Sacaramb – "Gold-Silver-Tellurid Deposits of the Golden Quadrilateral, South Apuseni Mts., Romania, 31 st. aug. – 7 sept., 2004" – IAGOD Guidebook Series 12;

3. http://ec.europa.eu/commission_2010-2014/tajani/hot-topics/raw-materials/index_ro.htm

4. http://ro.wikipedia.org

5. **Emsley J.**
Nature's building blocks: an A-Z guide to the elements, Oxford University Press, 2003, ISBN:0198503407, pag. 236/560;

6. **Chesu M.**
Elemente minore in minereuri neferoase din Romania, Ed. Tehnica, 1983;

7. **Popescu C. Gh., Neacşu A., Cioacă M., Filipescu D.**
The selenium and Se-minerals in the Săcărâmb ore deposits – Metaliferi Mountains, Romania;

8. **Udubaşa G., a.o**
Arhiva IGG, 1981-1983;

9. **Udubaşa G., a.o.**
Analele institutului de geologie şi geofizică, LXI, 1984;

10. **V. Arsenescu, C. Bițoianu, I. Berbeleac, T. Berzea, M. Borcoş, S. Bordea, S.G. Boştinescu, I. Dinică, H. Hann, P. Hârtopanu, I. Hârtopanu, I. Intorsureanu, H. Krautner, D. Jipa, C. Lazăr, M. C. Micu, M. Mureşan, L. Nedelcu, S. Peltz, S. Radan, D. Russo-Săndulescu, M. Săndulescu, G. Udubaşa**
Harta substanțelor minerale utile (ediția a II-a) Partea a doua, Sistematizare Gitologică