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ANNOTATED BIBLIOGRAPHY OF PAPERS ON GEOCHEMICAL PROSPECTING FOR ORES

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INTRODUCTION

This bibliography is a list of papers dealing with geochemical prospecting for ores. This field includes methods of exploration for metallic and nonmetallic mineral deposits by chemical studies of ore elements in soil, vegetation, and water.

No papers on general geochemistry are included in this list, nor are there references to geochemical prospecting for petroleum which has been adequately covered in the Geophysical Abstract series. Papers on analytical methods are listed only where the subject matter is directly related to geochemical prospecting problems.

Unless otherwise indicated, the papers are in English. The "stannometric survey" mentioned in some Russian papers refers to systematic sampling and analysis of soil material or alluvium for traces of tin.

The list may be incomplete, and the compiler would be grateful to anyone who could refer him to other publications on the subject.

Where abstracts have already been published, a notation follows the reference indicating where the abstract may be found. The following method of notation is used.

CA 40, 3075-3	"Chemical Abstracts," volume 40, column 3075, index line 3.
GA 5540	"Geophysical Abstracts," Geological Survey (July 1936 to 1942, 1947 to date) and Bureau of Mines (1929 to June 1936, 1943 to 1946), Item 5540.
EG 14-1, 909	"Annotated Bibliography of Economic Geology," volume 14, number 1, item 909.
GSA 9-71	Geological Society of America, "Bibliography and Index of Geology Exclusive of North America," volume 9, page 71.
ME 7,200-1	"Bibliography of References to the Literature on the Minor Elements," Chilean Nitrate Educational Bureau, 7th supplement, column 200, item 1.

Babička, J., Komárek, J., and Němec, B., Gold in animal bodies: Académie tchêque sci. Bull. internat., vol. 45, pp. 131-137, 1945.

The gold content of the antlers of roebuck browsing in a gold-bearing district was found to be higher than that of roebuck in unmineralized terrane. The gold content of a species of insect (cockshafer) showed a similar relaiionship.

Dorn, Paul, Plants as indicators of ore deposits [in German]: Der Biologe (Munich), vol. 6, pp. 11-13, 1937. [GSA 9-71; EG 15-1, 24]

A review of indicator plants that are reported to be useful in prospecting for deposits of zinc, tin, lead, gold, silver, copper, and mercury.

Flerov, B. L., The application of the stannometric survey for the exploration of primary tin deposits [in Russian]: Redkie Metal., no. 1, 1935.

(Not reviewed)

Flerov, B. L., On methods of prospecting for primary tin deposits [in Russian]: Sovet. Geol., vol. 8, no. 10, pp. 63-81, 1938. [CA 33, 9210-8]

A general and fairly elaborate discussion of the laws governing the dispersion of tin in deluvium and alluvium and of the applicability of the stannometric method to tin prospecting under various conditions.

Hawkes, Herbert E., Jr., The Geological Survey's geochemical prospecting unit [abstract]: Washington Acad. Sci. Jour., vol. 37, pp. 375-376, 1947. [GA 9436]

An outline of the research program of the Geological Survey on geochemical methods of prospecting for ores.

Hedström, Helmar, and Nordström, Allan, New aspects of ore prospecting [in Swedish]: Meddel. Jernkontorets Gruvbyrå, vol. 39, pp. 1-10, 1945.

A review of modern exploration techniques, including spectrographic analysis of plant ash, as a prospecting method. Graphs show the variation in chromium content of plant ash from a profile across a Greek chromite deposit and the variation in zinc, copper, and silver content of plant ash from two profiles across a Swedish lead-zinc deposit.

Jakoski, J. J., Dreyer, R. M., and Wilson, C. H., Geophysical investigation in the Tri-State zinc and lead mining district: Kansas Geol. Survey Bull. 44, pp. 51-77, 1942. [GA 6823; EG 16-1, 290]

A summary of results of extensive geophysical and geochemical experiments in the Tri-State district. Spectrographic analysis of surface soils for Mn, Ga, Ti, Ni, Pb, Mo, and V showed no apparent correlation with the distribution of ore at depth.

Konovalov, E. P., On the hydrochemical method of prospecting for gold [in Russian]: Sovet. Geol. vol. 11, no. 2, pp. 114-117, 1941. [CA 36, 6454-9]

Principally a criticism of a suggested method of gold prospecting by analysis of river water for gold held in solution or suspension. Main objections are lack of sensitivity of present analytical methods, and lack of basic data relating gold in rivers to gold in deposits and rocks of the drainage basin.

Landergren, Sture, On spectroanalysis and its application in investigating and prospecting for ore deposits [in Swedish]: Teknisk Tidskr., Bergsvetenskap, vol. 69, pp. 73-78, 1939. [EG 12-2, 176]

A general discussion of the application of geochemistry to mineral exploration, with a brief review of Swedish work on spectrographic analysis of plant ash as a prospecting method.

Leach, Paul, Simple chemical tests to aid prospectors: Eng. and Min. Jour., vol. 148, pp. 78-79, 1947. [CA 42, 79d]

A nontechnical article outlining some of the current research work of the Geological Survey on geochemical prospecting.

Lundberg, Hans, The future of geophysics in the light of new developments: Canadian Min. Jour., vol. 61, pp. 225-226, 1940. [GA 5540]

A nontechnical outline of the principles of spectrographic analysis of plant ash as a prospecting method.

——Future of geophysics in connection with plant life: California Min. Jour., vol. 9, no. 9, p. 5, 1940 [GA 5672]

A nontechnical outline of the principles of spectrographic analysis of plant ash as a prospecting method.

——New techniques in geoexploration: Mining and Metallurgy, vol. 22, pp. 257-258, 1941. [GA 6198; EG 14-1, 909]

A nontechnical outline of the principles of spectrographic analysis of plant ash as a prospecting method.

Malîuga, D. P., On soils and plants used in the search for metals [in Russian]: Akad. Nauk S.S.S.R. Izv., Ser. Geol. 1947, no. 3, pp. 135-138, 1947.

The nickel and cobalt content of three soil samples and two plant samples collected over known nickel-cobalt deposits is in the order of 10 to 100 times higher than that in similar samples from unmineralized areas. Both nickel and cobalt are apparently enriched in the upper soil horizons.

Ozerov, I. M., The stannometric survey as a prospecting method [in Russian]: Razvedka Nedr. no. 24, pp. 52-56, 1937.

General discussion of historical development and theory of stannometric surveying.

Rankama, Kalervo, On the use of the trace elements in some problems of practical geology: Soc. géol. Finlande Comptes rendus, no. 14, pp. 90-106, 1940; Comm. géol. Finlande Bull., no. 126, pp. 90-106, 1940. [CA 40, 3075-3; GSA 11-262]

The enrichment of nickel in plant ash from two nickel mining districts in Finland has been investigated by optical spectrography.

——On a new method of prospecting [in German]: Geol. Rundschau, vol. 32, pp. 575-578, 1941.

An outline of principles and summary of previous work on spectrographic analysis of plant ash as a prospecting method.

——Chemistry as an aid in the search for ore; geochemical and radioactive methods of prospecting [in Finnish]: Kemian Keskusliiton Eripainoksia, vol. 27, no. 4, pp. 3-11, 1945.

(Not reviewed)

——Some recent trends in prospecting; chemical, biogeochemical, and geobotanical methods: Mining and Metallurgy, vol. 28, pp. 282-284, 1947.

Summary and history of development (exclusive of Russia) of prospecting methods based on chemical and biological studies of plants, soils, and water.

Rafsbaum, E. A., Method of increasing the precision of results of spectral determinations for tin in field exploration [in Russian]: Razvedka Nedr, no. 8-9, pp. 50-52, 1938. [CA 34, 7778-5]

The precision of semiquantitative spectrographic determinations for tin in prospecting work may be increased by using cobalt as an internal standard.

——Field spectroanalytical laboratory for supporting prospecting parties [in Russian]: Razvedka Nedr, no. 1, pp. 38-41, 1939.

Equipment is listed for outfitting a portable field spectrograph including power plant, spectrographic and photographic equipment, and auxiliary supplies.

Robinson, W. O., Lakin, H. W., and Reichen, Laura A., The zinc content of plants of the Friedensville zinc slime ponds in relation to biogeochemical prospecting: Econ. Geology, vol. 42, pp. 572-582, 1947.

The zinc content of 30 species of plants growing on a zinc-rich slime pond ranges from 39 p.p.m. to 5400 p.p.m. The zinc contents of aspen, ragweed, and horsetail grown on normal soils are compared with those on the slime ponds, and it is recommended that aspen and ragweed be studied further as indicators of zinc ore bodies.

Rokhlin, M. I., Experiment in the application of the stannometric survey in the Arctic under permafrost conditions [in Russian]: Problemy Arktiki, no. 4, pp. 61-90, 1938.

A study of tin-bearing areas in the Arctic indicates that stannometric surveys of soil, alluvium, and beach sands can be used successfully for prospecting areas of permanently frozen ground. Distribution of tin according to grain size was investigated with results shown on five sectional diagrams.

Rosenqvist, A. M., and Vogt, Thorolf, Determination of copper in water samples; the analytical method [in Norwegian, with English summary]: K. norske vidensk. selsk. Forh., vol. 15, no. 22, pp. 83-86, 1942. [CA 39, 3762-9]

Analytical method for copper is described in which Cu acts catalytically on the reduction of ferric iron with sodium thiosulfate, with thiocyanate as the indicator. The method was used at Røros in geochemical prospecting work.

Safronov, A. P., and Sergeev, E. A., New geophysical methods of prospecting for deposits based on the study of "dispersion halos" [in Russian]: Razvedka Nedr, no. 18, pp. 24-25, 1936. [GA 3611]

General review of soil analysis as a prospecting method, including a discussion of spectrographic, polarographic, and electrode polarization methods.

Saukov, A. A., Geochemistry of mercury [in Russian]: Inst. Geol. Nauk Trudy, Akad. Nauk. S.S.S.R., vol. 78, Mineral-Geokhim. Ser. no. 17, 129 pp., 1946.

A comprehensive treatise on the geochemistry of mercury, with 89 references. The possible applications of secondary dispersion halos of mercury as a guide in prospecting is discussed (p. 99) but no reference to experimental work is made.

Sergeev, E. A., Use of spot tests in mineral exploration [in Russian]: Razvedka Nedr, no. 12, pp. 27-29, 1936.

Samples of residual soil were analyzed for borate by chemical methods in Indersk region. Soils rich in borate can be correlated with underlying borate beds.

——The physico-chemical method of searching for ores [in Russian, with English summary]: Materialy Vsesoiuzn. Nauch.-Issledovatel. Geologicheskogo Inst., Geofiz., no. 9-10, pp. 3-55, 1941.

A comprehensive detailed summary to 1940 of Russian work in soil analysis as a method of prospecting. The author describes the theory, equipment, field procedure; gives results of several surveys; and lists the mineral discoveries attributable to soil analysis. 19 illustrations and 49 references.

——Water analysis as a prospecting method [in Russian]: Razvedka Nedr, no. 5, pp. 51-55, 1946. [GA 9251; CA 40,5673-7]

The principles of dispersion "trains" of heavy metals in surface water draining mineralized areas are outlined. Data on the heavy metal content of streams draining two mining districts in the Altai are presented.

——A new luminoscope for field use [in Russian]: Razvedka Nedr, no. 5, pp. 41-42, 1946.

Describes a portable device consisting of a source of ultraviolet light and an optical system capable of 25-fold magnification for viewing the irradiated spot. It is designed for the qualitative determination of the abundance of fluorescent mineral particles in undisturbed soil.

Sergeev, E. A., and Solovov, A., The electrode polarization method of geophysical prospecting [in Russian]: Materialy, TSentral. Nauch.-Issledovatel. Geologo-Razvedochnyi Inst., Geofiz., no. 3, pp. 1-10, 1937. [GA 3917]

The sulfate ion concentration in soil moisture may be determined rapidly in the field by measuring the spontaneous potential generated on a specially prepared probing electrode. The physical theory of the method and the construction of the apparatus is discussed. The method is recommended as a means of prospecting for oxidizing sulfide deposits.

Sofronov, N. I., On the question of dispersion halos from mineral deposits [in Russian, with English summary]: Problemy Sovet. Geol., vol. 6, no. 4, pp. 302-323, 1936. [GA 3458]

General features of mechanical, saline, and gaseous dispersion halos developed by the weathering of primary mineral deposits are described. The use of spectrographic, polarographic, radiometric, and electrode polarization methods in exploring for dispersion halos is discussed. Data of four field surveys are shown in sectional diagrams.

Sofronov, N. I., and Solovov, A. P., Abstracts of papers: The problem of spectroanalysis in prospecting; Results of spectroanalysis in prospecting for tin veins [in Russian]: Problemy Sovet. Geol., vol. 6, pp. 739-740, 1936. [EG 9-2, 384]

Brief summary of the use of the spectrograph in prospecting for tin, with special reference to a project at Khapcheranga where a new tin vein was discovered by soil analysis.

Swedish Prospecting Company; concerning our geochemical prospecting method [in Swedish]: 11 pp., Malmo, Sweden, 1939.

An advertising brochure on spectrographic analysis of plant ash as a prospecting method. Maps and charts show the relative tin, tungsten, lead, and zinc content of plant ash in relation to known deposits of those metals.

Thyssen, Stephan von, Geochemical and botanical relationships in the light of applied geophysics [in German]: Beitr. angew. Geophysik, vol. 10, pp. 35-84, 1942.

An extended theoretical treatise on the chemical composition of vegetation as related to mineralization, with 124 references.

Tikhomirov, N. I., and Miller, S. D., On the physico-chemical method of prospecting for molybdenum in the semidesert climate of northern Pribalkhash [in Russian]: Razvedka Nedr, no. 2, pp. 34-39, 1946.

Dispersion halos of molybdenum and tungsten in residual material over molybdenite-wolframite deposits were found by spectrographic analysis. Data are presented in a series of graphs and maps.

Tkalich, S. M., Investigation of vegetation as a guide in prospecting [in Russian]: Vest. Dal' nevostoch. Filiala Akad. Nauk (Vladivostok), no. 32 (5), pp. 3-25, 1938.

Describes principles of plant analysis as a prospecting method and gives results of culture experiments on the uptake of Cu, Zn, Fe and Na. An experimental survey over a pyrite-arsenopyrite deposit indicates a positive correlation between the iron content of Calamagrostis and proximity to the ore body.

Vogt, Thorolf, Chemical and "botanical" ore prospecting in the Røros area [in Norwegian, with English summary]: K. norske vidensk. selsk. Forh., vol. 12, no. 23, pp. 81-84, 1939. [CA 35, 2095-1]

The relation of soluble sulfates in surface drainage to ore deposits at Røros, Norway, is described.

——Viscaria alpina (L.) G. Don as a sulfide indicator plant [in Norwegian, with English summary]: K. norske vidensk. selsk. Forh., vol. 15, no. 2, pp. 5-8, 1942. [CA 41, 667-h]

The occurrence of Viscaria alpina particularly on serpentine, dunite, and copper-ore outcrops is ascribed to the high tolerance of that species for copper in the soil.

——Notes on the vegetation at the ore deposits at Røros [in Norwegian, with English summary]: K. norske vidensk. selsk. Forh., vol. 15, no. 6, pp. 21-24, 1942. [CA 41, 668-a]

A list of plants thriving on copper-rich soil at Røros, Norway, is presented.

——Trace elements in bog and lake ores [in Norwegian, with English summary]: K. norske vidensk. selsk. Forh., vol. 15, no. 24, pp. 91-94, 1942. [CA 39, 3763-2]

X-ray spectrograms show that Zn, Cu, Ni, Co, Ca are co-precipitated with MnO_2 in bogs and lakes. Analysis of bog and lake ore thus may be useful in determining the types of ores to be expected within the drainage basin.

Vogt, Thorolf, and Bergh, H., Copper content of soil samples [in Norwegian, with English summary]: K. norske vidensk. selsk. Forh., vol. 19, no. 21, pp. 76-79, 1946. [CA 42, 493-h]

Copper isograds in humus-rich glacial soil near a copper mine in the Røros district outline a fan of glacial dispersion. The copper content of soil within the fan varies from 500 to 7,000 p.p.m. as compared with 20 p.p.m. in normal soil.

Vogt, Thorolf, and Braadlie, O., Vegetation and soil at the ore deposits at Røros [in Norwegian, with English summary]: K. norske vidensk. selsk. Forh., vol. 15, no. 7, pp. 25-28, 1942. [CA 41, 668-b]

Chemical analyses of 11 poisoned soils over sulfide mineral deposits are compared with analyses of 3 normal soils from the vicinity.

Vogt, Thorolf, Braadlie, O., and Bergh, H., Determination of Cu, Zn, Pb, Mn, and Fe in plants from the Røros district [in Norwegian, with English summary]: K. norske vidensk. selsk. Forh., vol. 16, no. 15, pp. 55-58, 1943. [CA 39, 3763-5; ME 7,200-1]

The Cu, Zn, Pb, Mn, and Fe content of plants growing over a copper deposit is compared with that of plants growing on normal soil. The authors conclude that the determination of copper and zinc in plants does not seem to be useful as a prospecting method in the areas under study.

Vogt, Thorolf, and Bugge, Jens, Determination of copper in plants from the Røros district by quantitative X-ray analysis [in Norwegian, with English summary]: K. norske vidensk. selsk. Forh., vol. 16, no. 14 pp. 51-54, 1943. [CA 39, 3763-4; ME 7,83-1]

Analyses of vegetation from normal and mineralized areas indicate that the same parts of the same species of plant must be collected for comparative results. The leaves of dwarf birch gave favorable results. The authors conclude that the method does not seem to be useful for copper in the areas under study.

Vogt, Thorolf, and Rosenqvist, A. M., Determination of copper in water samples from the Røros district [in Norwegian, with English summary]: K. norske vidensk. selsk. Forh., vol. 15, no. 23, pp. 87-90, 1942. [CA 39, 3763-1]

A survey of the copper content of surface water in relation to copper deposits in the Røros district. Four samples containing 2 to 3.2 p.p.m. Cu came from streams draining known mines; six samples containing 0.05 to 0.185 p.p.m. Cu have apparently received their copper from hidden ore; and 47 samples containing nil to 0.044 p.p.m. Cu are believed to represent normal waters.

Warren, H. V., and Howatson, C. H., Biogeochemical prospecting for copper and zinc: Geol. Soc. America Bull., vol. 58, pp. 803-820, 1947. [CA 42, 1533-c]

Studies in the vicinity of several mining camps in British Columbia indicate that the zinc and copper content of some trees and lesser plants may reflect the presence of zinc and copper concentrations in the underlying soils or rock formations.

Zaidina and Sergeev, Information on the work of the geophysical group of TsNIGRI on spectral analysis [in Russian]: Razvedka Nedr, no. 7, pp. 55-57, 1938.

A brief historical summary through 1937 of the development and application in Russia of spectrographic analysis of soil material as a method of prospecting for tin, tungsten, molybdenum, lead,