EXPERIMENTAL STUDY OF THE PROBABLE EXISTENCE OF AU-SB SULFIDE COMPLEXES AT 400°C, 1 KBAR

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Direct correlation of Au with Sb, As and Te was long ago established in relation to Au-Sb, Au-As and Au-Te ore deposits. Thus, it was assumed that H_2S-bearing solutions could contain not only simple Au-hydrosulfide complexes but some complicated heteropolynuclei ones. So R.Boyle [1] expected the existence of $Au(Sb)_3^{2-}$ and $AuSb^{2-}$ complexes and T. Seward [2] such as $Au(Sb_2 S_4)^-$ T.A.Grigoryeva and L.S.Sukneva [3] experimentally showed that Au solubility in antimony 0,1n NaHS solutions are one magnitude higher in relation to those without Sb_2S_3. According to I.Ya.Nekrasov and A.A.Konjushok [4] study of Au solubility in H_2S –bearing solutions being saturated in relation to Sb at T 300°C and P 1 kbar gold forms heteropolynucley complexes such as $H_2AuSbS_3^o$ in acidic solutions and $HAuSbS_3^-$ in alkaline solutions.

We have to point out that in all cited reports was not taken into account such phenomenon as a sufficient increase of sulfide sulfur concentration in Sb_2S_3-saturated solutions resulting in the changes of the solutions composition. Thus, the stability of f_{S2} should be supported in order to obtain the accurate interpretation of the experimental data. Besides, Au and Sb, both, are known as chemical elements with variable valency, so the f_{O2} buffering should be also adopted. The probable transforming of Au and Sb chemical forms in the solution as a function of pH-value also demands the constancy of this parameter. All these requirements are fulfilled by use of natural redox and pH-buffers.

This study includes the preliminary experimental data on Au solubility in H_2S-bearing 0,2M and 1M NaCL solutions saturated in relation to Sb at T 400°C, P 1kbar at presence of Py-Po-Mgt redox buffer and nepheline-albite-corundum Ne-Alb-Crn pH-buffer. It should be mentioned that NaCI concentration is buffered by nepheline-sodalite mineral buffer.

All runs were performed in titanium autoclaves, the sulfide buffer conteiner with gold foil being pendant was attached in its upper part, whereas, the silicate buffer with Sb_2S_3 sample was inserted in the lower part. After chilling the solution was analyzed by the iodometric method toward H_2S and by the ETAAS methods toward Au with the preliminary methylisobutylketon concentration. The obtained results show the Au solubility to increase by several times corresponding to the Sb_2S_3 saturation of the studied solutions. Formerly it was found that gold could exist in a form of $Au (HS)_2^-$ and antimonyin a form of $Sb (OH)_3^o$ complexes under the studied conditions. Thus, the reaction of combined complex formation could be expressed as following:

$$Au (HS)_2^- + H_3SbO_3^o (aq) = Au (HS)(H_2SbO_3)^- + H_2S^o (aq)$$

The quant chemistry calculations allows to present the structure of this complex in a form with oxygen as "bridge" group binding the antimony and gold ions. The established phenomenon of Au-Sb complex existence plays an important role in the understanding of physicochemical conditions of Au-Sb ore deposit formation.

References

1. *Boyle R.W.* // Econ. Geol. 1969. V. 64. N. 1. P. 112.
2. *Seward T.M.* // Geochim. Cosmochim. Acta. 1973. V. 37. N. 3. P. 379.
3. *Grigoryeva T.A., Sukneva L.S.* // Geokhimiy. 1981. N. 10. P. 1534.
4. *Nekrasov I.Ya., Konjushok A.A.* Dokl. AN SSSR. 1982. V. 266. N. 6. P. 1463.