Bibliography on the Geology and Resources of Vanadium to 1968

GEOLOGICAL SURVEY BULLETIN 1316

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By R. P. FISCHER *and* JANE P. OHL

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By R. P. Fischer and Jane P. Ohl

INTRODUCTION

PURPOSE AND SCOPE

This bibliography, which contains nearly 1,400 bibliographic references, was compiled to aid studies on the geology and resources of vanadium. It covers literature published through 1967 and contains references to a few papers published in the early part of 1968. Most references included are to original sources of information on the distribution and occurrence of vanadium-bearing deposits, on the geochemical relations of vanadium in rocks and deposits, and on vanadium mineralogy; some references on the exploitation and metallurgical treatment of vanadium source materials are also included.

The following paragraphs summarize the geologic distribution of vanadium and briefly explain the arrangement of the bibliographic references and the index, in order to help a student understand the organization of the index and to guide him in its use. A list of vanadium minerals and their chemical formulas is included.

GEOLOGIC DISTRIBUTION OF VANADIUM

Vanadium averages about 150 parts per million (ppm) in the Earth's crust; it is more abundant than copper, lead, or zinc. Silicic igneous rocks have an average content of about 50 ppm vanadium, whereas the mafic rocks commonly contain 100–200 ppm. Sandstone and limestone normally contain only about 20 ppm vanadium, but ordinary shale generally has almost as much vanadium as the mafic igneous rocks and carbonaceous shale commonly has even more. Vanadium generally does not occur as an essential part of any rock-forming mineral; rather, in igneous rocks the vanadium ions replace those of iron and aluminum in the common iron and ferromagnesian minerals, and in sedimentary rocks the vanadium is mainly associated with clay minerals or organic matter.

Magmatic and pyrometasomatic ore deposits associated with mafic igneous rocks are commonly enriched in vanadium—most titaniferous magnetite deposits contain nearly 0.5 percent V_2O_5 (about 0.3 percent vanadium or 3,000 ppm), and some contain 1½ to 2 percent V_2O_5; non-titaniferous magnetite deposits commonly contain about 0.1 to

0.2 percent V_2O_5; and some chromite deposits contain about 0.1 percent V_2O_5.

Most ore deposits of hypogene hydrothermal origin contain only sparse amounts of vanadium; indeed, many hypogene ores contain less vanadium than the average crustal abundance. On the other hand, vanadium does accumulate in some gold-bearing veins, especially those containing gold tellurides, and in some titanium-bearing veins a few tenths of a percent V_2O_5 is common.

Residual deposits rich in aluminum and iron, such as bauxites and laterites, commonly contain about 0.1 percent V_2O_5.

Some sedimentary deposits are enriched syngenetically in vanadium. Many sedimentary iron ores contain about 0.1 percent V_2O_5. Some organic-rich shale contains 1 percent or more V_2O_5. Some deposits of phosphate rock contain a few tenths of a percent V_2O_5, but most phosphate deposits have a much lower vanadium content. Vanadium is commonly the principal trace element in petroleum, especially asphalt-base oils; the ash of some crude oils contains more than 10 percent V_2O_5, as does the ash of some natural asphaltites and refinery residues derived from oils of this type. Coal, on the other hand, is usually low in vanadium.

Four geologic types of productive vanadium deposits are of epigenetic origin, but the source of vanadium and its manner of emplacement in these deposits are uncertain. These types are the vanadium-uranium deposits in sandstone; the somewhat similar deposits of the same metals in limestone; the deposits of base-metal vanadate minerals in the oxidized zones of copper, lead, and zinc deposits; and a recently discovered deposit in the zone of alteration at the contact of an alkalic intrusion. The vanadium content of ores from these deposits ranges from 1 to 2 percent V_2O_5.

BIBLIOGRAPHIC REFERENCES

Each bibliographic reference is listed alphabetically under the author's last name or the last name of the first author. Each reference includes the title of the article, the publication source, and the year published. The names of most serial publications are abbreviated in the bibliographic references and are listed alphabetically, both in abbreviated form and in full, in the accompanying serial list. Titles of articles published in foreign languages using the Roman alphabet are given both in the original language and in English translation; those using the Cyrillic alphabet are transliterated (using the style of the U.S. Board on Geographic Names) and translated. However, only translations are given for original titles that are unusually long. For titles of articles in Oriental languages, only translations are given. Most title translations were taken from journals that regularly publish abstracts of scientific articles.

Brief annotations are given with many references whose titles do not indicate the subject matter relative to vanadium. For example, the entry "Davidson, D. F. Selenium in some oxidized sandstone-type uranium deposits: U.S. Geol. Survey Bull. 1162–C, p. C1–C33, 1963" is accompanied by an annotation saying: "Includes data on the amount and occurrence of vanadium in many of the deposits described." A reference such as "Balsley, J. R., Jr. Vanadium-bearing magnetite-ilmenite deposits near Lake Sanford, Essex County, New York: U.S. Geol. Survey Bull. 940–D, p. 99–123, 1943" is not annotated. For a significant article published in a language other than English, or in a publication that is not available in many libraries, a more detailed annotation is given than in other cases, even though the title of the article may reveal the general subject matter relative to vanadium, or a reference is made to an abstracting journal if one of these published an informative abstract. Journals of this type include Annotated Bibliography of Economic Geology, Bibliography and Index of Geology Exclusive of North America, Chemical Abstracts, Mineralogical Abstracts, and Neues Jahrbuch für Mineralogie, Geologie, und Paläontologie.

Not all publications that contain information on the geologic occurrence of vanadium are included by reference in this bibliography. References to textbooks on mineral deposits and to summary or review articles are not included unless they contain some significant information on vanadium. Abstracts of papers presented at scientific meetings are not included if references to later publication of these papers are given. Also excluded are reports that merely mention the occurrence of vanadium minerals or deposits in areas where vanadium deposits are numerous and well described in the literature cited. Such areas include southwestern United States, where the oxidized zones of many deposits of copper, lead, and zinc contain mineralogic occurrences of base-metal vanadates, and the Colorado Plateau region, where vanadium-uranium deposits in sandstone are numerous. On the other hand, references are included to reports that only mention similar occurrences in areas that are not known to contain abundant vanadium deposits or minerals, in order to record these occurrences.

In recent years, many articles have been published on the trace-element content of rock types or geologic environments, but only a small proportion of those that contain data on vanadium are included in this bibliography. Those included are judged to be reasonably representative of that type of occurrence or they seem to emphasize some significant geochemical relation. Most of these references are indexed under the major heading "Geochemistry" and under the secondary headings "Abundance in . . ." or "Elemental association in rocks and deposits."

INDEX EXPLANATION

Each bibliographic reference is indexed under one or more index sets, each set consisting of three orders of headings. Topical and geographic terms are used for these headings. All references relating to vanadium accumulations that might be of economic interest are indexed both topically and geographically; references to occurrences dominantly of scientific interest are judged to have no geographic significance and are indexed only under topical headings.

References to productive vanadium deposits, and also to nonproductive occurrences of the same geologic types as the productive deposits, are all indexed under the first-order heading, "Deposits, geologic types." Second-order headings indicate the geologic types, such as "Asphaltite" and "Sandstone." Third-order headings relate to the geographic location. Also included under "Deposits, geologic types" are nonproductive types of occurrences that are judged to have a significant productive potential, such as vanadium-rich shale and tar sands.

All references indexed under "Deposits, geologic types" are also indexed under first-order geographic names, consisting of States in the United States, foreign countries, and major geographic units, such as the Colorado Plateau region. "The Statesman's Yearbook," 1965–1966, 102d edition, New York, St. Martin's Press, 1726 p., 1965, was used as an authority for the names of new countries; former names of countries are cross-referenced to the new names. Second-order headings consist of political and geographic subdivisions. Third-order headings identify the geologic types of deposits.

All references that include tonnage and grade data on the vanadium content of deposits or areas are also indexed under the first-order headings "Resources, geographic distribution" and "Resources, geologic types of deposits."

References that relate mainly to the geochemical abundance and association of vanadium and to geochemical processes involving vanadium are mainly indexed under the first-order heading, "Geochemistry," and those relating to studies of vanadium minerals are indexed under the first-order headings "Mineral data" and "Mineralogy." Most of these references are not considered to be significant geographically, and for that reason most of them are not indexed under first-order geographic terms.

LIST OF VANADIUM MINERALS

Most formulas and classifications are from Hey (1962, 1963, 1966); some are modified by Michael Fleischer, U.S. Geological Survey (written commun., 1965, 1968). Minerals that are generally not accepted or incompletely described and synonyms that are generally discarded are shown in italics.

Name and formula	*Classification*	*Remarks*
Alaïte, HVO_3	Oxide	
Alvanite, $Al_3VO_4(OH)_6 \cdot 2\frac{1}{2}H_2O$	Vanadate	
Araeoxene	do	Synonym of dechenite.
Ardennite, $Mn_5Al_5(As, V)O_4Si_5O_{20}(OH)_2 \cdot 2H_2O$.	Silicate	
Arsenosulvanite, $Cu_3(As, V)S_4$	Sulfovanadate	Arsenic analogue of sulvanite.
Arsenovanadinite	Vanadate	Synonym of endlichite.
Barium francevillite, $(Ba, Pb)(UO_2)_2(VO_4)_2 \cdot 5H_2O$.	do	Variety of francevillite.
Barnesite, $Na_2V_6O_{16} \cdot 3H_2O$	do	
Bokite, $KAl_3Fe_6V^{+4}{}_6V^{+5}{}_{20}O_{76} \cdot 30H_2O$	do	
Brackenbuschite, $Pb_2(Mn, Fe)(VO_4)_2 \cdot 2H_2O$.	do	
Calciocarnotite	do	Synonym of tyuyamunite.
Calciovolborthite, $CaCuVO_4OH$ (?)	do	See also tangeïte.
Carnotite, $K_2(UO_2)_2(VO_4)_2 \cdot 3H_2O$	do	
Carnotite, cesium analogue, $Cs_2(UO_2)_2(VO_4)_2$.	do	A synthetic compound.
Cavansite, $Ca(VO)(Si_4O_{10}) \cdot 6H_2O$	Silicate	
Chervetite, $Pb_2V_2O_7$	Vanadate	
Chilëite, $PbCu(V, As)O_4OH$	do	
Chromsteigerite	do	Variety of steigerite.
Collieite, $(Pb, Ca)_5[(P, V)O_4]_3Cl$	do	Variety of pyromorphite.
Colusite, $Cu_3(As, Sn, V)S_4$	Sulfovanadate	
Corvusite, $(VO)V_6O_{16} \cdot nH_2O$ (?)	Oxide	
Coulsonite, $(Fe, V)_3O_4$	do	
Cuprodescloizite, $Pb(Cu, Zn)VO_4OH$	Vanadate	
Cuprovanadinite, $(Pb, Cu)_5(VO_4)_3Cl$	do	Variety of vanadinite.
Dechenite, $PbZn(V, As)O_4OH$	do	Variety of descloizite.
Delrioite, $CaSrV_2O_7 \cdot 3H_2O$	do	
Descloizite,[1] $Pb(Zn, Cu)VO_4OH$	do	
Dewalquite	Silicate	Synonym of ardennite.
Doloresite, $V_3O_4(OH)_4$	Oxide	
Duttonite, $VO(OH)_2$	do	
Endlichite, $Pb_5[(V, As)O_4]_3Cl$	Vanadate	Variety of vanadinite.
Eosite		Vanadate and molybdate of Pb.
Eusynchite	Vanadate	Synonym of descloizite.
Ferganite (ferghanite)		Vanadate of U or of U and Li.
Fernandinite, $Ca(VO)_2V_{12}O_{28} \cdot 14H_2O$	Vanadate	
Fervanite, $FeVO_4 \cdot 1\frac{1}{4}H_2O$	do	
Francevillite, $(Ba, Pb)(UO_2)_2(VO_4)_2 \cdot 5H_2O$.	do	
Fritzscheite		Phosphate and vanadate of Mn and U.
Gamagarite, $Ba_4(Fe, Mn)_2V_4O_{15}(OH)_2$	Vanadate	
Goldmanite, $Ca_3V_2Si_3O_{12}$	Silicate	
Goldmanite, manganoan, $(Ca, Mn)_3V_2Si_3O_{12}$.	do	
Grantsite, $Na_4Ca(V^{+4}O)_2V^{+5}{}_{10}O_{30} \cdot 8H_2O$	Vanadate	
Gutsevichite, $(Al, Fe)_3[(V, P)O_4]_2(OH)_3 \cdot 7\frac{1}{2}$–$8\frac{1}{2}H_2O$.	do	

[1] The descloizite-mottramite series, $PbZn(VO_4)OH$–$PbCu(VO_4)OH$, includes the following minerals and mineral varieties, each of which is listed separately: araeoxene, chilëite, cuprodescloizite, dechenite, eusynchite, psittacinite, ramirite, schaffnerite, and vanadite.

Name and formula	*Classification*	*Remarks*
Häggite, $V_2O_2(OH)_3$	Oxide	
Haradaite, $SrVSi_2O_7$	Silicate	
Hendersonite, $Ca_2V^{+4}_{1+x}V^{+5}_{8-x}(O,OH)_{24}\cdot 8H_2O$.	Vanadate	
Hewettite, $CaV_6O_{16}\cdot 9H_2O$	do	
Huemulite, $Na_4MgV_{10}O_{28}\cdot 24H_2O$	do	
Hummerite	do	Hydrated vanadate of Mg.
Kalkvolborthite	do	Original name for calciovolborthite.
Karelianite, V_2O_3	Oxide	
Kentsmithite	do	Same as vanoxite.
Kolovratite		Probably a hydrous vanadate of Ni and Zn.
Kurumsakite, $(Zn,Ni,Cu)_8Al_8V_2Si_5O_{35}\cdot 27H_2O$.	Silicate	
Melanovanadinite, $Ca_2(VO)_4V_6O_{21}$	Vanadate	
Metahewettite, $CaV_6O_{16}\cdot 9H_2O$	do	
Metarossite, $CaV_2O_6\cdot 2H_2O$	do	
Metaschoderite, $Al_2VO_4PO_4\cdot 6H_2O$	do	
Metatyuyamunite, $Ca(UO_2)_2(VO_4)_2\cdot 3\text{–}5H_2O$.	do	
Minasragrite, $(VO)_2H_2(SO_4)_3\cdot 15H_2O$	Sulfate	
Montroseite, (V, Fe)O·OH	Oxide	
Mottramite,[1] Pb(Cu, Zn)VO_4OH	Vanadate	
Navajoite, $V_2O_5\cdot 3H_2O$	Oxide	
Nolanite, $Fe_4V_{10}O_{23}$, $Fe_3V_8O_{18}$	do	
Paraduttonite, near $V_2O_5\cdot H_2O$	do	
Paramontroseite, VO_4	do	
Pascoite, $Ca_2V_6O_{17}\cdot 11(?)H_2O$	Vanadate	
Patronite, VS_4	Sulfide	
Pintadoite, $Ca_2V_2O_7\cdot 9H_2O$	Vanadate	
Protodoloresite, $V_2O_3\cdot 2V_2O_4\cdot 5H_2O$	Oxide	
Psittacinite	Vanadate	Synonym of mottramite.
Pucherite, $BiVO_4$	do	
Pyrobelonite, PbMnVO_4OH	do	
Rafaelite	Organic mineral	Vanadiferous asphaltite.
Ramirite	Vanadate	Synonym of cuprodescloizite.
Rauvite, $Ca(UO_2)_2V_{12}O_{33}\cdot 20H_2O$	do	
Robellazite		Vanadate, tungstate, columbate, and tantalate of Fe, Al, and Mn.
Roscoelite, near $K(V, Al)_3Si_3O_{10}(OH)_2$	Silicate	
Rossite, $CaV_2O_6\cdot 4H_2O$	Vanadate	
Rusakovite, $(Fe, Al)_5[(V, P)O_4]_2(OH)_9\cdot 3H_2O$.	do	
Santafeite, $Na_2(Mn,Ca,Sr)_6Mn^{+4}_3(V, As)_6O_{28}\cdot 8H_2O$	do	
Satpaevite, $Al_{12}(V^{+4}O)_2V^{+5}_6O_{35}\cdot 30H_2O$.	do	
Schaffnerite	do	Variety of descloizite.
Schoderite, $Al_2VO_4PO_4\cdot 8H_2O$	do	
Sefstromite	Oxide	Vanadiferous ilmenite.
Sengierite, $Cu(UO_2)_2(VO_4)_2\cdot 8$ or $10H_2O$	Vanadate	
Sherwoodite, $Ca_3(V^{+4}O)_2V^{+5}_6O_{20}\cdot 15H_2O$	do	
Simplotite, $CaV_4O_9\cdot 5H_2O$	Oxide	
Sincosite, $Ca(VO)_2(PO_4)_2\cdot 5H_2O$	Phosphate	

See footnote 1, p. IX.

Name and formula	*Classification*	*Remarks*
Steigerite, $AlVO_4 \cdot 3\frac{1}{4}H_2O$	Vanadate	
Sulvanite, Cu_3VS_4	Sulfovanadate	
Tangeïte, $CaCuVO_4OH$	Vanadate	
Turanite, $Cu_5(VO_4)_2(OH)_4$	do	
Turkestan volborthite	do	Variety of tangeïte.
Tyuyamunite, $Ca(UO_2)_2(VO_4)_2 \cdot 10H_2O$	do	
Unnamed mineral of Chernik, 1922, near $Cu_2(UO_2)_2V_6O_{19} \cdot 6H_2O$.	do	
Uvanite, $(UO_2)_2V_6O_{17} \cdot 15H_2O$	do	
Uzbekite	do	Probably identical with volborthite.
Vanadinite, $Pb_5(VO_4)_3Cl$	do	
Vanadiolite		Silicate and vanadate of Ca.
Vanadite	Vanadate	Synonym of descloizite.
Vanalite, near $NaAl_8V_{10}O_{38} \cdot 30H_2O$	Vanadate	
Vanoxite, $(VO)_4V_2O_9 \cdot 8H_2O$ (?)	Oxide	
Vanuralite, $(UO_2)_2Al(VO_4)_2OH \cdot 8H_2O$	Vanadate	
Vanuranylite, $(H_3O)_2U_2V_2O_{12} \cdot 3 \cdot 6H_2O$	do	
Vesbine	do	Probably identical with mottramite.
Vésigniéite, $Cu_3Ba(VO_4)_2(OH)_2$	do	
Vichlovite		Original spelling of wicklowite.
Volborthite, $Cu_3(VO_4)_2 \cdot 3H_2O$	Vanadate	
Wicklowite	do	Vanadate of Pb.
Yamatoite, $Mn_3V_2Si_3O_{12}$	Silicate	Name given to hypothetical end-member.

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Describes the stratigraphy and deposition of the vanadium-bearing shale and associated strata, and the geology of various areas where these beds are present.

Ankinovich, S. G. *See* Ankinovich, E. A. 01134

01135 **Ankinovich, S. G.; Ankinovich, E. A.** Geology and assimilation of the Karatau vanadium-bearing territory [in Russian]: Proiz. Sily Yuzh. Kazakh., v. 1, p. 168–184, 1966; abs. *in* Chem. Abs., v. 67, abs. no. 83867v, 1967.

Annell, C. S. *See* Deul, Maurice. 00416

00055 **Anosov, F. Ya.; Chukhrov, F. V.** O vanadatakh v zone okisleniya mestorozhdeniy tsentral'nogo Kazakhstana [Vanadates in the oxidation zone of ore deposits of central Kazakhstan]: Vses. Mineralog. Obshch., Zapiski, 2d ser., v. 77, p. 43–54, 1948; abs. *in* Geol. Soc. America Bibliography and Index of Geology Exclusive of North America, v. 14, p. 8, 1949.

Describes four deposits of base-metal vanadates in lower Paleozoic sedimentary beds, which include shales containing vanadium and other metals.

00057 **Antipov, I. A.** Mineraly iz mestorozhdeniya Tyuya-Muyun v Ferganskoy oblasti [Minerals in the ore deposit at Tyuya-Muyun in the Fergana oblast]: Gornyy Zhurn., year 84, v. 4, p. 255–267, 1908; abs. *in* Neues Jahrb. Mineralogie, Geologie u. Paläontologie, 1909, v. 2, Ref. p. 37–40, 1909.

The vanadium, uranium, and copper minerals that occur in veins in limestone are described.

00056 **Appleman, D. E.; Evans, H. T., Jr.** The crystal structure of carnotite: Acta Cryst., v. 10, p. 765, 1957.

Appleman, D. E. *See* Barton, P. B., Jr. 00117

00892 **Appleman, D. E.; Evans, H. T., Jr.** The crystal structures of synthetic carnotite, $K_2(UO_2)_2V_2O_8$, and its cesium analogue, $Cs_2(UO_2)_2V_2O_8$: Am. Mineralogist, v. 50 p. 825–842, 1965.

00058 **Arambourg, Camille; Orcel, Jean.** Observations préliminaires sur la présence d'un vanadate d'urane dans les gisements de phosphates du Maroc [Preliminary observations on the presence of a vanadate of uranium in Moroccan phosphate deposits]: Acad. Sci. [Paris] Comptes Rendus, v. 233, no. 25, p. 1635–1636, 1951.

00130 **Archbold, N. L.** Relationship of carbonate cement to lithology and vanadium-uranium deposits in the Morrison formation in southwestern Colorado: Econ. Geology, v. 54, no. 4, p. 666–682, 1959.

Archbold, N. L. *See* Shawe, D. R. 00679

00882 **Argall, G. O., Jr.** The occurrence and production of vanadium: Colorado School Mines Quart., v. 38, no. 4, 56 p., 1943.

00060 **Argentine Dir. Nac. de Geol. y Min.** Los depositos de minerales nucleares en la Republica Argentina [The deposits of nuclear minerals in the Republic of Argentina]: Argentine Dirección Nac. Geología y Minería, Bol. Inf., Año 2, no. 13, p. 31–32, 1958.

The occurrence of uranium, copper, and vanadium minerals in sandstone in the Province of Neuquén is briefly mentioned.

01226 **Argentine Dir. Nac. de Geol. y Min.** Panorama general del trabajo realizado por esta reparticion durante el ano 1957 [General report of the work performed by this division during the year 1957]: Argentine Dirección Nac. Geología y Minería, Bol. Inf., Año 2, no. 4/5, p. 7–11, 1958.

A description is given of two deposits containing vanadates in the Province of San Luis.

00062 **Arkhangel'skiy, A. D.; Kopchenova, E. V.** Chemical composition of the iron ores of USSR [in Russian with English summary]: Moscow, Nauchn.-Issledov. Inst. Geologii i Mineralogii, Trudy 11, p. 5–66, 1935; abs. *in* Chem. Abs., v. 30, col. 2529, 1936.

An interpretation of the geochemical conditions in which various minor elements accumulate in sedimentary iron ores is included.

00061 **Arkhangel'skiy, A. D.; Kopchenova, E. V.** Zametka ob organicheskom veshchestve, fosfore i vanadii v otlozheniyakh Chernogo morya [Organic matter, phosphorus and vanadium in the Black Sea deposits]: Akad. Nauk SSSR, Izv., 7th ser., Otd. Fiz-Mat., no. 3, p. 205–215, 1930; abs. *in* Chem. Abs., v. 25, p. 266–267, 1931.

Armstrong, F. C. *See* McKelvey, V. E. 00402

Armstrong, F. C. *See* McKelvey, V. E. 00404

00883 **Arnáiz y Freg, Arturo.** Don Andrés del Rio describridor del Eritronio (Vanadio) [Don Andrés del Rio. the discoverer of erythronium (vanadium)]: Rev. Historia América, v. 25, p. 27–68, 1948.

Arrhenius, G. O. S. *See* Goldberg, E. D. 01269

01227 **Arrhenius, Olof.** Vissa ämnens fördelning i marken i Kopparbergs län [The distribution of certain elements in soil in the province of Kopparberg (Dalecarlia, Sweden)]: Sveriges Geol. Undersökn. Ser. C, no. 518, Årsbok. 44, no. 4, 40 p. (English summary p. 37–40), [1950] 1953.

The elemental association and geochemical relations of vanadium and other elements in many samples of soils and rocks are described.

00131 **Arribas, A.** Mineralogia de los yacimientos Españoles de uranio [Mineralogy of Spanish uranium deposits], *in* Genetic problems of uranium and thorium deposits: Internat. Geol. Cong., 21st, Copenhagen 1960, Rept., v. 15, p. 98–108, 1960.

Vanadium–uranium minerals occur in uranium deposits in sandstone.

Askerov, A. B. *See* Bezrukov, I. Ya. 00893

01127 **Asmanow, Assen.** Der Titaneisensand an der bulgarischen Küste des Schwarzen Meeres [Ti–Fe sand on the shore of the Bulgarian Black Sea]: Freiberger Forschungshefte, ser. B., v. 106, p. 77–92, 1965; abs. *in* Chem. Abs., v. 64, col. 12387, 1966.

00069 **Assarsson, G. O.** Vanadinhalten i svenska oljeskiffrar och vanadinets föreskomstsätt [The vanadium content of Swedish oil shale and the nature of the occurrence of vanadium]: Geol. Fören., Stockholm, Förh., v. 63, no. 2, p. 182, 1941.

The alum (oil) shale contains about 0.02 to 0.2 percent vanadium.

01204 **Assarsson, G. O.; Grundulis, V.** Chemical investigations of Upper Cambrian shales at Hynneberg, Naerke [in English]: Geol. Fören., Stockholm, Förh., v. 83, p. 269–277 (correction, ibid., p. 433), 1961; abs. *in* Chem. Abs., v. 58, col. 2290, 1963.

The chemical and mineralogical composition of the vanadium–bearing alum shale and the biogeochemical relations during sedimentation and diagenesis are discussed.

00064 **Aurola, Erkki.** (editor). The mines and quarries of Finland [in English]: Finland Geol. Tutkimus. Geotek. Julkaisuja, no. 55, 123 p., 1954.

A description of the vanadium–bearing titaniferous magnetite at Otanmäki is included.

00884 **Axelrod, J. M.** A field test for vanadium: U.S. Geol. Survey Bull. 950, p. 19–23, 1946.

Axelrod, J. M. *See* Fleischer, Michael. 01241

00065 **Bachmann, H. G.** Kristallchemische beziehungen zwishen natrulichen faser–polyvanadaten (hewettiten) und vanadiumbronzen [Crystal–chemical relations between natural fibrous polyvanadates (hewettites) and vanadium bronzes]: Beitr. Mineralogie u. Petrographie, v. 8, p. 210–214, 1962.

00066 **Bachmann, H. G.; Ahmed, F. R.; Barnes, W. H.** The crystal structure of vanadium pentoxide [in English]: Zeitschr. Kristallographie, v. 115, p. 110–131, 1961.

00067 **Bachmann, H. G.; Barnes, W. H.** The crystal structure of a sodium-calcium variety of metahewettite: Canadian Mineralogist, v. 7, pt. 2, p. 219–235, 1962.

00127 **Bachmann, H. G.** Beiträge zur Kristallchemie natürlicher und künstlicher Schwermetallvanadate, Pt. 1 [Contribution to the natural and artificial crystal chemistry of heavy metal vanadate, Pt. 1]: Neues Jahrb. Mineralogie Monatsh., 1953, p. 68–82, 1953 [1954]; abs. *in* Mineralog. Abs., v. 12, p. 282, 1955.

00128 **Bachmann, H. G.** Beiträge zur Kristallchemie natürlicher und künstlicher Schwermetallvanadate, Pt. 2 [Contribution to the natural and artificial crystal chemistry of heavy metal vanadate, Pt. 2]: Neues Jahrb. Mineralogie Monatsh., 1953, p. 193–208, 1953 [1954]; abs. *in* Mineralog. Abs., v. 12, p. 282, 1955.

00129 **Bachmann, H. G.** Beiträge zur Kristallchemie natürlicher und künstlicher Schwermetallvanadate, Pt. 3 [Contribution to the natural and artificial crystal chemistry of heavy metal vanadate, Pt. 3]: Neues Jahrb. Mineralogie Monatsh., 1953, p. 209–223, 1953 [1954]; abs. *in* Mineralog. Abs., v. 12, p. 332, 1955.

01215 **Back, A. B.; Chindgren, C. J.; Paterson, R. D.** Treatment of titaniferous magnetite ore from Iron Mountain, Wyoming: U.S. Bur. Mines Rept. Inv. 4902, 15 p., 1952.

Treatment tests described include the recovery of vanadium.

00068 **Badalov, S. T.** Vanadium-bearing tourmaline and garnet [in Russian]: Vses. Mineralog. Obshch., Zapiski, 2d ser., v. 80, p. 212–213, 1951.

00341 **Badalov, S. T.** Materialy k geokhimii vanadiya [Data on the geochemistry of vanadium]: Akad. Nauk Uzbek. SSR, Inst. Geologii, Trudy, no. 12, p. 65–73, 1956; abs. *in* Chem. Abs., v. 53, col. 11130, 1959.

Spectral analyses indicate the amount of vanadium assimilated by rock-forming minerals and by types of igneous rocks that intruded vanadium-bearing shale (black quartz-graphitic hornstone).

01228 **Badalov, S. T.; Zemlyanov, A. A.** Redkie i rasseyannye elementy svintsovo-tsinkovogo mestorozhdeniya Kumyshkan [Rare and dispersed elements of the lead-zinc deposits of Kumyshkan]: Akad. Nauk Uzbek. SSR Doklady, 1963, no. 5, p. 39–42, 1963.

Reports on the distribution of vanadium and other elements in the ore minerals.

00339 **Bader, Erich.** Vanadin in organogenen Sedimenten; I. Die Gründe der Vanadinanreicherung in organogenen Sedimenten [Vanadium in organic sediments; I. The causes of vanadium enrichment in organic sediments]: Zentralbl. Mineralogie, Geologie u. Paläontologie, Abt. A, p. 164–173, 1937; abs. *in* Chem. Abs., v. 31, col. 5389, 1937.

The vanadium content is related mainly to the presence of plant rather than animal remains.

00132 **Bado, A. A.** Presence of vanadium and arsenic in the subterranean waters of Bell-ville (Córdoba) [in Spanish]: Soc. Cient. Argentina Anales, v. 84, p. 284–296, 1917; *also in* Acad. Nac. Cienc. [Córdoba, Argentina] Bol., v. 23, pt. 1, p. 85–96, 1918; abs. *in* Chem. Abs., v. 12, p. 1324–1325, 1918.

Analyses of water samples from three wells show 4.8 ppm V_2O_5 in water from one well; water from the nearby river contained no detectable vanadium.

00133 **Bain, G. W.** Patterns to ores in layered rocks: Econ. Geology, v. 55, no. 4, p. 695–731, 1960.

Discusses geologic features of genetic significance in the vanadium-bearing alum shales of Sweden and the vanadium-uranium deposits in sandstone in the Colorado Plateau region.

00989 **Bain, G. W.** Geology of the fissionable materials: Econ. Geology, v. 45, p. 273–323, 1950.

Gives a general description and some resource information on uranium deposits, some of which contain vanadium.

Baker, B. L. *See* Hodgson, G. W. 01342

Balakishieva, B. A. *See* Sultanov, A. D. 00781

Bales, W. E. *See* Bell, Henry, 3d. 00123

00070 **Ballard, S. M.** Geology and gold resources of the Boise Basin, Boise County, Idaho: Idaho Bur. Mines and Geology Bull., no. 9, p. 38, 1924.

The occurrence of vanadate minerals at one locality is reported.

00080 **Balsley, J. R., Jr.** Vanadium-bearing magnetite-ilmenite deposits near Lake Sanford, Essex County, New York: U.S. Geol. Survey Bull. 940-D, p. 99–123, 1943.

Baltz, E. H., Jr. *See* Zeller, H. D. 00971

01216 **Bancroft, J. A.** Mining in Northern Rhodesia; a chronicle of mineral exploration and mining development : British South Africa Company (Sidney Press, Ltd., Bedford, England), 174 p., 1961.

Includes an account of the history and development of the lead-zinc-vanadium deposits at Broken Hill, with some production data.

Banerjee, M. K. *See* Chakravarty, Priyasankar. 00191

Banner, R. G. H. *See* Perrin, T. S. 00318

01232 **Banning, L. H.; Rasmussen, R. T. C.** Processes for recovering vanadium from western phosphates: U.S. Bur. Mines Rept. Inv. 4822, 44 p., 1951.

00071 **Bannister, F. A.** The identity of mottramite and psittacinite with cupriferous descloizite: Mineralog. Mag. [London], v. 23, p. 376–386, 1933.

00072 **Bannister, F. A.; Horne, J. E. T.** A radioactive mineral from Mozambique related to davidite: Mineralog. Mag. [London], v. 29, p. 101–112, 1950.

00073 **Baragwanath, J. G.** The vanadiferous asphaltites of central Peru: Eng. Mining Jour., v. 111, p. 778–781, 1921.

01217 **Bardill, J. B.** Ferroalloy metallurgy of Japan: U.S. Bur. Mines Mineral Trade Notes, Spec. Supp. no. 14, (*to* v. 24, no. 5), 40 p., 1947.

Information on vanadium-alloy production (1940–45) and deposits of vanadium-bearing magnetite (beach) sands is included.

00885 **Bardin, I. P.** (editor). Zhelezorudnaya baza chernoy metallurgii SSSR [The iron-ore base of the ferrous-metallurgy industry of the U.S.S.R.]: Moscow, Izd-vo Akademiya Nauk SSSR, Mezhvedomstvennaya Postoyanaya Komissiya po Zhelezu, 565 p., 1957; listed *in* Tech. Translations, v. 1, p. 261, 1959.

Includes data on vanadium content and reserves of some iron-ore deposits.

00074 **Bariand, Pierre.** Contribution à la minéralogie de l'Iran [Contribution to the mineralogy of Iran]: Soc. Francaise Minéralogie et Cristallographie Bull., v. 86, no. 1, p. 17–64, 1963.

Vanadate minerals are reported in the oxidized zones of some of the lead-zinc deposits described, the locations of which are shown on maps.

00075 **Bariand, Pierre; Chantret, Francis; Pouget, Robert; Rimsky, Alexandre.** Une nouvelle espèce minérale; la chervetite, pyrovanadate de plomb $Pb_2V_2O_7$ [A new mineral specie; chervetite, pyrovanadate of lead $Pb_2V_2O_7$]: Soc. Française Minéralogie et Cristallographie Bull., v. 86, no. 2, p. 117–120, 1963; abs. *in* Am. Mineralogist, v. 48, p. 1416, 1963.

Bariand, Pierre. *See* Branche, Georges. 00162

Barnes, W. H. *See* Ahmed, F. R. 00025

Barnes, W. H. *See* Bachmann, H. G. 00066

Barnes, W. H. *See* Bachmann, H. G. 00067

00076 **Barnes, W. H.** "Hewettite" and "metahewettite": Am. Mineralogist, v. 40, p. 689–691, 1955.

00113 **Barnes, W. H.; Qurashi, M. M.** Unit cell and space group data for certain vanadium minerals: Am. Mineralogist, v. 37, p. 407–422, 1952.

Barnes, W. H. *See* Donaldson, D. M. 00424

Barnes, W. H. *See* Qurashi, M. M. 00527

Barnes, W. H. *See* Qurashi, M. M. 00528

Barnes, W. H. *See* Qurashi, M. M. 00529

Barnes, W. H. *See* Qurashi, M. M. 00530

Barnes, W. H. *See* Kelsey, C. H. 00556

Barnes, W. H. *See* Trotter, James. 00806

Baron, M. *See* Fester, G. A. 00464

00335 **Barreiro, Luis.** Strategic ores (of Spain) [in Spanish]: Metalurgia y Electricidad, v. 6, no. 58, p. 31–34, 1942.

Includes mention of vanadium-bearing deposits.

Barshchevskaya, A. N. *See* Tarasenko, V. Z. 01028

Barshchevskaya, A. N. *See* Zazubin, A. I. 01174

00114 **Barthoux, J.** Mineraux de la région d'Oudjda (Maroc) [Minerals of the Oujda region (Morocco)]: Acad. Sci. [Paris] Comptes Rendus, v. 175, p. 312–314, 1922.

A description of vanadinite crystals and their occurrence in oxidized lead ore is included.

00115 **Barthoux, J.** Description de quelques Minéraux Marocains [Description of several Moroccan minerals]: Soc. Française Minéralogie et Cristallographie Bull., v. 47, p. 36–45, 1924.

Included are descriptions of varieties of vanadinite at two localities.

00116 **Barton, P. B., Jr.** Synthesis and properties of carnotite and its alkali analogues: Am. Mineralogist, v. 43, p. 799–817, 1958.

00117 **Barton, P. B., Jr.; Appleman, D. E.** Crystal chemistry of carnotite, *in* Advances in nuclear engineering: Engineers Joint Council, Proc. Nuclear Eng. and Sci. Conf., 2d, Philadelphia 1957, v. 2, p. 294–299, 1957.

00118 **Bassett, H.** A vanadiferous variety of tourmaline from Tanganyika: Tanganyika Geol. Survey Recs., v. 3 (1953), p. 93–96, 1956.

01233 **Bates, R. C.** An application of statistical analysis to exploration for uranium on the Colorado Plateau: Econ. Geology, v. 54, no. 3, p. 449–466, 1959.

Describes a statistical application of geologic factors in appraising ground favorable for uranium–vanadium deposits in sandstone.

Bates, T. F. *See* Leudeman, L. W. 00370

00119 **Baumann, I. H.** Patronit, VS_4, und die Mineral-Paragenese der bituminösen Schiefer von Minasragra, Peru [Patronite, VS_4, and the mineral paragenesis of bituminous shales of Minasragra, Peru]: Neues Jahrb. Mineralogie Abh., v. 101, no. 1, p. 97–108, 1964; abs. *in* Mineralog. Abs., v. 16, no. 7, p. 620, 1964.

00120 **Bayley, W. S.** Iron mines and mining in New Jersey: New Jersey State Geologist, Final Rept., v. 7, 512 p., 1910.

Includes some sample data on the vanadium content of the iron ores (about 0.08 percent V_2O_3).

00121 **Bayley, W. S.** The magnetic iron ores of east Tennessee and western North Carolina: Tennessee Div. Geology Bull. 29, 252 p., 1923; *see also* General features of the magnetite ores of western North Carolina and eastern Tennessee: U.S. Geol. Survey Bull. 735–G, p. 157–208 (1922).

Includes information on the vanadium content of some deposits.

00122 **Beath, O. A.; Hagner, A. F.; Gilbert, C. S.** Some rocks and soils of high selenium content: Wyoming Geol. Survey Bull. 36, p. 1–23, 1946.

A rough correlation in content of selenium and vanadium in siltstone is noted.

Beavis, G. *See* Monro, A. D. 00729

01218 **Beck, A. C.** Iron sands at Waitara, New Plymouth: New Zealand Jour. Sci. and Technology, v. 28, Sec. B, no. 6, p. 307–313, 1947.

Describes and appraises deposits of iron sands, which contain some vanadium.

Beisembaev, B. B. *See* Kunaev, A. M. 01238

00123 **Bell, Henry, 3d; Bales, W. E.** Uranium deposits in Fall River County, South Dakota: U.S. Geol. Survey Bull. 1009–G, p. 211–233, 1955.

Some vanadium occurs in the uranium deposits in sandstone.

00134 **Bell, K. G.** Uranium and other trace elements in petroleums and rock asphalts: U.S. Geol. Survey Prof. Paper 356–B, p. 45–65, 1960.

Analyses of 498 samples show vanadium is a major constituent among the trace elements in crude oils and natural asphalts.

Belyaeva, L. I. *See* Morachevskiy, Yu. V. 01138

00124 **Belyashov, N. M.** Main regular features of distribution of minor elements in magnetites from the Kacharsk deposit (The Turgai syncline) [in Russian]: Akad. Nauk Kazakh. SSR, Izv., Ser. Geol., 1963, no. 6, p. 43–56, 1963; abs. *in* Chem. Abs., v. 60, col. 9023, 1964.

The abundance and origin of vanadium and other metals in magnetite are discussed.

Belyayev, Yu. I. *See* Gerasimovskiy, V. I. 01119

Bennett, J. A. E. *See* Davidson, C. F, 00350

00125 **Benson, W. T.; Engel, A. L.; Heinen, H. J.** Titaniferous magnetite deposits, Los Angeles County, California: U.S. Bur. Mines Rept. Inv. 5962, 40 p., 1962.

The vanadium content of the lode and placer deposits is generally small, as shown by analyses of several samples.

00126 **Bergemann, C.** Untersuchung einiger Mineralien; Über den Dechenit [Examination of some minerals; dechenite]: Annalen der Physik, v. 80, p. 393–403, 1850.

00135 **Bergendahl, M. H.; Davis, R. E.; Izett, G. A.** Geology and mineral deposits of the Carlile quadrangle, Crook County, Wyoming: U.S. Geol. Survey Bull. 1082–J, p. 613–706, 1961.

A description of uranium–vanadium deposits in sandstone is included.

01128 **Berger, G. S.; Naumov, V. P.** Concentration of emulsion-impregnation ores of the type of Karatau vanadium-containing shales [in Russian]: Kazakh. Nauchn.—Issled. Inst. Mineral'n. Syr'ya, Trudy no. 7, p. 237–241, 1962; abs. *in* Chem. Abs., v. 61, col. 1542, 1964.

00336 **Bergman, G. G.** Vanadiy v nefteproduktakh i bituminoznykh porodakh [Vanadium in oil products and bituminous rocks]: Akad. Nauk SSSR Comptes Rendus (Doklady), nouv. sér., v. 29, no. 2, p. 108–111 [1940]; translated *from* Akad. Nauk SSSR Doklady, nov. ser., v. 29, no. 2, p. 111–114 [1940]; abs. *in* Chem. Abs., v. 35, col. 2823, 1941.

Bergman, G. G. *See* Vinogradov, A. P. 00841

Bergman, G. G. *See* Vinogradov, A. P. 01137

Berman, Harry. *See* Palache, Charles. 00622

Berman, Harry. *See* Palache, Charles. 00623

00136 **Bernazeaud, Jacques.** Premières données sur le gisement d'uranium de Mounana [Preliminary notes on the uranium deposit of Mounana (also in English)]: Chronique Mines d'outre mer et Recherche Minière, v. 27, no. 279, p. 311–314, 1959.

A deposit that contains an unusual assemblage of uranium and vanadium minerals is briefly described.

00137 **Beroni, E. P.; King, R. U.** The Mike Doyle carnotite deposit, El Paso County, Colorado: U.S. Geol. Survey TEM Rept. 133–A, 6 p., Atomic Energy Comm. Tech. Inf. Service, Oak Ridge, Tenn., 1950 [1952].

00138 **Berry, L. G.; Graham, A. R.** X-ray measurements on brackebuschite and hematolite: Am. Mineralogist, v. 33, p. 489–495, 1948.

00139 **Bertrand, Didier.** Sur la diffusion du vanadium dans la terre arable [Distribution of vanadium in soils]: Soc. Chim. France Bull., 5th ser., v. 9, p. 133–135, 1942; *also in* Chem. Zentralbl., 1942, v. 2, p. 1273, 1942; abs. *in* Chem. Abs., v. 37, col. 5539, 1943.

00140 **Bertrand, Didier.** Survey of contemporary knowledge of biogeochemistry. 2.—The biogeochemistry of vanadium: Am. Mus. Nat. History Bull., v. 94, p. 405–455, 1950; abs. *in* Mineralog. Abs., v. 11, p. 245, 1952.

00141 **Bertrand, Didier.** Le vanadium et le molybdène dans les Prochordés [Vanadium and molybdenum in the prochordates]: Acad. Sci. [Paris] Comptes Rendus, v. 240, p. 2356–2357, 1955.

00990 **Bertrand, Didier.** Distribution of V among the invertebrates and vertebrates [in French]: Soc. Chimie Biol. Bull., v. 25, p. 36–39, 1943; abs. *in* Chem. Abs., v. 38, col. 2125, 1944.

Bertuzzi, F. *See* Fester, G. A. 00221

Bertuzzi, F. *See* Fester, G. A. 00222

00081 **Berzelius, J. J.** Om den Vanadin och des egenskaper [On the characteristics of vanadium]: Svenska Vetenskapsakad. Handlingar, 3d ser. [v. 19], p. 1–65, 1831; also *in* Philos. Mag., new ser., v. 10, p. 321–337, 1831, *and* ibid., v. 11, p. 7–20, 1832; *and* Annalen der Physik u. Chemie, 2d ser., v. 22, p. 1–67, 1831.

This is one of the earliest published papers on vanadium. The type locality at Zimapan, Mexico, (for the element "erythronium") and the type locality at Jaberg, Sweden (for the element vanadium) are discussed. More than a dozen unnamed vanadium compounds are described.

00142 **Betekhtin, A. G.** The new mineral arsenosulvanite [in Russian with English summary]: Vses. Mineralog. Obshch., Zapiski, v. 70, p. 161–164, 1941; abs. *in* Am. Mineralogist, v. 40, p. 368–369, 1955.

00893 **Bezrukov, I. Ya.; Zolotavin, V. L.; Askerov, A. B.; Prokopchuk, V. V.** O sostave uranovanadievykh mineralov [On the composition of uranium–vanadium minerals]: Geokhimiya, 1965, no. 9, p. 1120–1129 (English summ. p. 1129), 1965; abs *in* Chem. Abs. v. 63, col. 16041, 1965; *see also* Geochemistry Internat., v. 2, no. 5, p. 828, 1965.

00143 **Bezrukov, P. L.** Sedimentation in the northwestern part of the Pacific Ocean [in English], *in* Submarine geology: Internat. Geol. Cong., 21st, Copenhagen 1960, Rept., v. 10, p. 39–49, 1960.

Summarizes data on deep-sea sediments, including the content of vanadium and other elements.

Bhatnagar, P. P. *See* Roy, Mrinal. 00327

Bhatnagar, P. P. *See* Srinivasan, S. R. 01024

00894 **Bhimasankaram, V. L. S.** Vanadiferous magnetite ores from Tiruvuru, Krishna district, *in* Symposium on mineral industries in Andhra Pradesh, 1962, Proceedings: Hyderabad, Andhra Pradesh Dept. Mines and Geology, p. 67–72, 1963.

Bhoray, S. S. *See* Srinivasan, S. R. 01024

01131 **Bidaut, Henri.** Note préliminaire sur un mode de formation possible des phosphates dinantiens des Pyrénées [A possible mode of origin of the dinantian phosphates of the Pyrenees], *in* Origine des gisements de phosphates de chaux: Internat. Geol. Cong., 19th, Algiers 1952, Comptes rendus, pt. 11, p. 185–190, 1953.

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00145 **Birdseye, H. S.** The relation of the Ambrosia Lake uranium deposits to a pre-existing oil pool, *in* Geology of southwestern San Juan basin: Four Corners Geol. Soc. Guidebook, 2d Field Conf. 1957, p. 26–29, 1957.

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00148 **Blake, James.** Roscoelite, a vanadium mica: Am. Jour. Sci., 3d ser., v. 12, p. 31–32, 1876.

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Block, Stanley. *See* Evans, H. T., Jr. 00458

00063 **Boardman, R. L.; Ekren, E. B.; Bowers, H. E.** Sedimentary features of upper sandstone lenses of the Salt Wash sandstone member and their relation to uranium–vanadium deposits in the Uravan district, Montrose County, Colo.: U.S. Geol. Survey Prof. Paper 300, p. 221–226, 1956.

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00151 **Bøgomolov, Yu.** Minerals in the Teterev River basin [in Russian]: Nauk.–Tekh. Visnik, no. 1, p. 35, 1936; abs. *in* Chem. Abs., v. 30, col. 8094, 1936.

Resources in the area include iron, titanium, vanadium, and nonmetallic minerals.

00152 **Bogvad, Richard; Nielsen, A. H.** Vanadinindholdet i en Raekke danske Bjergarter [The quantitative occurrence of vanadium in rocks of Denmark (with English summary p. 539)]: Dansk Geol. Foren. Medd., v. 10, no. 5, p. 532–540, 1945.

00153 **Bok, I. I.; Parshin, A. V.** Poleznye iskopaemye Kazakhstana [Mineral resources of Kazakhstan]: Alma-Ata Kazakh. SSR, Izdatel. Akad. Nauk Kazakh. SSR, Inst. Geol. Nauk, 52 p., 1961.

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00155 **Borchert, Hermann; Krejci-Graf, Karl.** Spurenmetalle in Sedimenten und ihren Derivaten [Trace metals in sediments and their derivatives (with English summ.)]: Bergbauwissenschaften, v. 6, p. 205–215, 1959; abs. *in* Chem. Abs., v. 56, col. 6954, 1962.

00156 **Borisenko, L. F.; Shcherbina, V. V.** Zakonomernosti raspredeleniya skandiya i vanadiya v izverzhennykh gornykh porodakh i slagayushchikh ikh mineralakh [Regularity of distribution of scandium and vanadium in minerals in igneous rocks], *in* Geokhimiya redkikh elementov v svyazi s problemoy petrogenezisa: Geokhim. Simpozium, Moscow 1957, Trudy, p. 9–19, 1959.

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01195 **Borisenko, L. F.** Malye elementy i voprosy genezisa giperbazitov Nizhnetagil'skogo massiva [Trace elements and the problem of the genesis of ultrabasic rocks of the Nizhnetagil'sk massif]: Geochemistry, 1961, no. 12, p. 1244–1254, 1961; translated *from* Geokhimiya, 1961, no. 12, p. 1115–1123, 1961.

Data are given on the range and average content of vanadium and other trace elements in samples from four massifs of dunite and pyroxenite and their geochemical significance is discussed.

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A brief description of vanadium-bearing titaniferous magnetite deposits is included.

00157 **Borovick, S. A.; Gotman, Ya. D.** Content of rare and other elements in the cassiterites of different genesis from USSR deposits according to spectrum analysis data [in English]: Akad. Nauk SSSR, Comptes Rendus (Doklady), nouv. sér., 1939, v. 23, no. 4, p. 351–354, 1939; abs. *in* Mineralog. Abs., v. 7, p. 439, 1938–1940.

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Botez-Postelnicu, Cornelia. *See* Savul, Micea. 00650

00158 **Botinelly, Theodore; Fischer, R. P.** Mineralogy and geology of the Rifle and Garfield mines, Garfield County, Colorado, *in* Geochemistry and mineralogy of the Colorado Plateau uranium ores: U.S. Geol. Survey Prof. Paper 320, p. 213–218, 1959.

Vanadium–uranium deposits in sandstone are described.

00159 **Botinelly, Theodore; Weeks, A. D.** Mineralogic classification of uranium–vanadium deposits of the Colorado Plateau: U.S. Geol. Survey Bull. 1074–A, p. 1–5, 1957.

Botinelly, Theodore. *See* Elston, D. P. 00449

Bowers, H. E. *See* Boardman, R. L. 00063

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00888 **Bowers, H. E.; Shawe, D. R.** Heavy minerals as guides to uranium–vanadium ore deposits in the Slick Rock district, Colorado: U.S. Geol. Survey Bull. 1107–B, p. 169–218, 1961 [1962].

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Oxidized uranium ore in the Miracle mine contains a U:V ratio of 4:1 but in the nearby Kergon mine the vanadium content of the uranium ore is negligible.

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Argentina] Bol., v. 5, p. 441–524, 1883; abs. *in* Neues Jahrb. Mineralogie, Geologie u. Paläontologie, 1885, v. 1, Ref. p. 204–206, 1885.

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00164 **Brandenstein, M.; Janda, I.; Schroll, Erich.** Seltene Elemente in österreichischen Kohlen- und Bitumengesteinen [Rare elements in Austrian coal and bituminous rock]: Tschermaks Mineralog. u. Petrog. Mitt., 3d ser., v. 7, no. 3, p. 260–285, 1960.

Tabulates the content of vanadium and other trace elements in ash and air-dried material of 119 samples of coal and bitumen.

Brandt, J. W. *See* Willemse, J. 00934

Brannock, W. W. *See* Wells, R. C. 00872

00338 **Brassens, Alain.** Note sur le gisement d'uranium dans les sables oligocènes de Saint-Pierre (Cantal) [The uranium deposit in the Oligocene sands of Saint-Pierre (Cantal)]: Soc. Géol. France Bull., 7th ser., v. 4, p. 602–606, 1962.

The occurrence of the uranium-vanadium mineral francevillite in sandstone is described.

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Breitenstein, J. S. *See* Cole, S. S. 00090

00166 **Breithaupt, J. F. A.** Mineralogische Studien. 1.—Fauserit (Salz. Sulfat). 2.—Fritzscheit und Uranite überhaupt [Mineralogical study. 1.—Fauserite. 2. Fritzscheite and uranite]: Berg- u. Hüttenm. Zeitg., v. 24, no. 36, p. 302–303, 1865; abs. *in* Neues Jahrb. Mineralogie, Geologie u. Paläontologie, 1865, p. 743, 1865.

Brennan, D. J. *See* Galbraith, F. W. 01257

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The distribution, stratigraphy, paleogeography, and origin of these shales and their metal and carbonaceous content are described; the shales contain more than average amounts of vanadium, copper, chromium, molybdenum, nickel, and cobalt.

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Huemul deposit, Mendoza Province (with English summary)]: Asoc. Geol. Argentina, Rev. v. 21, no. 3, p. 165–179, 1966.

Brokaw, A. L. *See* Albritton, C. C., Jr. 00027

Bromfield, C. S. *See* Bush, A. L. 00174

Brooks, D. B. *See* Hawley, C. C. 00920

Brotzen, Otto. *See* Byström, Anders. 00337

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A brief description is included of vanadium occurrences and potential resources in India.

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A brief note on the production of vanadate minerals from the Eldorado mine, Riverside County is included.

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Includes information on the occurrence of a previously described base-metal vanadate and introduces the name "collieite" for it.

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The analyses of the high content of vanadium (38–45 percent) in ash of crude oil from Maracaibo, Venezuela, is reported.

00083 **Bruÿn, Kathleen.** Uranium country: Boulder, Colo., Univ. of Colorado Press, 165 p., 1955.

A historical account of the development of the uranium-vanadium mining industry in the Colorado Plateau region.

00170 **Bubenicek, Louis.** Recherches sur la constitution et la répartition du minerai de fer dans l'Aalénien de Lorraine [Investigation of the composition and distribution of iron ore in l'Aalénien de Lorraine]: Sci. Terre, v. 8, no. 1–2, p. 5–204, 1961.

This is a detailed study of the stratigraphy, sedimentation, mineralogy and geochemistry of the Lorraine (Minette) iron ores. The vanadium content (average about 0.06 percent V) is indicated by analyses.

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Includes descriptions of vanadium-bearing deposits.

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00172 **Burwell, Blair.** Mining methods and costs at the vanadium mine of the United States Vanadium Corp., Rifle, Colorado: U.S. Bur. Mines Inf. Circ. 6662, 10 p., 1932.

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00174 **Bush, A. L.; Bromfield, C. S.; Pierson, C. T.** Areal geology of the Placerville quadrangle, San Miguel County, Colorado: U.S. Geol. Survey Bull. 1072-E, p. 299–384, 1959.

A description of the vanadium deposits in sandstone is given.

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A description of the vanadium deposits in sandstone in part of the Placerville area is included in this report.

01110 **Bush, A. L.** Vanadium–uranium deposits in the Entrada Sandstone, western San Juan Mountains, Colorado [abs.]: Geol. Soc. America Bull., v. 67, p. 1678, 1956.

01111 **Bush, A. L.; Stager, H. K.** Accuracy of ore-reserves estimates for uranium–vanadium deposits on the Colorado Plateau: U.S. Geol. Survey Bull. 1030-D, p. 131–148, 1956.

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Brief descriptions are included for vanadium–uranium deposits in sandstone and occurrences of base–metal vanadate minerals.

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A description is included of the occurrences of base–metal vanadates.

Butler, G. M. *See* Allen, M. A. 00034

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A brief description and a partial resource appraisal is included of the vanadium–bearing shale beds associated with phosphate rock.

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A description is included of the occurrence of base–metal vanadates and carnotite.

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00337 **Byström, Anders; Wilhelmi, Karl-Axel; Brotzen, Otto.** Vanadium-pentoxide—a compound with fine-coordinated vanadium atom: Acta Chem. Scandinavica, v. 4, p. 1119–1130, 1950.

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The graphite deposits of Alabama and their geology, but not the occurrence of vanadium in them, are described.

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Campbell, R. H. *See* Lewis, R. Q., Sr. 00373

Campbell, R. M. *See* McKelvey, V. E. 00402

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The geology of the world's vanadium deposits and the uses and marketing of vanadium is summarized.

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Includes discussion of geochemical relations of vanadium to iron in titaniferous magnetite deposits.

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01202 **Carstens, Harald.** Investigations of titaniferous iron ore deposits—Pt. II, Gabbro, anorthosite, and titaniferous iron ore on Flakstadøy in Lofoten, northern Norway: Norsk Videnskab. Selskab Skr. 1957, no. 4, 24 p., 1957; abs. *in* Geol. Soc. America Bibliography and Index of Geology Exclusive of North America, v. 23, p. 82, 1960.

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Chantret, Francis. *See* Bariand, Pierre. 00075

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Chantret, Francis. *See* Branche, Georges. 00163

00193 **Charola, F.** Analisis espectográfico del agua de consumo de Bell Ville. Método de dosificacion de vanadio [Spectrographic analysis of drinking water from Bell Ville. Method of determination of vanadium]: Asoc. Quím. Argentina, Anales, v. 27, p. 35–40, 1939.

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Includes information on the occurrences of vanadium and other minor metals.

01114 **Charrin, Victor.** Le vanadium en France [Vanadium in France]: Génie Civil, v. 124, no. 10, p. 199, 1947.

Relates to the vanadium resources in sedimentary iron ores in Burgundy, France.

01165 **Charrin, Victor.** Le vanadium, ses minerais et ses gisements [Vanadium, its minerals and its occurrence]: Génie Civil, v. 133, no. 21, p. 398–401, 1956.

Briefly describes common vanadium minerals and their occurrence and indicates the vanadium potential of iron ores, clays, and phosphatic limestone in France.

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00876 **Chatterjee, P. K.; Chowdhury, A. N.; Ghosh, R. B.** Indian raw materials for ferro-alloys industry: Indian Minerals, v. 13, no. 3, p. 293–298, 1959.

00194 **Chatterjee, S. K.** On a green mica from the Bhandara district, C. P.: India Geol. Survey Recs., v. 65, p. 536–539, 1932.

The green mica contains chromium and vanadium.

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Chêng, Chien. *See* Chên, Chin. 00195

00196 **Chenoweth, W. L.** The geology and the uranium deposits of the northwest Carrizo area, Apache County, Arizona, *in* Geology of parts of Paradox, Black Mesa, and San Juan Basins: Four Corners Geol. Soc. Guidebook, [1st] Field Conf. 1955, p. 177–185, 1955.

The uranium deposits described also contain recoverable amounts of vanadium.

00994 **Chentsov, I. G.** The problems of the mineralogy and geochemistry of certain sedimentary uranium ore occurrences [English translation]: Akad. Nauk SSSR, Inst. Geologii Rudnykh Mestorozhdeniy, Petrografi, Mineralogii i Geokhimü, trans. no. 28, p. 65–124, 1962; translated *from* . . .Trudy no. 28, p. 43–82, 1959; abs. *in* Mineralog. Abs., v. 15, p. 192, 1962.

A detailed study of uranium, vanadium, and other metals in carbonaceous carbonate sedimentary rocks, including the migration of the metals and their concentration to form ore deposits.

00197 **Chernik, G. P.** Analizy urano–vanadievykh rud Tyuya–Muyunskogo mestorozhdeniya Ferganskoy oblasti [Analyses of the urano–vanadic ores from Tyuya–Muyun deposit in Fergana]: Ross. Akad. Nauk, Izv., 6th ser., v. 16, p. 505–514, 1922.

00198 **Chernyak, A. S.** O vanadievom syr'e dlya proizvodstva legirovannykh staley i chugunov v Vostochnoy Sibiri [On vanadium raw materials for production of steel alloys and cast iron in Eastern Siberia]: Akad. Nauk SSSR Sibirskoye Otdeleniya, Izv., no. 7, p. 120–121, 1959.

Briefly describes the occurrence of roscoelite and secondary vanadate minerals in carbonaceous (graphitic) beds in clastic sediments in eastern Siberia and the metallurgical process used in recovering vanadium.

00199 **Chew, R. T., 3d.** (compiler). Uranium and vanadium deposits of the Colorado Plateau that produced more than 1,000 tons of ore through June 30, 1955: U.S. Geol. Survey Mineral Inv. Field Studies Map MF 54, 1956.

Chindgren, C. J. *See* Back, A. B. 01215

01193 **Chirvinsky, P. N.** Tyuyamunite from the Tyuya–Muyun radium mine in Fergana: Mineralog. Mag. [London], v. 20, p. 287–295, 1925.

Describes the geology and origin of the uranium–vanadium deposits and gives analyses of the ore.

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Choubert, G. *See* Lebedeff, V. 00363

Chowdhury, A. N. *See* Chatterjee, P. K. 00876

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Cisney, E. A. *See* Weeks, A. D. 00861

Cisney, E. A. *See* Weeks, A. D. 00862

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The geology of the copper–lead–vanadium deposits and the origin of the vanadium are described.

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00202 **Clarke, F. W.** The data of geochemistry: U.S. Geol. Survey Bull. 770, 841 p., 1924.

00203 **Clarke, F. W.; Washington, H. S.** The composition of the earth's crust: U.S. Geol. Survey Prof. Paper 127, 112 p., 1924.

00204 **Claussen, G. E.** Spectroscopic analysis of certain galenas, spalerites, and pyrites: Am. Mineralogist, v. 19, p. 221–224, 1934.

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00205 **Clifford, J. O.** Vanadium in New Mexico; Caballos Mountains deposits: Mining World [Chicago], v. 35, p. 857–858, 1911.

Clinton, N. J. *See* Carithers, L. W. 01194

00899 **Coertze, F. J.; Schuman, F. W.** The basic portion and associated minerals of the Bushveld igneous complex north of Pilanesberg: South African Geol. Survey Bull. 38, 48 p., 1962.

Data on the vanadium content of magnetite layers and pipes are given and their modes of emplacement are described.

00877 **Coetzee, C. B.** Ilmeniethoudende sand langs die weskus in die distrik Vanrhynsdorp [Ilmenite-bearing sand along the west coast in the Vanrhynsdorp district (with English summ.)]: South Africa Geol. Survey, Geol. ser., Bull. 25, p. 1–17, 1957.

Describes and appraises deposits of beach sands containing moderate amounts of ilmenite; ilmenite concentrates average 0.9 percent V_2O_5.

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00208 **Colombo, Umberto; Sironi, Giuseppe.** Geochemical analysis of Italian oils and asphalts: Geochim. et Cosmochim. Acta, v. 25, no. 1, p. 24–51, 1961.

Determinations are tabulated for vanadium, chromium, molybdenum, manganese, and nickel in 39 fractionated samples.

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Brief descriptions of vanadium occurrences in Australia are included.

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The occurrence and origin of the uranium- and vanadium-bearing seams and nodules of kolm in the alum shale are described. The shale also contains uranium and vanadium, but in lesser quantity.

00350 **Davidson, C. F.; Bennett, J. A. E.** The uranium deposits of the Tete district, Mozambique: Mineralog. Mag. [London], v. 29, no. 211, p. 291–303, 1950.

Describes deposits of davidite, which commonly contains accessory vanadium.

00351 **Davidson, D. F.** Selenium in some oxidized sandstone-type uranium deposits: U.S. Geol. Survey Bull. 1162-C, p. C1–C33, 1963.

Includes data on the amount and occurrence of vanadium in many of the deposits described.

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Shales from several formations and sampled at various localities show appreciable amounts of vanadium and other metals.

00353 **Davidson, D. F.; Lakin, H. W.** Metalliferous shales in the United States [abs.], *in* Program 1961 annual meeting, San Diego, Calif.: Geo. Soc. America, Spec. Papers no. 68, Abstracts for 1961, p. 18, 1961.

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00355 **Davidson, D. F.; Smart, R. A.; Peirce, H. W.; Weiser, J. D.** Stratigraphic sections of the Phosphoria formation in Idaho, 1949—Pt. 2: U.S. Geol. Survey Circ. 305, 28 p., 1953.

Some data on the vanadium content of phosphate rock and shale are included in this report.

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Davis, R. E. *See* Bergendahl, M. H. 00135

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Data on the occurrence of vanadium in the deposits of the Strawberry Hill quadrangle, Wyo. are included.

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The content of vanadium and other metals in the Kupferschiefer of central Germany, the Lias Shale of northern Germany, the alum shale of Sweden, and the Marl Slate of England is shown in a table, and the similar characteristics of these host rocks and the metals they contain are described in the text.

01000 **Deans, T.** Vanadium in iron ores consumed by the British iron and steel industry: Great Britain Imp. Inst. Bull., v. 46, p. 104–110, [1948], 1949.

01201 **Deans, T.** The mineral resources of Northern Rhodesia: Great Britain Imp. Inst. Bull., v. 40, no. 4, p. 295–306, 1942.

Includes a brief description of the lead-zinc-vanadium deposits in the Broken Hill and Lusaka districts, with some production data

00407 **Degens, E. T.; Williams, E. G.; Keith, M. L.** Environmental studies of carboniferous sediments. I—Geochemical criteria for differentiating marine from fresh-water shales: Am. Assoc. Petroleum Geologists Bull. v. 41, p. 2427–2455, 1957.

Reports the content of vanadium and other trace metals in samples of shale and organic fractions of these samples; vanadium and nickel are the best indicators of marine sediments.

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Includes some data on vanadium content of phosphate rock and shale.

00411 **Del Rio, S. M.** (editor). Mineral resources of Colorado; first sequel: Denver, Publishers Press, Colorado Mineral Resources Board, 764 p., 1960.

A discussion of some vanadium deposits and occurrences is included.

00410 **Del Vo, A. J. C.; Davids, N. C.** The uraniferous concentrations of Chihuido del Medio, Department Anelo (Neuquén Province) [in Spanish], *in* Yacimientos minerales: Jornadas Geol. Argentinas, Anales, 1st, San Juan 1960, v. 3, p. 91–102, 1962; abs. *in* Chem. Abs., v. 58, col. 6587, 1963.

The uranium–vanadium–copper deposits in sandstone are described.

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00413 **Demarcay, Eug.** Sur la presénce dans les végétaux du vanadium, du molybdéne et du chrome [On the presence in plants of vanadium, molybdenum, and chromium]: Acad. Sci. [Paris] Comptes Rendus, v. 130, p. 91–92, 1900.

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00095 **Dickson, R. E.; Blair, R. G.; Hart, H. R.; Sharp, J. V. A.; Thompson, C. D.** Drilling results and favorability criteria in Bull Canyon, Montrose and San Miguel Counties, Colorado: U.S. Atomic Energy Comm. RME-42, pt. 1, 67 p., 1955.

Relates to uranium–vanadium deposits in sandstone.

00417 **Diefenbach, A.** Mineralogical and chemical investigation of descloizite and mottramite from Otavibergland, South West Africa [in German]: Zeitschr. Kristallographie, v. 74, p. 155–188, 1930; abs. *in* Mineralog. Abs., v. 4 (Mar. 1929–Sept. 1931), p. 382–383, 1931.

00418 **Diemer, R. A.** Titaniferous magnetite deposits of the Laramie Range, Wyoming: Wyoming Geol. Survey Bull. 31, 23 p., 1941.

00419 **Dieseldorff, A.** Sulvanit, ein primäres Vanadinmineral [Sulvanite, a primary vanadium mineral]: Zeitschr. Prakt. Geologie, v. 9, p. 421–422, 1901.

01072 **Dimmick, T. D.** Mineral resources of Australia; Minor metals (caesium, calcium, germanium, indium, selenium, strontium, tellurium, vanadium, yttrium): Australia Bur. Mineral Resources, Geology and Geophysics, Summ. Rept. 35, 35 p., 1949.

Includes a section on vanadium that gives the reported occurrence of vanadium-bearing minerals and rocks in Australia.

Dinnin, J. I. *See* MacMillan, R. T. 00303

01188 **Ditte, A.** Sur la formation dans la nature des minerais de vanadium [On the natural formation of vanadium minerals]: Acad. Sci. [Paris] Comptes Rendus, v. 138, p. 1303–1308, 1904.

Suggests an origin for vanadate deposits.

00420 **Dittler, E.; Hueber, H.** Mottramit aus Bolivien [Mottramite from Bolivia]: Mineralog. u. Petrog. Mitt., v. 41, p. 173–179, 1931.

00421 **Dobrovol'skiy, V. V.** Landshaftno-geokhimicheskie osobennosti Kol'skogo poluostova i ikh znachenie dlya poiskovykh rabot [Topographic-geochemical characteristics of the Kola Peninsula and their significance in exploration work]: Sovetskaya Geologiya, 1964, no. 3, p. 81–93, 1964.

A study of trace elements in rocks, soils, and plant ashes to facilitate geochemical exploration; vanadium probably is not as useful in exploration as some other elements.

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00422 **Dodd, P. H.** Examples of uranium deposits in the Upper Jurassic Morrison formation on the Colorado Plateau, *in* Geology of uranium and thorium: New York, United Nations, Internat. Conf. Peaceful Uses Atomic Energy Proc., Aug. 8–20, 1955, v. 6, p. 615–633, 1956; revised *in* U.S. Geol. Survey Prof. Paper 300, p. 213–219, 1956.

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00902 **Doetsch Sundheim, J.** El vanadio y sus minerales [Vanadium and its minerals]: Spain, Inst. Geol. Minero, Notas y Comun. no. 77, pt. 1, p. 207–216, 1965.

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00079 **Domeyko, Ignacio.** Notice sur le plomb vanadate et la vanadate double de plomb et de cuivre du Chile [Note on the lead vanadate and the double vanadate of lead and copper from Chile]: Annales Mines, 4th ser., v. 14, p. 145–151, 1848.

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00425 **Donnay, Gabrielle; Donnay, J. D. H.** Tyuyamunite, carnotite, and sengierite [abs.]: Geol. Soc. America Bull., v. 64, p. 1412–1413, 1953; also *in* Am. Mineralogist, v. 39, p. 323–324, 1954.

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00426 **Donovan, W.** The distribution of titanium, phosphorus, and vanadium in Taranaki ironsand: New Zealand Inst. Trans., v. 48, p. 503–507, 1916.

00878 **Dow, V. T.** Magnetite and ilmenite resources, Iron Mountain area, Albany County, Wyoming: U.S. Bur. Mines Inf. Circ. 8037, 133 p., 1961.

Describes and appraises the vanadium-bearing titaniferous magnetite deposits.

00427 **Drysdall, A. R.** Graphite of the Petauke district, Eastern Province: Northern Rhodesia Geol. Survey Rept. 14, p. 1–28, 1960.

Data on vanadium and other metals in graphite and its metasedimentary host rock are included.

00437 **Du Toit, A. L.** The geology of South Africa [3d ed. prepared by S. H. Haughton]: New York, Hafner Publishing Co., 611 p., 1953.

Descriptions of vanadium-bearing iron ores in the Republic of South Africa and deposits of base-metal vanadates in South-West Africa are included.

Dubinkina, R. P. *See* Kul'tiasov, S. V. 00590

00428 **Dűenas, E. I.** Reconocimiento geológico-minero de la cuenca carbonera septentrional Lima-Junín (hoyas de Oyón, Checras y Pasco) [Mining-geological examination of the coal basin of the northern Lima-Junín area (valleys of the Oyón, Checras and Pasco)]: Perú, Cuerpo Ingenieros de Minas Bol. 97, 292 p., 1919.

A description of the vanadium-bearing asphaltite deposit at Mina Ragra is included.

00429 **Duncan, D. C.** (compiler). Reconnaissance investigations for uranium in black shale deposits of the western States during 1951 and 1952: U.S. Geol. Survey TEI Rept. 381, 89 p., 1953; issued by U.S. Atomic Energy Comm. Tech. Inf. Service, Oak Ridge, Tenn.

Includes data on the vanadium content of some shales.

00430 **Dunham, C. K.** The geology of the Organ Mountains, with an account of the geology and mineral resources of Dona Ana County, New Mexico: New Mexico Bur. Mines and Mineral Resources Bull. 11, 272 p., 1935.

Includes mention of a base-metal vanadate in oxidized ore in the Bear Canyon district.

01122 **Dunn, H. E.; Edlund, D. L.** Vanadium, *in* Rare metals handbook, 2d ed.: New York, Reinhold Publishing Corp., p. 629–652, 1961.

00431 **Dunn, J. A.** The mineral deposits of eastern Singhbhum and surrounding areas: India Geol. Survey Mem., v. 69, pt. 1, 279 p., 1937.

A description is given of titaniferous magnetite deposits, which are unusually rich in vanadium and in which the vanadium-iron mineral "coulsonite" was found.

00432 **Dunn, J. A.** The economic geology and mineral resources of Bihar province: India Geol. Survey Mem., v. 78, 238 p., 1942.

Describes geology and mineral resources, including vanadium-bearing titaniferous magnetite deposits and occurrences of vanadium-bearing green mica in sandstone.

00433 **Dunn, J. A.; Dey, A. K.** Vanadium-bearing titaniferous iron-ores in Singhbhum and Mayurbhanj, India: Mining Geol. Inst. India Trans., v. 31, pt. 3, p. 119–184; discussion, ibid., p. 184–194, 1937; abs. *in* Annot. Bibliography Econ. Geology, v. 10, p. 36, 1937.

Dunning, H. N. *See* Champlin, J. B. F. 00192

Durand, Georges. *See* Longchambon, Louis. 00384

00434 **Durand, Georges.** Sur la synthèse de la vanadinite [On the synthesis of vanadinite]: Acad. Sci. [Paris] Comptes Rendus, v. 244, p. 2621–2622, 1957.

00435 **Durand, Georges.** Contribution à l'étude du gîte de vanadinite d'Hérival (Vosges) [Contribution to the study of the occurrence of vanadinite in the Hérival [district] (Vosges)]: Soc. Française Minéralogie et Cristallographie Bull. 81, no. 1–3, p. 61–63, 1958; abs. *in* Annot. Bibliography Econ. Geology, v. 32, p. 52, 1959.

Dürr, Fritz. *See* Stoiber, R. E. 00770

00436 **Durum, W. H.; Haffty, Joseph.** Occurrence of minor elements in water: U.S. Geol. Survey Circ. 445, 11 p., 1961.

Vanadium occurs in small amounts (2–7 ppb) in some samples and is below the limit of detection in many samples.

00438 **Dvortsova, K. I.** Kembriyskie fosforitonosnye otlozheniya v gorakh Kandyktas (Yuzhnyy Kazakhstan) [Cambrian phosphorite-bearing deposits in the Kandyktas Mountains (South Kazakhstan)]: Akad. Nauk SSSR, Comptes Rendus (Doklady), nouv. sér., v. 123, p. 907–909, 1958; abs. *in* Chem. Abs., v. 55, col. 17390, 1961.

The phosphorite contains 0.1–1 percent vanadium.

00439 **Dybdahl, Ivar.** Ilmenite deposits of the Egersund anorthosite complex, *in* Mines in south and central Norway: Internat. Geol. Cong., 21st, Copenhagen 1960, Guide to Excursion no. C–10, p. 48–53, 1960.

Includes data on the vanadium content of two deposits of titaniferous magnetite.

00998 **Dymkin, A. M.; Vasil'eva, A. I.** The distribution of admixture elements in the principal ore minerals of the Aleshin magnetite deposit (Turgay syncline) [in Russian]: Geologiya i Geofizika, no. 8, p. 75–81, 1961; abs. *in* Chem. Abs., v. 56, col. 191, 1962.

The amount of vanadium, titanium, magnesium, and manganese in magnetite is related to temperature of crystallization.

Dymkov, Yu. M. *See* Brodin, B. V. 00168

00440 **Eargle, D. H.; Weeks, A. D.** Uranium-bearing clays and tuffs of south-central Texas: Texas Univ., Bur. Econ. Geology, Guidebook no. 3, p. 19–30, 1961.

A general description of the lithology, diagenesis, and alteration by weathering of the rocks that might have yielded the uranium and small amounts of vanadium in the uranium ores in the region.

00441 **Eargle, D. H.** Some uranium occurrences in west Texas: Texas Univ., Bur. Econ. Geology, Rept. Inv. 27, 23 p., 1956.

Describes occurrences of uranium-vanadium minerals that form thin, spotty coatings on carbonate rocks at the outcrop.

00442 **Eargle, D. H.; Snider, J. J.** A preliminary report on the stratigraphy of the uranium-bearing rocks of the Karnes County area, south-central Texas: Texas Univ., Bur. Econ. Geology, Rept. Inv., no. 30, 30 p., 1957.

00443 **Eckel, E. B.** Geology and ore deposits of the La Plata district, Colorado: U.S. Geol. Survey Prof. Paper 219, 179 p., 1949.

Includes a brief description of the occurrence of the vanadium-bearing mica, roscoelite, associated with gold-tellurium deposits.

00444 **Eckel, E. B.** Minerals of Colorado—A 100-year record: U.S. Geol. Survey Bull. 1114, 399 p., 1961.

Lists vanadium-bearing minerals and gives localities of occurrence.

Edlund, D. L. *See* Dunn, H. E. 01122

00879 **Edwards, W. F.** Some notes on vanadium: Colorado Sci. Soc. Proc., v. 7, p. 297–312, 1904.

00445 **Efendiev, G. Kh.; Rza-Zade, P. F.** Soderzhanie vanadiya v bitumakh i bituminoznykh porodakh Apsherona [Vanadium content of bitumens and bituminous rocks of Apsheron]: Akad. Nauk Azerbaydzhan. SSR Doklady, v. 9, no. 5, p. 283–286, 1953; abs. *in* Chem. Abs., v. 49, col. 2055, 1955.

Suggests the low vanadium content of these materials is due to a low vanadium content of the parent crude oil and the conditions under which the source beds accumulated.

01136 **Efendiev, G. Kh.; Alekperova, A. A.** Geokhimiya vanadiya v svyazi s ego rasprostraneniem v Azerbaydzhanskoy SSR [Geochemistry of vanadium in connection with its distribution in Azerbaydshan SSR], *in* Geokhimiya redkikh elementov: Baka, Akademiya Nauk Azerbaydzhan. SSR, Inst. Neorganicheskoy i Fizicheskoy Khimii, p. 80–95, 1966; abs. *in* Chem. Abs. v. 68, abs. no. 31997p, 1968.

00447 **Eichhoff, H. J.; Reineck, H. E.** Uran-Vanadinkerne mit Verfärbungshöfen in Gesteinen [Uranium–vanadium grains with discoloration halos in rocks]: Neues Jahrb. Mineralogie, Monatsh. 1952, p. 294–314, 1953; abs. *in* Mineralog. Abs., v. 12, p. 162, 1955.

Ekren, E. B. *See* Boardman, R. L. 00063

00903 **Ekren, E. B.; Houser, F. N.** Geology and petrology of the Ute Mountain area, Colorado: U.S. Geol. Survey Prof. Paper 481, 74 p., 1965.

00450 **El Wakeel, S. K.; Riley, J. P.** Chemical and mineralogical studies of deep-sea sediments: Geochim. et Cosmochim. Acta, v. 25, p. 110–146, 1961.

Gives content of vanadium and other trace elements in 34 samples and major constituents in these and additional samples, and discusses significant relations of vanadium and other elements.

00448 **El-Hinnawi, E. E.** Mineralogical and geochemical studies on Egyptian (U.A.R.) black sands: Beitr. Mineralogie u. Petrographie, v. 9, p. 519–532, 1964.

Data on the vanadium content of the various heavy mineral concentrates are included.

00446 **Ellsworth, H. V.; Gunning, H. C.** An occurrence of vanadium-bearing rock on Quadra Island, British Columbia: Canada Geol. Survey Summ. Rept. 1932, pt. A2, p. 51–56, 1933.

Elston, D. P. *See* Lindberg, M. L. 00378

00449 **Elston, D. P.; Botinelly, Theodore.** Geology and mineralogy of the J. J. mine, Montrose County, Colorado, *in* Geochemistry and mineralogy of the Colorado Plateau uranium ores: U.S. Geol. Survey Prof. Paper 320, p. 203–211, 1959.

A description of a uranium–vanadium deposit in sandstone is given.

Elston, D. P. *See* Newman, W. L. 00479

Engel, A. L. *See* Benson, W. T. 00125

00880 **Engineering and Mining Journal.** Vanadium recovery at Rhodesian Broken Hill: Eng. Mining Jour., v. 131, no. 6, p. 259, 1931.

Includes a brief description of the occurrence of the zinc–lead–vanadium ore.

00904 **Engineering and Mining Journal.** Tar sand mining—start of a new era: Eng. Mining Jour., v. 168, no. 12, p. 65–71, 1967.

00451 **Erickson, R. L.; Blade, L. V.** Geochemistry and petrology of the alkalic igneous complex at Magnet Cove, Arkansas: U.S. Geol. Survey Prof. Paper 425, 95 p., 1963.

Data on vanadium associated with titanium minerals are included.

00452 **Erickson, R. L.; Myers, A. T.; Horr, C. A.** Association of uranium and other metals with crude oil, asphalt, and petroliferous rocks: Am. Assoc. Petroleum Geologist Bull., v. 38, no. 10, p. 2200–2218, 1954.

The content of vanadium and other trace elements in ash from samples of hydrocarbons are given and the significant geochemical relations are discussed.

01168 **Ermolaev, N. P.** Vanadievye mineraly v uransoderzhashchikh gidrotermal'nykh zhilakh rudnykh gor [Vanadium minerals in the Erzgebirge uranium-containing hydrothermal veins], *in* Voprosy prikladnoy radiogeologii, v. 2: Moscow, Atomizdat, p. 248–262, 1967; abs. *in* Chem. Abs., v. 68, abs. no. 61650n, 1968.

00453 **Etchart, L. M.; Olsen, H.; Saccone, E. R.; Schiano, E.** Sierra Cuadrada, su geologia y aspectos de la mineralizacion uranifera [Geology and uranium mineralization of Sierra Cuadrada]: Jornadas Geol. Argentinas, Anales, 1st, San Juan 1960, v. 3, p. 113–124, 1962.

Vanadium-bearing minerals occur in these deposits, which are in sedimentary rocks containing silicified organic matter.

Evans, H. T., Jr. *See* Appleman, D. E. 00056

00454 **Evans, H. T., Jr.; Garrels, R. M.** Thermodynamic equilibria of vanadium in aqueous systems as applied to the interpretation of the Colorado Plateau ore deposits: Geochim. et Cosmochim. Acta, v. 15, nos. 1–2, p. 131–149, 1958.

00455 **Evans, H. T., Jr.** Recent developments in the crystal chemistry of vanadium oxide minerals, *in* Short papers in the geological sciences: U.S. Geol. Survey Prof. Paper 400-B, p. B443–B446, 1960.

00456 **Evans, H. T., Jr.** The crystal chemistry and mineralogy of vanadium, *in* Geochemistry and mineralogy of the Colorado Plateau uranium ores: U.S. Geol. Survey Prof. Paper 320, p. 91–102, 1959.

00457 **Evans, H. T., Jr.** Crystal structure refinement and vanadium bonding in the metavanadates KVO_3, NH_4VO_3 and $KVO_3 \cdot H_2O$: Zeitschr. Kristallographie, v. 114, p. 257–277, 1960.

00458 **Evans, H. T., Jr.; Block, Stanley.** The crystal structure of montroseite, a vanadium member of the diaspore group [Colorado]: Am. Mineralogist, v. 38, p. 1242–1250, 1953.

00459 **Evans, H. T., Jr.; Mrose, M. E.** A crystal chemical study of montroseite and paramontroseite: Am. Mineralogist, v. 40, p. 861–875, 1955.

00460 **Evans, H. T., Jr.; Mrose, M. E.** The crystal structures of three new vanadium minerals [Colorado Plateau]: Acta Cryst., v. 11, p. 56–58, 1958.

00461 **Evans, H. T., Jr.; Mrose, M. E.** A crystal chemical study of the vanadium minerals häggite and doloresite: Am. Mineralogist, v. 45, nos. 11–12, p. 1144–1166, 1960.

Evans, H. T., Jr. *See* Robinson, S. C. 00548

Evans, H. T., Jr. *See* Stern, T. W. 00768

Evans, H. T., Jr. *See* Appleman, D. E. 00892

Evans, H. T., Jr. *See* Staples, L. W. 01025

00881 **Evensen, C. G.; Gray, I. B.** Evaluation of uranium ore guides, Monument Valley, Arizona and Utah: Econ. Geology, v. 53, no. 6, p. 639–662, 1958.

The deposits described also contain vanadium.

Everhart, D. L. *See* McKelvey, V. E. 00403

01151 **Eyssautier, L.** L'industrie minière du Maroc (zone française) [The mining industry of Morocco (French zone)]: Internat. Geol. Cong., 19th, Algiers 1952, Mon. Régionales, 3d ser., Maroc, no. 2, 183 p., 1952; *also in* Morocco, Service Géol., Notes et Mém. no. 88, 1952.

A table on which vanadium production (1940–1944) is reported and a map showing the location of the Taouz vanadium deposit are included.

Fahey, J. J. *See* Robinson, S. C. 00548

00474 **Fairbairn, H. W.; Ahrens, L. H.; Gorfinkle, L. G.** Minor element content of Ontario diabase: Geochim. et Cosmochim. Acta, v. 3, p. 34–46, 1953.

00905 **Faulhaber, Engelbert; Liebetrau, Lothar.** Distribution of the trace elements vanadium and nickel in petroleum and its fractions [in German]: Erdöl und Kohle, v. 18, no. 4, p. 270–272, 1965.

Feira, Armando. *See* Fester, G. A. 01172

00086 **Fergusson, Malcolm; Wagner, P. A.** Vanadinite in the Marico district: South African Jour. Industries, v. 4, no. 11, p. 911–915, 1921; abs. *in* Mining Mag. [London], v. 26, p. 123–124, 1922.

00087 **Fersman, A. E.** U.S.S.R. resources in mineral raw materials, their geographical distribution and exploitation in chemical industry [in Russian]: Zhurn. Khim. Promyshlenn., v. 4, p. 277–282, 1927; abs. *in* Chem. Abs., v. 22, p. 3376–3377, 1928.

A generalized appraisal of raw material supplies; vanadium is classified in "moderate" supply.

00232 **Fersman, A. E.** Tyuya-Muyun mine of uranium and vanadium in Turkestan [in Russian]: Vses. s"ezd geologov, 3d Tashhend, 1928, Trudy, Geol. Kom-ta, pt. 1, p. 1–20, 1928.

00475 **Fersman, A. E.** General review of the zeolites of Russia, Pt. 4—Materials for the investigation of the zeolites of Russia [in Russian]: Akad. Nauk Leningrad, Geol. i Mineralog. Muzey, Travaux du Musée Geologique et Mineralogique, Trudy, v. 2, no. 7, p. 263–374, [1916] 1922; abs. *in* Mineralog. Abs., v. 2, p. 299, 1925.

This article includes data on vanadium content of some zeolites.

00476 **Fersman, A. E.** Otkrytie novykh mineralov—tangeita i uzbekita [Discovery of new minerals—tangeite acd uzbekite]: Priroda, 1925, (v. 14?), no. 7–9, col. 238–239, 1925.

This article contains the first descriptions of tangeite and uzbekite.

00477 **Fersman, A. E.** K morfologii i geokhimii Tyuya-muyuna [The morphology and geochemistry of Tyuya-muyun], *in* Trudy po izucheniyu radiya i radioaktivnykh rud: Leningrad, U.S.S.R., Akad. Nauk, v. 3, p. 1–92, 1928; abs. *in* Chem. Abs., v. 24, p. 571, 1930.

A description of the geologic structures and solution cavities in the limestone host rock, and the ore occurrences, paragenesis, and origin of the uranium, vanadium, and copper deposits at Tyuya-Muyun is given.

00985 **Fersman, A. E.** Geochemical migration of the elements and their scientific and economic significance shown in four mineral deposits [in German]: Halle (Saale), W. Knapp. 2 volumes; also *in* Abhand. Prakt. Geologie und Bergwirts., v. 18, 116 p.; ibid., v. 19, 86 p., 1929–1930.

Includes description of uranium-vanadium deposit at Tyuya Muyun.

01124 **Fersman, A. E.; Shcherbakov, D. I.** Tyuya-Muyunskoe mestorozhdenie radievykh rud v Fergane [The Tyuya-Muyun deposit of radium ore in the Fergana district]: Russia, V.S.N.Kh., Nauchn.—Tekh. Otdel no. 74, 37 p., 1925.

00088 **Fester, G. A.** Vanadium in the Republic of Argentina [in Spanish (?)]: Soc. Argentina Minería y Geología, Rev. Minera, v. 24, no. 4, p. 49–53, 1959; abs. *in* Chem. Abs., v. 54, col. 20691, 1960.

00089 **Fester, G. A.; Mazzola, E.** Vanadium in the ore of the Gonzalito mine [in Spanish]: Rosario, Argentine Univ. Nac. Litoral, Fac. Ingenieria Química, Rev., v. 30, p. 47–53, 1961; abs. *in* Chem. Abs., v. 59, col. 248, 1963.

Describes the occurrence of lead-vanadate ore and the method used to recover vanadium.

00219 **Fester, G. A.** On the useful mineral deposits of the region of San Rafael, Mendoza Province [in Spanish]: Soc. Argentina Minería y Geología, Rev. Minera, v. 10, no. 4, p. 105–118, 1939; abs. *in* Geol. Soc. America Bibliography and Index of Geology Exclusive of North America, v. 8, p. 68, 1940.

Includes a description of some vanadium deposits.

00220 **Fester, G. A.** La geoquímica del vanadio [The geochemistry of vanadium]: Cienc. e Inv., v. 4, no. 7, p. 276–283, 1948.

Discusses abundance in crustal rocks and especially in organic-rich sediments.

00221 **Fester, G. A.; Bertuzzi, F.** Vanadium minerals in Argentina [in German]: Zeitschr. Angew. Chemie, v. 38, p. 363–364, 1925; abs. *in* Chem. Abs., v. 19, p. 2010–2011, 1925.

Occurrences of vanadium-bearing asphaltite are described.

00222 **Fester, G. A.; Bertuzzi, F.; Gitlin, J.** Bituminous materials from the Republic of Argentina—1. Bitumen of the rafaelites; 2. Vanadium in the rafaelites; 3. Bitumen in the lignites of the Republic of Argentina [in Spanish]: Acad. Nac. Cienc. [Córdoba, Argentina] Bol. 30, p. 117–122, 1927.

00223 **Fester, G. A.; Cruellas, José** Las asfaltitas de la provincia de Mendoza [The asphaltites of the Mendoza Province]: Rosario, Argentine Univ. Nac. Litoral, Fac. Química Indus. y Agrícola, Rev., v. 11–12, p. 1–7 [del apartado, años 1942–1943], 1944.

00462 **Fester, G. A.** La geoquìmica y el vanadio [Geochemistry and vanadium]: Rosario, Argentine Univ. Nac. Litoral, Fac. Química Indus. y Agrícola, Rev. v. 6 (1937), p. 56–71, 1938.

00463 **Fester, G. A.** La geoquímica de los filones vanadiníferous, Pt. 2 [The geochemistry of vanadiferous veins, Pt. 2]: Rosario, Argentine Univ. Nac. Litoral, Fac. Química Indus. y Agrícola, Rev. v. 14, p. 3–8 [1945] 1946.

See also Fester, Lombardozzi and Solchaga, 1942.

00464 **Fester, G. A.; Cruellas, José; Baron, M.** Cenizas vanadiferas [Vanadium-containing ashes]: Rosario, Argentine Univ. Nac. Litoral, Fac. Química Indus. y Agrícola, Rev., v. 8, p. 95–110, [1939] 1940; abs. *in* Chem. Abs., v. 35, col. 4945, 1941.

This report presents and discusses analytical data on the vanadium content of several types of petroleum from Argentina, Peru, and Venezuela, and suggests that vanadium is significant in forming asphalt.

00465 **Fester, G. A.; Cruellas, José.** Petroleo, asfaltita y vanadio (Estudio geoquímico) [Petroleum, asphaltite, and vanadium (Geochemical study)]: Soc. Geol. Peru, Bol., v. 7, no. 1, p. 1–13, 1936; also *in* Rosario, Argentine Univ. Nac. Litoral, Fac. Quimica Indus. y Agrícola, Rev., v. 4, p. 186–201, [1935] 1936; abs. *in* Chem. Abs.: v. 30, col. 7505, 1936.

01172 **Fester, G. A.; Feira, Armando.** Exploitation of vanadium in Argentina [in Spanish]: Rosario, Argentine Univ. Nac. Litoral, Fac. Química Indus. y Agrícola, Rev., v. 18, no. 2, p. 3–14, 1949; abs. *in* Chem. Abs., v. 45, col. 510, 1951.

Discusses vanadium uses, sources, and recovery methods in Argentina.

01220 **Fester, G. A.; Lombardozzi, V. P.; Solchaga, M. A.** La geoquímica de los filones vanadiníferos [The geochemistry of vanadiferous veins]: Rosario, Argentine Univ. Nac. Litoral, Fac. Química Indus. y Agrícola, Rev., v. 9–10, [1940–1941], p. 11–28, 1942; abs. *in* Chem. Abs., v. 36, col. 5735, 1942.

The occurrence of vanadate minerals at several places is briefly described and theories of origin are suggested. *See also* Fester, 1946.

00224 **Finch, W. I.** Preliminary geologic map showing the distribution of uranium deposits and principal ore-bearing formations of the Colorado Plateau region: U.S. Geol. Survey Mineral Inv. Field Studies Map MF-16, 1955.

Many of the uranium deposits shown also contain vanadium.

00225 **Finch, W. I.** Uranium in terrestrial sedimentary rocks in the United States exclusive of the Colorado Plateau, *in* Geology of uranium and thorium: New York, United Nations, Internat. Conf. Peaceful Uses Atomic Energy, Proc., Aug. 8–20, 1955, v. 6, p. 600–604, 1956; revised *in* U.S. Geol. Survey Prof. Paper 300, p. 321–327, 1956.

Some of the deposits described contain small amounts of vanadium.

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00906 **Finch, W. I.** Geology of epigenetic uranium deposits in sandstone in the United States: U.S. Geol. Survey Prof. Paper 538, 121 p., 1967.

Some of the deposits described yield vanadium

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00227 **Finnell, T. L.** Structural control of uranium ore at the Monument No. 2 mine, Apache County, Arizona: Econ. Geology, v. 52, no. 1, p. 25–35, 1957.

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00228 **Fischer, E.; Kleber, W.; Sommer, J.** Über pucherit unter besonderer Berücksichtigung de Vorkommen in den mesothermalen BiCoNi-Gängen Südwestsachsens [On pucherite, with special consideration to the occurrence in mesothermal BiCoNi veins, southwest Saxony]: Chemie der Erde, v. 19, p. 361–385, 1958.

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00097 **Fischer, R. P.** Federal exploration of carnotite ore: Denver, Colo., Colorado Mining Association, 14 p., 1949.

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00100 **Fischer, R. P.** Vanadium in the United States, exclusive of Alaska and Hawaii: U.S. Geol. Survey Mineral Inv. Resource Map MR–16, 8 p., 1962.

00101 **Fischer, R. P; King, R. U.** Trends in the consumption and supply of molybdenum and vanadium: Am. Inst. Mining Metall. Engineers Preprint 64–K–2, 18 p., 1964.

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00230 **Fischer, R. P.** Sedimentary deposits of copper, vanadium–uranium, and silver in southwestern United States: Econ. Geology, v. 32, no. 7, p. 906–951, 1937.

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00233 **Fischer, R. P.** Deposits of vanadium-bearing sandstone, *in* Mineral resources of Colorado: Denver, Colo., Colorado Mineral Resources Board, p. 451–456, 1947.

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00235 **Fischer, R. P.** Uranium-bearing sandstone deposits of the Colorado Plateau: Econ. Geology, v. 45, no. 1, p. 1–11, 1950.

00236 **Fischer, R. P.** Uranium–vanadium–copper deposits of the Colorado Plateau region, *in* Geology of uranium and thorium: New York, United Nations, Internat. Conf. Peaceful Uses Atomic Energy, Proc., Aug. 8–20, 1955, v. 6, p. 605–614, 1956; revised *in* U.S. Geol. Survey Prof. Paper 300, p. 143–154, 1956.

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00473 **Fischer, R. P.** Vanadium, *in* Mineral and water resources of South Dakota: U.S. Cong., 88th, 2d sess., Comm. Interior and Insular Affairs, Comm. Print, p. 80–81, 1964.

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00907 **Fischer, R. P.** Vanadium, *in* Mineral and water resources of California: U.S. Cong., 89th, 2d sess., Comm. Interior and Insular Affairs, Comm. Print, p. 439–441, 1966.

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00908 **Flanagan, F. J.** U.S. Geological Survey silicate rock standards: Geochim. et Cosmochim. Acta, v. 31, p. 289–308, 1967.

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01243 **Flink, Gust.** Pyrobelonit, ein neues Blei–Mangan–Vanadat von Långbanshyttan [A new lead manganese vanadate of Langbanshyttan]: Geol. Fören., Stockholm, Förh., v. 41, p. 433–447, 1919; abs. *in* Chem. Abs., v. 14, p. 1097, 1920.

Florensky, K. P. *See* Zil'bermints, V. A. 00973

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01244 **Fominykh, V. G.** Vizeyskie titanonosnye gabbro–diabazy na Yuzhnom Urale [The Visean titaniferous gabbro–diabases in the Southern Urals], *in* Magmatizm, Metamorfizm, Metallogeniya Urala: Ural'. Petrograf. Soveshch., Trudy, v. 1, p. 481–484, [1961]1963; abs. *in* Chem. Abs., v. 61, col. 15859, 1964.

A description is given of the vanadium–bearing titaniferous magnetite.

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Includes a description of the occurrence of vanadate minerals.

01245 **Foshag, W. F.; Hess, F. L.** Rossite and metarossite, two new vanadates from Colorado: U.S. Natl. Mus. Proc., v. 72, no. 2707, 12 p., 1927.

Foshag, W. F. **See** Hess, F. L. 01316

00103 **Foster, M. D.** Studies on the peroxide method for determining vanadium in minerals and ores: U.S. Geol. Survey Bull. 950, p. 7–13, 1946.

00910 **Foster, M. D.; Schaller, W. T.** New analysis of Genth's volborthite: Am. Mineralogist, v. 50, nos. 5 and 6, p. 785–789, 1965.

01246 **Foster, M. D.** Chemical study of the mineralized clays, *in* Geochemistry and mineralogy of the Colorado Plateau uranium ores: U.S. Geol. Survey Prof. Paper 320, p. 121–123, 1959.

Vanadium–bearing clay minerals in sandstone deposits are discussed.

01145 **Foye, W. G.** The relation of the titaniferous magnetite ores of Glamorgan Township, Haliburton County, Ontario, to the associated scapolitic gabbros: Econ. Geology, v. 11, p. 662–680, 1916.

Includes some data on the V content of the ores.

01189 **Frankel, J. J.; Grainger, G. W.** Notes on Bushveld titaniferous iron ore: South African Jour. Sci., v. 37, p. 101–110, [1940] 1941.

Describes the minerals in the ore, with special attention on the distribution of vanadium.

01247 **Franklin, F. F.** Vanadium minerals, Pts. 1 and 2—Mineral sources of vanadium: Vancoram Rev., v. 6, pt. 2, no. 2, p. 11–15; and ibid., no. 4, p. 10–17, 1945.

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01248 **Freitas, A. J., de.** A geologia e o desenvolvimento económico e social de Moçambique [On the geology and the economic and social development of Mozambique]: Lourenço Marques, Impr. Nacional de Moçambique, Junta Comércio Externo, Prov. Moçambique, 396 p., 1959.

A brief description of the occurrence of roscoelite with graphite is included.

Freitas, Fernando. *See* Luna, I. R., de. 00397

01077 **Frenzel, August.** Mineralogisches—1, Pucherit; 2, Lithiophorit; 3, Hypochlorit: Jour. Prakt. Chemie, 2d ser., v. 4, p. 227–231, 353–362, 1871; abs. *in* Neues Jahrb. Mineralogie, Geologie u. Paläontologie, 1872, p. 72, 1872.

01249 **Friedel, Charles; Cumenge, E.** Sur un nouveau minerai d'urane, la carnotite [On a new uranium mineral, carnotite]: Acad. Sci. [Paris] Comptes Rendus, v. 128, p. 532–534, 1899.

00912 **Friedrich, Vilem.** Production of vanadium slag from bauxite red mud [in English]: Tech. Digest [Prague], v. 9, no. 7, p. 443–444, 1967; abs. *in* Chem. Abs., v. 68, abs. no. 32133r, 1968.

01250 **Friend, J. N.; Vallance, R. H.** Vanadiferous nodules in Worcester clay: Nature [London], v. 144, p. 286, 1939.

01251 **Fróes Abreu, Sylvio.** Recursos minerais do Brasil, vol. II—Combustíveis fósseis e minérios metálicos [Mineral resources of Brazil, vol. II—Fossil fuels and metallic ores]: Rio de Janeiro, Brazil, Ministério da Indústria e do Comércio Instituto Nacional de Technologia, 696 p., 1962.

A brief description is included of several occurrences of vanadium-bearing minerals and deposits.

Frondel, Clifford. *See* Palache, Charles. 00622

Frondel, Clifford. *See* Palache, Charles. 00623

01252 **Frondel, Clifford; Riska, Daphne; Frondel, J. W.** X-ray powder data for uranium and thorium minerals: U.S. Geol. Survey Bull. 1036-G, p. 91–153, 1956.

Data for several vanadium-bearing minerals are included.

Frondel, J. W. *See* Frondel, Clifford. 01252

Frost, I. C. *See* Stanfield, K. E. 00765

01253 **Fryklund, V. C., Jr.; Harner, R. S.; Kaiser, E. P.** Niobium (columbium) and titanium at Magnet Cove and Potash Sulphur Springs, Arkansas: U.S. Geol. Survey Bull. 1015-B, p. 23–57, 1954.

Includes data on vanadium content of rocks and minerals.

01254 **Fryklund, V. C., Jr.; Holbrook, D. F.** Titanium ore deposits of Hot Spring County, Arkansas: Arkansas Div. Geology Bull. 16, 173 p., 1950.

Includes data on the vanadium content of drill-hole samples.

00913 **Fuganti, Andrea.** Geological study of the "bituminous uraniferous shales" of Mollaro, Val di Non, Trentino [in Italian]: Trent, Mus. Storia Nat. Venezia Tridentina, Studi trent. sci. nat., v. 38, no. 1, p. 17–33, 1961.

Vanadium averaged 870 ppm in six samples of shale.

01255 **Fujiwara, Tetsuo; Futamase, Kiyoshi.** Titaniferous iron sands in Hokkaido, 1.—Chemical composition [in Japanese (?)]: Hokkaido Chikashigan Chosasho Hokoku, no. 25, p. 57–78, 1961; abs. *in* Chem. Abs., v. 56, col. 6940, 1962.

Describes deposits in 11 areas, giving content of vanadium and other elements.

Fuller, G. W. *See* Tschanz, C. M. 00810

Futamase, Kiyoshi. *See* Fujiwara, Tetsuo. 01255

00104 **Fyfe, H. E.** The iron ore resources of New Zealand [in English]: Internat. Geol. Cong., 19th Algiers 1952, Symposium sur les gisements de fer du monde, v. 2, p. 589–594, 1952.

Beach sands contain nearly 800 million long tons of recoverable titanomagnetite, averaging about 55 percent metallic Fe, 9 percent TiO_2, and 0.4 percent V_2O_3.

00105 **Gabelman, J. W.** Application of hydrothermal zoning to uranium exploration: Am. Inst. Mining Metall. Petroleum Engineers Trans., v. 223, p. 406–411, 1962.

Some of the deposits discussed also contain vanadium.

01256 **Gabelman, J. W.** Uranium deposits in limestone, *in* Geology of uranium and thorium: New York, United Nations, Internat. Conf. Peaceful Uses Atomic Energy Proc., Aug. 8–20, 1955, v. 6, p. 338–345, 1956; revised *in* U.S. Geol. Survey Prof. Paper 300, p. 387–404, 1956.

A little vanadium is present in some of the deposits described.

01257 **Galbraith, F. W.; Brennan, D. J.** Minerals of Arizona [3d ed., revised]: Tucson, Arizona Univ. Press, 116 p., 1959.

Vanadium-bearing minerals are listed and localities of occurrences are given.

01258 **Gale, H. S.** Carnotite in Rio Blanco County, Colorado: U.S. Geol. Survey Bull. 315–C, p. 110–117, 1907.

01259 **Gale, H. S.** Carnotite and associated minerals in western Routt County, Colorado: U.S. Geol. Survey Bull. 340–D, p. 256–262, 1908.

01260 **Gallagher, David.** Iron ore deposits, vol. 4 *of* Mineral resources of Korea: Issued to Mining Branch, Industry and Mining Division, United States Operations Mission to Korea, in cooperation with Geological Survey, Republic of Korea, 50 p., 1963.

A description and appraisal of a titaniferous magnetite deposit is included.

00536 **Gamaleev, I. E.; Khamrabaev, I. Kh.** Vanadiy i molibden v siluriyskikh otlozheniyakh gor Mal'guzar, Nuratau i Tamdy [Vanadium and molybdenum in the Silurian deposits of the Mal'guzar, Nuratau, and Tamdy Mountains]: Uzbek. Geol. Zhurn., 1958, no. 2, p. 47–54, 1958; abs. *in* Chem. Abs., v. 53, col. 5053, 1959.

01261 **Ganguli, S. C.; Das-Gupta, J.** Indian bauxite, I—Chromium and vanadium: Indian Chem. Soc. Jour., v. 15, p. 243–244, 1938; abs. *in* Chem. Abs., v. 33, col. 507, 1939.

Bauxite from 15 localities contained 0.0025 to 0.142 percent V_2O_5, averaging 0.075 percent.

Gardiner, Lynn. *See* Gruner, J. W. 01288

00106 **Gardner, D. E.** Titanium (rutile and ilmenite) [revised]: Australia Bur. Mineral Resources, Geology and Geophysics, Summ. Rept. 2, 36 p., 1951.

A brief description and partial resource appraisal of deposits of titanium-bearing sands and bodies of titaniferous magnetite; a bulk sample from one body assayed 0.72 percent V_2O_3.

01262 **Gardner, L. S.** Phosphate deposits of the Teton Basin area, Idaho and Wyoming: U.S. Geol. Survey Bull. 944-A, p. 1-36, 1944.

Includes data on the vanadium content of phosphate rock.

00245 **Garrels, R. M.; Pommer, A. M.** Some quantitative aspects of the oxidation and reduction of the ores, *in* Geochemistry and mineralogy of the Colorado Plateau uranium ores: U.S. Geol. Survey Prof. Paper 320, p. 157-164, 1959.

00246 **Garrels, R. M.; Larsen, E. S., 3d; Pommer, A. M.; Coleman, R. G.** Detailed chemical and mineralogical relations in two vanadium-uranium ores, *in* Geochemistry and mineralogy of the Colorado Plateau uranium ores: U.S. Geol. Survey Prof. Paper 320, p. 165-184, 1959.

00247 **Garrels, R. M.; Larsen, E. S., 3d.** (compilers). Geochemistry and mineralogy of the Colorado Plateau uranium ores: U.S. Geol. Survey Prof. Paper 320, 236 p., 1959.

00248 **Garrels, R. M.** Some thermodynamic relations among the vanadium oxides, and their relation to the oxidation state of the uranium ores of the Colorado Plateaus: Am. Mineralogist, v. 38, p. 1251-1265, 1953.

00249 **Garrels, R. M.** Some thermodynamic relations among the uranium oxides and their relation to the oxidation states of the uranium ores of the Colorado Plateaus: Am. Mineralogist, v. 40, p. 1004-1021, 1955.

Garrels, R. M. *See* Hostetler, P. B. 00254

Garrels, R. M. *See* McKelvey, V. E. 00403

Garrels, R. M. *See* Evans, H. T., Jr. 00454

01263 **Gaudefroy, C.** Étude cristallographique de la vanadinite du Tadaout, près de Taouz, Maroc sud-oriental [Crystallographic study of vanadinite from Tadaout, near Taouz, southeastern Morocco]: Morocco Service Geol., Notes et Mém. no. 95, [Notes du Service Géol., v. 6], p. 237-246, 1952; abs. *in* Chem. Abs., v. 49, col. 4465, 1955.

Gaultieri, J. L. *See* Carter, W. D. 00897

Gay, T. E., Jr. *See* Wright, L. A. 00953

Gays, S. N. *See* Kochergin, I. A. 00928

Gekht, I. I. *See* Ankinovich, E. A. 00053

Gekht, I. I. *See* Ankinovich, E. A. 01225

01075 **Genth, F. A.; Rath, Gerhard vom.** On the vanadates and iodyrite, from Lake Valley, Sierra Co., New Mexico: Am. Philos. Soc. Proc., v. 22, p. 363-375, 1885; also *as* Ueber Vanadate und Jodsilber von Lake Valley, Donna Anna County, New Mexico: Zeitschr. Krystallographie u. Mineralogie, v. 10, p. 458-474, 1885.

01190 **Genth, F. A.** On some tellurium and vanadium minerals: Am. Philos. Soc. Proc., v. 17, p. 113-123, 1877.

Describes the occurrence and gives analyses of roscoelite and several tellurium minerals, a few of which contain small amounts of vanadium.

01264 **Genth, F. A.** On some American vanadium minerals: Am. Jour. Sci., 3d ser., v. 12, p. 32–36, 1876.

00107 **Geology and Mineral Res. Far East.** Geologic map of Lung-hua: Compilation Committee, Geology and Mineral Resources Far East, c/o Tokyo Geog. Soc., Tokyo, Japan [Manchuria] [Lung-hua (Huang-ku-t'un), China], NK 50-8, scale 1:250,000, 1960.

01118 **Gerasimov, A. G.; Tatsienko, P. A.; Luk'yanov, S. M.; Rybakov, V. N.** Industrial testing of iron-titanium-vanadium ores from the Lysansk deposit [in Russian]: Gornyy Zhurn., 1960, no. 10, p. 59–60, 1960; abs. *in* Chem. Abs., v. 55, col. 2391, 1961.

The ores, which occur in serpentinite and pyroxenite, and their metallurgical treatment are briefly described.

01119 **Gerasimovskiy, V. I.; Belyayev, Yu. I.** O soderzhanii khroma, nikelya, vanadiya i medi v shchelochnykh porodakh Kol'skogo poluostrova [Chromium, nickel, vanadium, and copper content of alkalic rocks, Kola Peninsula]: Geokhimiya, 1963, no. 1, p. 22–34 [1963]; translated *in* Geochemistry, 1963, no. 1, p. 23–34 [1963].

Includes a discussion of geochemical relations among these metals.

Ghosh, R. B. *See* Chatterjee, P. K. 00876

Gibbons, A. B. *See* Sharp, W. N. 00677

Gibbs, H. S. *See* Monro, A. D. 00311

Gibson, F. H. *See* Abernathy, R. F. 00018

Gilbert, C. S. *See* Beath, O. A. 00122

01076 **Gill, J. R.; Moore, G. W.** Carnotite-bearing sandstone in Cedar Canyon, Slim Buttes, Harding County, South Dakota: U.S. Geol. Survey Bull. 1009-I, p. 249–264, 1955.

00914 **Gimmel'farb, B. M.** Zakonomernosti razmeshcheniya mestorozhdeniy fosforitov SSSR i ikh geneticheskaya klassifikatsiya [The regularities of distribution of the phosphorite deposits of the U.S.S.R. and their genetic classification]: Moscow, Nedra, 306 p., 1965; review *in* Econ. Geology v. 61, no. 2, p. 418, 1966.

Girhard, M. N. *See* Stern, T. W. 01123

Girty, G. H. *See* Mansfield, G. R. 00702

Gitlin, J. *See* Fester, G. A. 00222

01265 **Gjelsvik, Tore.** Geochemical and mineralogical investigations of titaniferous iron ores, west coast of Norway: Econ. Geology, v. 52, no. 5, p. 482–498, 1957.

The effects of metamorphism and the possible origin of four titaniferous magnetite deposits are discussed. Analyses of samples give vanadium content of ores, ore minerals, and related rocks.

Gladyshev, V. I. *See* Freidenzon, E. Z. 00911

01266 **Glagoleva, M. A.** Forms of migration of the elements in river water: Akad. Nauk SSSR, Proc. Sec. Geochemistry, English translation, v. 120–121, p. 73–76, 1958; translated *from* Akad. Nauk SSSR, Doklady, nov. ser., v. 121, p. 1052–1055, 1958.

Vanadium was detected in suspended solids but not in solution.

Goddard, E. N. *See* Lovering, T. S. 00393

01267 **Goddard, E. N.** Preliminary report on the Gold Hill mining district, Boulder County, Colorado: Colorado Sci. Soc. Proc., v. 14, no. 4, p. 103–139, 1940.

The occurrence of the vanadium-bearing mica, roscoelite, with gold-telluride ores is briefly described.

01268 **Goldberg, E. D.** Marine geochemistry. I—Chemical scavengers of the sea: Jour. Geology, v. 62, p. 249–265, 1954.

Analyses of the ashes of some marine plants and animals show relatively large amounts of vanadium and other metals that occur only in minute traces in sea water.

01269 **Goldberg, E. D.; Arrhenius, G. O. S.** Chemistry of Pacific pelagic sediments: Geochim. et Cosmochim. Acta, v. 13, p. 153–212, 1958.

Gives content of vanadium and other elements in samples and discusses significant relations.

Goldenstein, S. J. *See* Hague, R. S. 00250

00243 **Goldschmidt, V. M.; Krejci-Graf, Karl; Witte, H.** Spuren-Metalle in Sedimenten [Trace elements in sediments]: Akad. Wiss., Göttingen, Math.-Phys. -Chem. Abt., Nachr., 1948, no. 2(?), p. 35–52, 1948; abs. *in* Chem. Abs., v. 47, col. 11095, 1953.

Discusses the content of vanadium and other trace metals in several kinds of rocks and the ratios of some of these elements in sediments containing organic matter, as a clue to the source beds of petroleum.

01270 **Goldschmidt, V. M.** Vanadium, *in* Geochemistry: Oxford, Clarendon Press, p. 485–499, 1954.

01271 **Goldschmidt, V. M.; Peters, Cl.** Über die Anreicherung seltener Elemente in Steinkohlen [The concentration of rare elements in coal]: Akad. Wiss., Göttingen, Math.-Phys. Kl., Nachr., 1933, no. 4, p. 371–386, 1933; abs. *in* Chem. Abs., v. 27, p. 5690, 1933.

00108 **Gonzáles Reyna, Jenaro.** Riqueza minera y yacimientos minerales de México, 3d ed. [Mining wealth and mineral deposits of Mexico, 3d ed.]: Mexico, Banco de Mexico, Departamento de Investigaciones Industriales, 497 p., 1956.

Information on the occurrence and production of vanadium-bearing ores is included in this report.

00537 **Gonzáles Reyna, Jenaro.** Geological-mining report of the State of Chihuahua; metallic minerals [in Spanish], *in* Contribución al Congreso, del Instituto de Geólogía de la Universidad Nacional Autónoma de México: Mexico, 20th Congreso Geologico Internacional, 280 p., 1956.

Information on the distribution of vanadate minerals in Chihuahua is given.

01272 **Gonzalez, R. R. L.** Descripción geologica de la Hoja 22g-Quines, Provincia de San Luis [Description of the geology of sheet 22g-Quines, San Luis Province]: Argentine Dirección Nac. Minería Bol. 87, p. 1–50, 1957.

Brief descriptions of deposits of vanadium and other metals are given.

Goode, H. D. *See* Robinson, C. S. 00638

01170 **Gordillo, C. E.; Linares, E.; Toubes, R. O.; Winchell, H.** Huemulite, $Na_4MgV_{10}O_{28}.24H_2O$, a new hydrous sodium and magnesium vanadate from the

Huemel mine, Mendoza Province, Argentina: Am. Mineralogist, v. 51, no. 1–2, p. 1–13, 1966.

Gordillo, C. E. *See* Linares, Enrique. 01185

Gordillo, C. E. *See* Linares, Enrique. 01186

00244 **Gordon, MacKenzie, Jr.; Murata, K. J.** Minor elements in Arkansas bauxite: Econ. Geology, v. 47, p. 169–179, 1952.

Gives content of vanadium and other minor elements in bauxite and its source rock and discusses significant geochemical relations.

Gorfinkle, L. G. *See* Fairbairn, H. W. 00474

00109 **Gösta-Sjöberg, Sven.** Nils Gabriel Sefström and the discovery of vanadium: Jour. Chem. Education, v. 28, p. 294–296, 1951.

Gotman, Ya. D. *See* Borovick, S. A. 00157

01273 **Gotman, Ya. D.** Petrography and mineralogy of the Agalyk uranium and vanadium deposit in Middle Asia [in Russian with English summ.]: Akad. Nauk SSSR Izv. Ser. Geol., no. 2, p. 291–311, 1937.

01272 **Gott, G. B.; Schnabel, R. W.** Geology of the Edgemont NE quadrangle, Fall River and Custer Counties, South Dakota: U.S. Geol. Survey Bull. 1063–E, p. 127–190, 1963.

A description of uranium–vanadium deposits in sandstone is included.

01274 **Gottis, Ch.; Sainfeld, P.** Les gites métallifères Tunisiens [The metalliferous deposits of Tunisia]: Internat. Geol. Cong., 19th, Algiers 1952, Mon. Régionales, 2d sér. Tunisie, no. 2, 104 p., 1952.

Vanadium occurrences are mentioned and two lead–zinc–vanadium deposits are indicated by map (note that lines of latitude and longitude are incorrectly labeled).

01275 **Goyder, G. A.** Sulvanite, a new mineral: Chem. Soc. Jour. [London], v. 77, pt. 2, p. 1094–1096, 1900; also *in* Royal Soc. South Australia Trans., v. 24, p. 69–70, 1900.

01276 **Graf, D. L.** Geochemistry of carbonate sediments and sedimentary carbonate rocks; Pt. III—Minor element distribution: Illinois Geol. Survey Circ. 301, 71 p., 1960.

01277 **Graf, D. L.; Kerr, P. F.** Trace elements studies, Santa Rita, New Mexico: Geol. Soc. America Bull., v. 61, p. 1023–1052, 1950.

Describes studies of the distribution of vanadium and other elements in various types of country rocks to indicate source of the ore metals.

Graham, A. R. *See* Berry, L. G. 00138

Grainger, G. W. *See* Frankel, J. J. 01189

00242 **Granger, H. C.** Mineralogy, *in* Geology and technology of the Grants uranium region: New Mexico Bur. Mines and Mineral Resources Mem. 15, p. 21–37, 1963.

Lists U- and V-bearing minerals according to environment and describes their general occurrence.

Granger, H. C. *See* Waters, A. C. 00850

Granger, H. C. *See* Shawe, D. R. 01016

01278 **Granger, H. C.; Santos, E. S.** An ore-bearing cylindrical collapse structure in the Ambrosia Lake uranium district, New Mexico, *in* Short papers in geology and hydrology, Article 100, Geological Survey Research, 1963: U.S. Geol. Survey Prof. Paper 475–C, p. C156–C161, 1963.

Includes a little information on the vanadium content of the ore.

01279 **Granger, H. C.; Santos, E. S.; Dean, B. G.; Moore, F. B.** Sandstone-type uranium deposits at Ambrosia Lake, New Mexico—an interim report: Econ. Geology, v. 56, p. 1179–1210, 1961.

Gray, I. B. *See* Evensen, C. G. 00881

00110 **Great Britain Imperial Institute.** Vanadium ores: Great Britain Imp. Inst., Mineral Resources Comm., Mon., 72 p., 1924.

01280 **Green, Jack.** Geochemical table of the elements for 1959: Geol. Soc. America Bull., v. 70, no. 9, p. 1127–1184, 1959.

00478 **Gregorowicz, Zbigniew; Orzechowski, Piotr.** Vanadium and nickel in Polish crude oils [in Polish]: Nafta [Poland], v. 14, p. 106–107, 1958; abs. *in* Chem. Abs., v. 52, col. 15882, 1958.

01281 **Gregorowicz, Zbigniew.** Die geochemische Kennzahl V/Ni der Erdöle Karpatenvorlandes [The geochemical index V/Ni of the petroleum of the Carpathian foreland]: Acta Geol. [Budapest], v. 6, p. 107–118, 1959; abs. *in* Chem. Abs., v. 53, col. 22850, 1959.

Grimaldi, F. S. *See* Rader, L. F. 01183

00915 **Grimbert, A.** La prospection geóchimique de l'uranium; application aux zones intertropicales forestières [Geochemical prospecting for uranium; application to tropical forest zones]: Chronique Mines et Recherche Minière, v. 32, no. 326, p. 3–12 [summary and conclusion in English, p. 3, and 11–12] 1964.

Geochemical prospecting for uranium–vanadium deposits is described.

01282 **Gross, E. B.** Mineralogy and paragenesis of the uranium ore, Mi Vida mine, San Juan County, Utah: Econ. Geology, v. 51, no. 7, p. 632–648, 1956.

A description of vanadium minerals and their occurrence in the ore is given.

01283 **Gross, E. B.** Mineralogy, *in* Uranium–vanadium deposits of the Cottonwood Wash mining district, San Juan County, Utah [revised]: U.S. Atomic Energy Comm. RME-109, p. 18–26, 1958.

Gross, E. B. *See* Laverty, R. A. 00359

00916 **Gross, G. A.** Geology of iron deposits in Canada, vol. 2, Iron deposits in the Appalachian and Grenville regions of Canada: Canada Geol. Survey, Econ. Geology Rept. 22, 111 p., 1967.

Groth, F. A. *See* Zitting, R. T. 00977

01284 **Grout, F. F.** The titaniferous magnetites of Minnesota: St. Paul, Minnesota, Office of the Commissioner of the Iron Range Resources and Rehabilitation, 117 p., 1949–50.

Includes some information on the vanadium content of these deposits.

Grundulis, V. *See* Assarsson, G. O. 01204

01285 **Grundy, W. D.; Oertell, E. W.** Uranium deposits in the White Canyon and Monument Valley mining districts, San Juan County, Utah, and Navajo and Apache Counties, Arizona: Intermtn. Assoc. Petroleum Geologists, 9th Annual Field Conf. 1958, Guidebook, p. 197–207, 1958.

Describes the sandstone-bearing uranium deposits, which are generally similar except some contain appreciable copper and some appreciable vanadium.

01078 **Gruner, J. W.** Concentration of uranium in sediments by multiple migration—accretion: Econ. Geology, v. 51, p. 495–520, 1956.

The theory presented applies also to vanadium in some deposits.

01286 **Gruner, J. W.** The uranium mineralogy of the Colorado Plateau and adjacent regions: Utah Geol. Soc. Guidebook, no. 9, p. 70–77, 1954.

Lists uranium and vanadium minerals in sandstone deposits and describes their physical properties and associations.

01287 **Gruner, J. W.** Mineral associations in the continental-type uranium deposits of the Colorado Plateau and adjacent areas, *in* Geology and economic deposits of east-central Utah: Intermtn. Assoc. Petroleum Geologist, 7th Annual Field Conf., Guidebook, p. 151–154, 1956.

01288 **Gruner, J. W.; Gardiner, Lynn; Smith, D. K., Jr.** Mineral associations in the uranium deposits of the Colorado Plateau and adjacent regions: U.S. Atomic Energy Comm. RME-3092, 48 p., 1954.

Lists minerals, including those containing vanadium, in numerous deposits.

01289 **Gruner, J. W.; Rosenzweig, Abraham; Smith, D. K., Jr.** Further studies relating to the origin and distribution of uranium deposits on the Colorado Plateau: U.S. Atomic Energy Comm. RME-3094, 37 p. 1954.

00078 **Guernsey, T. D.** A prospector's guide to mineral occurrences in Northern Rhodesia, 2d ed.: Salisbury, Rhodesia. The British South Africa Company, Charter House, 87 p., 1952.

Includes a description of the deposits at Broken Hill and data on Zambia (Northern Rhodesia) vanadium production from 1906–1950.

01289 **Guilinger, R. R.; Theobald, P. K.** Uranium deposits in oolitic limestone near Mayoworth, Johnson County, Wyoming: U.S. Geol. Survey Bull. 1030-K, p. 335–342, 1957.

Describes low-grade uranium deposits that contain a little vanadium.

00535 **Guillemin, Claude.** Contribution a la minéralogie des arséniates, phosphates et vanadates de cuivre, II—Phosphates et vanadates de cuivre [Contribution to the mineralogy of arsenates, phosphates, and vanadates of copper, II—Phosphates and vanadates of copper]: Soc. Française Minéralogie et Cristallographie Bull. 79, p. 219–275, 1956.

01290 **Guillemin, Claude.** Une nouvelle espèce minérale; la vésigniéite $Cu_3Ba(VO_4)_2(OH)_2$ [Anew mineral specie, vésigniéite, $Cu_3Ba(VO_4)_2(OH)_2$]: Acad. Sci. [Paris] Comptes Rendus, v. 240, p. 2331–2333, 1955.

01291 **Guillemin, Claude; Prouvost, J.; Wintenberger, M.** Sur les variétés fibreuses de mimetite (prixite) et de vanadinite [On the fibrous varieties of mimetite (prixite) and of vanadinite]: Soc. Française Minéralogie et Cristallographie Bull., v. 78, p. 301–306, 1955.

01293 **Guimãraes, Djalma.** Fundamentos de metalogênese e os depósitos minerais do Brasil [Fundamentals of the metallogenesis and mineral deposits of Brazil]: Brazil Div. Fomento Produção Mineral Bol. 109, 441 p., 1961.

A brief description of occurrences of vanadates is included.

01292 **Guimarães, [Guimaraens], C. P.** The presence of mineralization in Caledonian deposits, djalmaite and calogerasite (Occurrence of zinc, silver, and vanadium in northern Minas Gerais) [in Portuguese]: Minas Gerais, Brazil, Inst. Tecnologia Indus. Bol. 3, p. 1–25, 1948; abs. *in* Mineralog. Abs., v. 11, p. 47, 1952.

Gulbrandsen, R. A. *See* McKelvey, V. E. 00402

00917 **Gulbrandsen, R. A.** Some compositional features of phosphorites of the Phosphoria Formation, *in* Anatomy of the western phosphate field: Intermtn. Assoc. Geologists 15th Ann. Field Conf., p. 99–102, 1967.

Data on the content of vanadium and other elements in phosphate rock are given.

01294 **Gulbrandsen, R. A.** Petrology of the Meade Peak phosphatic shale member of the Phosphoria Formation at Coal Canyon, Wyoming: U.S. Geol. Survey Bull. 1111–C, p. 71–146, 1960.

Gives the major and minor element constituents, including vanadium, according to their stratigraphic distribution, and discusses their petrological and geochemical relations.

00241 **Gulyayeva, L. A.; Itkina, E. S.** The halogens and vanadium, nickel and copper in coals [in Russian with English summ.]: Geochemistry, 1962, no. 4, p. 395–407, 1962; translated *from* Geokhimiya, 1962, no. 4, p. 345–355, 1962.

01148 **Gulyayeva, L. A.; Lositskaya, I. F.; Kovaleva, T. A.** Vanadiy i tsink v kaustobiolitakh, *in* Mikroelementy v kaustobiolitakh i osadochnykh porodakh [Vanadium and zinc in caustobioliths, *in* Microelements in caustobioliths and sedimentary deposits]: Moscow, Institut geologii i razrabotki goryuchikh iskopaemykh, p. 62–73, 1965; abs. *in* Chem. Abs., v. 64, col. 7914, 1966.

01295 **Gulyayeva, L. A.** Vanadiy i nikel' v neftyakh devona [Vanadium and nickel in Devonian petroleum]: Akad. Nauk SSSR Inst. Nefti Trudy, v. 2, p. 73–83, 1952; abs. *in* Chem. Abs., v. 48, col. 3870, 1954.

Gives analyses of ash of some oils from the Volga–Ural area (up to 50 percent vanadium and nickel) and discusses the geochemical significance relative to the source of these metals and the host oils.

01296 **Gulyayeva, L. A.; Itkina, E. S.; Romm, I. I.** Vanadium, nickel, and copper in petroleum of the Urals and Volga region [in English]: Acad. Sci. URSS Comptes Rendus (Doklady), nouv. sér., v. 32, no. 6, p. 406–409, 1941; abs. *in* Chem. Abs., v. 37, col. 2166, 1943.

Gunning, H. C. *See* Ellsworth, H. V. 00446

01297 **Gunning, H. C.; Carlisle, Donald.** Vanadium on the west coast of British Columbia: Western Miner, v. 17, no. 10, p. 39–43, 1944; revised *in* Mining Mag. [London], v. 72, p. 59–62, 116–117, 1945; abs. *in* Chem. Abs., v. 39, col. 1374–1375, 1945.

Haff, J. C. *See* Fischer, R. P. 00239

Haffty, Joseph. *See* Durum, W. H. 00436

01358 **Hägele, G.** Adelit und Descloizit [Adelite and descloizite]: Neues Jahrb. Mineralogie, Geologie u. Paläontologie, Abh. Beil.–bd. 75, no. 1, Abt. A, p. 101–109, 1939.

Hagner, A. F. *See* Beath, O. A. 00122

00250 **Hague, R. S.; Goldenstein, S. J.; Blakey, E.** [Map of the] Uranium–vanadium deposits of the Uravan mineral belt, *in* The geology of the Paradox Basin: Intermtn. Assoc. Petroleum Geologists, 9th Annual Field Conf., Guidebook, map, revised, 1958.

01359 **Hahn, A. D.; Fine, M. M.** Examination of ilmenite–bearing sands in Otter Creek Valley, Kiowa and Tillman Counties, Oklahoma: U.S. Bur. Mines Rept. Inv. 5577, 77 p., 1960.

Data on vanadium content of ilmenite and magnetite concentrates are included.

Haldane, W. G. *See* Fleck, Herman. 00102

01360 **Hall, W. E.; MacKevett, E. M., Jr.** Geology and ore deposits of the Darwin quadrangle, Inyo County, California: U.S. Geol. Survey Prof. Paper 368, 87 p., 1962.

Vanadinite is present though sparse in the oxidized zone of the Darwin mine.

01361 **Hallimond, A. F.** Iron ores; Bedded ores of England and Wales; Petrography and chemistry: Great Britain Geol. Survey Mem., Spec. Repts. Mineral Resources Great Britain, v. 29, 139 p., 1925.

Vanadium occurs in small amounts (about 0.1 percent V_2O_5) in some of these sedimentary iron ores.

01363 **Ham, W. F.** Asphaltite in the Ouachita Mountains: Oklahoma Geol. Survey Mineral Rept. 30, 12 p., 1956.

Data on vanadium content are given only for a deposit at Page, Okla.

Hamilton, L. F. *See* Lindgren, Waldemar. 00380

00111 **Hammond, Paul.** Geology of Allard Lake ilmenite deposits: Canadian Mining and Metall. Bull., v. 42, no. 443, p. 117–121, 1949.

Describes and appraises the vanadium-bearing titaniferous magnetite deposits.

01362 **Hammond, Paul.** Allard Lake ilmenite deposits: Econ. Geology, v. 47, p. 634–649, 1952.

Data on the vanadium content of the deposits are included.

01364 **Hanson, A. W.** The crystal structure of nolanite: Acta Cryst., v. 11, pt. 10, p. 703–709, 1958.

Haq, B. T. *See* Read, H. H. 00532

01203 **Haranczyk, C.** Copper-bearing Zechstein shales from the Wroclaw monocline (Lower Silesia) [in English]: Polska Akad. Nauk Bull., Ser. Sci. Géol. et Geog., v. 12, no. 1, p. 13–18, 1964; abs. *in* Chem. Abs., v. 61, col. 6806, 1964.

The copper-bearing shale contains 0.125 percent vanadium.

00918 **Harder, Hermann.** Über den Mineralbestand und die Entstehung einiger sedimentärer Eisenerze des Lias-gamma [Origin and mineral constituents of a sedimentary iron ore of the Lias-gamma formation]: Heidelberger Beitr. Mineralogie u. Petrographie, v. 2, p. 455–476, 1951.

01221 **Harding, W. D.** The Brazeau vanadium-bearing magnetite deposit, Papineau Township: Ontario Dept. Mines, Ann. Rept., 1944, v. 53, pt. 6, p. 48–51, 1946; abs. *in* Annot. Bibliography Econ. Geology, v. 19, p. 118, 1946.

00112 **Harki, Ilmari.** Discovery and mining methods at Finland's largest Fe-Ti-V mine: Mining World [Seattle], v. 18, no. 9, p. 62–63, 1956.

00270 **Harley, G. T.** The geology and ore deposits of Sierra County, New Mexico: New Mexico Bur. Mines and Mineral Resources Bull. 10, 220 p., 1934.

A brief description of base-metal vanadate deposits is given.

01298 **Harley, G. T.** The geology and ore deposits of northeastern New Mexico: New Mexico Bur. Mines and Mineral Resources Bull. 15, 104 p., 1940.

Reports the presence of roscoelite in a gold-bearing vein.

01299 **Harmon, G. F.; Taylor, P. S.** Geology and ore deposits of the Sandstone mine, southeastern Ambrosia Lake area, *in* Geology and technology of the Grants uranium region: New Mexico Bur. Mines and Mineral Resources Mem. 15, p. 102–107, 1963.

The uranium ore deposits that contain a little vanadium are described.

Harner, R. S. *See* Fryklund, V. C., Jr. 01253

00919 **Harrer, C. M.** Wyoming iron-ore deposits. Description, beneficiation processes, and economics: U.S. Bur. Mines Inf. Circ. 8315, 114 p., 1966.

01234 **Harris, J. F.** Summary of the geology of Tanganyika, Pt. 4—Economic geology: Tanganyika Geol. Survey Mem. 1, 143 p., 1961.

Reports that the only known occurrence of vanadium is in titaniferous magnetite deposits averaging about 0.67 percent V_2O_5 and containing 45 million tons of ore.

Hart, H. R. *See* Dickson, R. E. 00095

01300 **Hart, O. M.** Uranium deposits in the Pryor–Big Horn Mountains, Carbon County, Montana, and Big Horn County, Wyoming, *in* Survey of raw material resources: Geneva, United Nations, Internat. Conf. Peaceful Uses Atomic Energy, 2d, Proc., Sept. 1–13, 1958, v. 2, p. 523–526, 1958.

The uranium deposits in limestone also contain some vanadium

Hartl, Kurt. *See* Weiss, Armin. 00869

Hartley, J. *See* Kingsbury, A. W. G. 00569

01301 **Hartmann, Martin.** Einige geochemische Untersuchungen an Sandsteinen aus Perm und Trias [Geochemical investigations of Permian and Triassic sandstones]: Geochim. et Cosmochim. Acta, v. 27, p. 459–499 [with English Abstract p. 459], 1963.

The alteration of sandstone due to reducing environment of organic matter is described. The iron minerals originally present are altered and associated vanadium is released and moves in pore waters until it precipitates in reduced valence state in a reducing environment. Geochemical relations described seem to simulate some of those observed and postulated for the vanadium deposits in sandstone on the Colorado Plateau.

00001 **Hastings, J. S.** Exploration and development drilling in the Uravan mineral belt, *in* Geology of the Paradox Basin fold and fault belt: Four Corners Geol. Soc. Guidebook, 3d Field Conf. 1960, p. 115–117, 1960.

01302 **Hathaway, J. C.** Mix-layered structures in vanadium clays, *in* Geochemistry and mineralogy of the Colorado Plateau uranium ores: U.S. Geol. Survey Prof. Paper 320, p. 133–138, 1959.

00002 **Hattori, Tomio.** Titaniferous iron sand resources in Japan [in Japanese]: Japan Geol. Survey Rept., Spec. no. (E), p. 1–38, 1960.

Describes the geology and resources of vanadium-bearing black sands.

01303 **Hauptman, C. M.** The new uranium district of the Pryor Mountains in southern Montana and northern Wyoming: Colorado Mining Assoc., Natl. Western Mining Conf., 60th, Trans., 1957, v. 1, p. 52–58, 1957.

The uranium deposits in limestone also contain some vanadium.

01304 **Hausen, D. M.** Schoderite, a new phosphovanadate mineral from Nevada: Am. Mineralogist, v. 47, p. 637–648, 1962.

00920 **Hawley, C. C.; Wyant, D. G.; Brooks, D. B.** Geology and uranium deposits of the Temple Mountain district, Emery County, Utah: U.S. Geol. Survey Bull. 1192, 154 p., 1965.

01079 **Hawley, J. E.** Spectrographic studies of pyrite in some eastern Canadian gold mines: Econ. Geology, v. 47, p. 260–304, 1952.

Hazen, S. W., Jr. *See* Huleatt, W. P. 00008

Hazen, S. W., Jr. *See* Koch, G. S., Jr. 00287

Hazenbush, G. C. *See* Wright, L. A. 00953

01305 **Hazlett, G. W.; Kreek, Justin.** Geology and ore deposits of the southeastern part of the Ambrosia Lake area, *in* Geology and technology of the Grants uranium region: New Mexico Bur. Mines and Mineral Resources Mem. 15, p. 82–89, 1963.

Vanadium-bearing uranium deposits in sandstone are described.

01306 **Headlee, A. J. W.; Hunter, R. G.** Characteristics of minable coals in West Virginia. Pt. 5.—The inorganic elements in the coals: West Virginia Geol. Survey [Rept.] 13A, p. 36–122, 1955.

The content of vanadium and other elements is given for about 600 samples of coal and coal ash.

00003 **Heath, K. C. G.** Mining and metallurgical operations at Rhodesia Broken Hill—past, present, and future: Inst. Mining and Metallurgy Bull. 658, Trans., v. 70, p. 681–736, 1961.

Information on the occurrence, production, and reserves of base-metal vanadate ores is included in this report.

01307 **Hedström, Herman.** Om vanadinhaltigt stenkol i Västergötlands kambro-silur [On vanadium-bearing coal in the Cambro-silurian deposits in Västergötlands]: Sveriges Geol. Undersökning, Ser. C, no. 318, Årsbok 16 (1922), no. 8, p. 1–24, 1923.

00251 **Hegemann, Friedrich.** Die Herkunft des Mo, V, As und Cr im Wulfenit der alpinen Blei-Zinklagerstätten [The origin of molybdenum, vanadium, arsenic, and chromium in wulfenite of the alpine lead-zinc deposits]: Heidelberger Beitr. Mineralogie u. Petrographie, v. 1, nos. 5–6, p. 690–715, 1949; abs. *in* Chem. Abs., v. 44, col. 491, 1950.

Heikes, V. C. *See* Butler, B. S. 00176

Heikkinen, Aulis. *See* Vaasjoki, O. 00827

Heikkinen, Aulis. *See* Vaasjoki, O. 01167

Heindl, R. A. *See* MacMillan, R. T. 00304

Heinen, H. J. *See* Benson, W. T. 00125

01308 **Heinrich, E. W.; Levinson, A. A.** Studies in the mica group; X-ray data on roscoelite and barium muscovite: Am. Jour. Sci., v. 253, p. 39–43, 1955.

01309 **Henderson, E. P.** Steigerite, a new vanadium mineral: Am. Mineralogist, v. 20, p. 769–772, 1935.

01310 **Henderson, E. P.; Hess, F. L.** Corvusite and rilandite, new minerals from the Utah-Colorado carnotite region: Am. Mineralogist, v. 18, p. 195–205, 1933.

Henderson, E. P. *See* Hess, F. L. 01317

00252 **Hentze, Ernst.** Die Versorgung der Welt mit Molybdän, Vanadium und Wolfram [The world supply of molybdenum, vanadium, and tungsten]: Zeitschr. Berg-, Hütten-u. Salinenwesen Preuss. Staate, v. 79, no. 5, p. 274–302, 1931; abs. *in* Annot. Bibliography Econ. Geology, v. 4, p. 249, 1931.

01311 **Hermann, Felix.** Das naturliche Vorkommen des Vanadiums [The natural occurrence of vanadium]: Metallwirtschaft, v. 15, no. 43, p. 1007–1015, 1936; abs. *in* Annot. Bibliography Econ. Geology, v. 9, p. 289, 1936.

The distribution and geochemical cycle of vanadium in rock and ore deposits are discussed.

01191 **Hermann, R.** On the composition of lavrovite, as well as on vanadiolite, a new mineral [in Russian]: Moskov. Obshch. Ispytateley Prirody, v. 42, no. 4, p. 234–239, 1869; abs. titled "Uber die Zusammensetzung des Lawrowits, sowie über Vanadiolith, ein neues Mineral," *in* Neues Jahrb. Mineralogie, Geologie u. Paläontologie, 1870, p. 780–781, 1870.

00004 **Hernandez Aquije, Silvio.** El vanadio en el Perú [Vanadium in Peru]: Minería, v. 2, no. 5, p. 19–30, 1954; ibid., no. 6, p. 31–50, 1954; ibid., v. 4, no. 8, p. 21–22, and no. 9, p. 23–29, 1955.

Herring, B. F. *See* Kaiser, E. P. 00256

00005 **Hess, F. L.** Uranium, vanadium, radium, gold, silver and molybdenum sedimentary deposits, *in* Ore deposits of the Western States (Lindgren volume): New York, Am. Inst. Mining Metall. Engineers, p. 450–481, 1933.

Hess, F. L. *See* Hutchinson, W. S. 00009

01155 **Hess, F. L.** A hypothesis for the origin of the carnotites of Colorado and Utah: Econ. Geology, v. 9, p. 675–688, 1914.

01156 **Hess, F. L.** Vanadium: U.S. Bur. Mines Inf. Circ. 6572, 8 p., 1932.

Hess, F. L. *See* Foshag, W. F. 01245

Hess, F. L. *See* Henderson, E. P. 01310

01312 **Hess, F. L.** Notes on the vanadium deposits near Placerville, Colorado: U.S. Geol. Survey Bull. 530-K, p. 142–156, 1913.

01313 **Hess, F. L.** Vanadium in Sierra de los Caballos, New Mexico: U.S. Geol. Survey Bull. 530-K, p. 157–160, 1913.

01314 **Hess, F. L.** Uranium-bearing asphaltite sediments of Utah: Eng. Mining Jour., v. 114, no. 7, p. 272–276, 1922.

The uranium deposits, which also contain recoverable amounts of vanadium, are described.

01315 **Hess, F. L.** New and known minerals from the Utah-Colorado carnotite region: U.S. Geol. Survey Bull. 750-D, p. 63–78, 1924 [1925].

01316 **Hess, F. L.; Foshag, W. F.** Crystalline carnotite from Utah: U.S. Natl. Mus. Proc., v. 72, no. 2708, 6 p., 1927.

01317 **Hess, F. L.; Henderson, E. P.** Fervanite, a hydrous ferric vanadate: Am. Mineralogist, v. 16, no. 7, p. 273–277, 1931.

01318 **Hess, F. L.; Schaller, W. T.** Pintadoite and uvanite, two new vanadium minerals from Utah, a preliminary note: Washington Acad. Sci. Jour., v. 4, p. 576–579, 1914.

Hess, H. *See* Volborth, Alexander. 00842

01319 **Hevesy, G. V.; Alexander, E.; Würstlin, K.** Die Häufigkeit der Elemente der Vanadiumgruppe in Eruptivgesteinen [The abundance of elements of the vanadium group in eruptive rocks]: Zeitschr. Anorganische u. Allgemeine Chemie, v. 194, p. 316–322, 1930; abs. *in* Mineralog. Abs., v. 5, p. 8, 1934.

The abundance and geochemical relations of the vanadium-group elements (vanadium, niobium, tantalum, protactinium, and radium) in eruptive rocks are discussed.

00006 **Hewett, D. F.** The story of Mina Ragra—Premier vanadium find: Eng. Mining Jour., v. 148, no. 1, p. 59–63, 1947.

01080 **Hewett, D. F.; Fleischer, Michael; Conklin, Nancy.** Deposits of the manganese oxides; supplement: Econ. Geology, v. 58, p. 1–51, 1963.

01117 **Hewett, D. F.; Fleischer, Michael.** Deposits of the manganese oxides: Econ. Geology, v. 55, p. 1–55, 1960.

The presence of small amounts of vanadium in some samples of manganese minerals and ores is shown by the analyses given.

01320 **Hewett, D. F.** A new occurrence of vanadium in Peru: Eng. Mining Jour., v. 82, p. 385, 1906.

01321 **Hewett, D. F.** Vanadium deposits in Peru: Am. Inst. Mining Engineers Trans., v. 40, p. 274–299, [1909]1910.

01322 **Hewett, D. F.** Carnotite in southern Nevada: Eng. Mining Jour., v. 115, p. 232–235, 1923.

01323 **Hewett, D. F.** Zonal relations of the lodes of the Sumpter quadrangle: Am. Inst. Mining Metall. Engineers Trans., v. 96, p. 305–346, 1931.

Vanadium-bearing mica, roscoelite, is reported in a few gold-bearing veins.

01324 **Hewett, D. F.** Geology and ore deposits of the Goodsprings quadrangle, Nevada: U.S. Geol. Survey Prof. Paper 162, 172 p., 1931.

Vanadate minerals are reported in several mines in the Goodsprings area.

01325 **Hewett, D. F.** Geology and mineral resources of the Ivanpah quadrangle, California and Nevada: U.S. Geol. Survey Prof. Paper 275, 172 p., 1956.

A table shows the distribulion of vanadate minerals in the individual mines.

Hewitt, W. P. *See* Signer, C. M. 00332

01326 **Hewitt, W. P.** Geology and mineralization of the San Antonio mine, Santa Eulalia district, Chihuahua, Mexico: Geol. Soc. America Bull., v. 54, p. 173–204, 1943; Geología y mineralización de la mina San Antonio, distrito minero de Santa Eulalia, estado de Chihuahua: México Inst. Nac. Inv. Recursos Minerales Bol. no. 28, 39 p., 1951.

A description is included of the occurrence of base-metal vanadate ore in the oxidized zone.

00921 **Hey, M. H.** Twenty-fourth list of new mineral names: Mineralog. Mag., v. 35, p. 1126–1164, 1966.

01327 **Hey, M. H.** An index of mineral species and varieties arranged chemically, with an alphabetical index of accepted mineral names and synonyms [2d revised ed. reprinted with corrections]: London, Jarrold and Sons Ltd., Norwich, 728 p., 1962.

01328 **Hey, M. H.** Appendix to the second edition of an index of mineral species and varieties arranged chemically: London, Eyre and Spottiswoode Limited, 135 p., 1963.

01330 **Heyl, A. V.; Bozion, C. N.** Oxidized zinc deposits of the United States. I.—General geology: U.S. Geol. Survey Bull. 1135-A, 52 p., 1962.

A brief discussion is included of base-metal vanadate minerals and their distribution in the United States.

01329 **Heyl, A. V., Jr.** Zoning of the Bitter Creek vanadium-uranium deposit near Uravan, Colorado: U.S. Geol. Survey Bull. 1042-F, p. 187-201, 1957.

00007 **Higazy, R. A.; Naguib, A. G.** A study of the Egyptian monazite-bearing black sands, *in* Survey of raw material resources: Geneva, United Nations, Internat. Conf. Peaceful Uses Atomic Energy, 2d, Proc., Sept. 1-13, 1958, v. 2, p. 658-662, 1958.

Hilke, K. J. *See* Weiss, Armin. 00870

Hill, W. L. *See* Jacob, K. D. 00271

01199 **Hill, W. L.; Marshall, H. L.; Jacob, K. D.** Minor metallic constituents of phosphate rock: Indus. Eng. Chemistry, Indus. ed., v. 24, p. 1306-1312, 1932; abs. *in* Chem. Abs., v. 27, p. 363, 1933.

00253 **Hillebrand, W. F.** The vanadium sulphide, patronite and its mineral associates from Minasragra, Peru: Am. Chem. Soc. Jour., v. 29, no. 7, p. 1019-1029, 1907; also *in* Am. Jour. Sci., 4th ser., v. 24, p. 141-151, 1907.

01192 **Hillebrand, W. F.; Merwin, H. E.** Two varieties of calciovolborthite (?) from eastern Utah: Am. Jour. Sci., 4th ser., v. 35, p. 441-445, 1913.

01331 **Hillebrand, W. F.** Distribution and quantitative occurrence of vanadium and molybdenum in rocks of the United States: Am. Jour. Sci., 4th ser., v. 6, no. 33, p. 209-216, 1898; *also in* U.S. Geol. Survey Bull. 167, p. 49-55, 1900.

01332 **Hillebrand, W. F.** Carnotite and tyuyamunite and their ores in Colorado and Utah: Am. Jour. Sci., 5th ser., v. 8, p. 201-216, 1924.

01333 **Hillebrand, W. F.; Merwin, H. E.; Wright, F. E.** Hewettite, metahewettite, and pascoite, hydrous calcium vanadates: Am. Philos. Soc. Proc., v. 53, p. 31-54, 1914.

01334 **Hillebrand, W. F.; Ransome, F. L.** On carnotite and associated vanadiferous minerals in western Colorado: Am. Jour. Sci., 4th ser., v. 10, p. 120-144, 1900; also *in* U.S. Geol. Survey Bull. 262, p. 9-31, 1905.

01335 **Hillebrand, W. F.; Turner, H. W.** On roscoelite; with a note on its chemical constitution by F. W. Clarke: Am. Jour. Sci., 4th ser., v. 7, p. 451-458, 1899.

Hilpert, L. S. *See* Fischer, R. P. 00240

01336 **Hilpert, L. S.; Moench, R. H.** Uranium deposits of the southern part of the San Juan Basin, New Mexico, *in* Survey of raw material resources: Geneva, United Nations, Internat. Conf. Peaceful Uses Atomic Energy, 2d, Proc., Sept. 1-13, 1958, v. 2, p. 527-538, 1958; *revised in* Econ. Geology, v. 55, no. 3, p. 429-464, 1960.

The uranium deposits in sandstone and limestone also contain small amounts of vanadium.

Hinrichs, E. N. *See* Smith, J. F., Jr. 00697

01081 **Hirai, Keizo.** Rarer elements in soils—I. Vanadium contents in soils [in Japanese(?)]: Nihon Dojô Hiryôgaku Zasshi, v. 11, p. 279-283, 1937; abs. *in* Chem. Abs., v. 31, col. 7804, 1937.

The average of all samples is 0.018 percent V_2O_5 and the range in average of samples of soils developed on rocks of several types and geologic ages is 0.010 to 0.032 percent V_2O_5.

01337 **Hirst, D. M.** The geochemistry of modern sediments from the Gulf of Paria. II—The location and distribution of trace elements: Geochim. et Cosmochim. Acta, v. 26, p. 1147–1187, 1962.

Includes information on the geochemistry of vanadium and its abundance in sands, clays, and iron-rich parts.

01338 **Hitchon, Brian.** The geochemistry, mineralogy, and origin of pegmatites from three Scottish Pre-Cambrian metamorphic complexes, *in* Minerals and genesis of pegmatites: Internat. Geol. Cong., 21st, Copenhagen 1960, Rept., v. 17, p. 36–52, 1960.

The content of vanadium and other elements in pegmatites and constituent minerals is given and the geochemistry and origin of these pegmatites is discussed.

01339 **Hjelmqvist, Sven.** The titaniferous iron-ore deposit of Taberg in the south of Sweden [in English]: Sveriges Geol. Undersökning, Ser. C, no. 512, Årsbok 43, no. 10 (1949), p. 1–55, 1950.

Includes information on the vanadium content.

01340 **Hodge-Smith, T.** Mineralogical notes, no. V: Australian Mus., Rec., v. 19, p. 165–176, 1934.

A description of vanadinite from Broken Hill, New South Wales is given.

Hodgson, G. W. *See* Scott, Jean. 00674

01342 **Hodgson, G. W.; Baker, B. L.** Geochemical aspects of petroleum migration in Pembina, Redwater, Joffre, and Lloyd-Minster oil fields of Alberta and Saskatchewan, Canada: Am. Assoc. Petroleum Geologists Bull., v. 43, p. 311–328, 1959.

The vanadium and nickel content of numerous samples of crude oil is reported and interpreted from the standpoint of source of oil.

Hoffman, Vladimir. *See* Novák, František. 00489

Holager, T. M. *See* Christensen, K. W. 00996

Holbrook, D. F. *See* Fryklund, V. C., Jr. 01254

01341 **Holler, Herbert.** Vanadium-Minerale und ihre genetische Position in der Bleiberger Lagerstätte [Vanadium minerals and their genetic relations in the ore deposits of Bleiberg, Austria]: Beitr. Naturw. Heimatk. Kärntens, Richard Canaval Festschr., Sonderheft [III], p. 120–125, 1935.

The occurrence of fine needles of vanadate minerals is briefly described.

00922 **Hollingsworth, J. S.** Geology of the Wilson Springs vanadium deposits, Garland County, Arkansas, *in* Central Arkansas, economic geology and petrology: Geol. Soc. America Guidebook, Field Conf., Nov. 18–19, 1967, p. 22–28; prepared by Arkansas Geol. Comm., 1967.

Holmes, C. N. *See* Craig, L. C. 00214

Holmes, R. S. *See* Slater, C. S. 00695

Hoppin, R. A. *See* McKelvey, V. E. 00404

Horne, J. E. T. *See* Bannister, F. A. 00072

Horr, C. A. *See* Erickson, R. L. 00452

Hosford, G. F. *See* Smith, L. E. 00698

00254 **Hostetler, P. B.; Garrels, R. M.** Transportation and precipitation of uranium and vanadium at low temperatures, with special reference to sandstone-type uranium deposits: Econ. Geology, v. 57, no. 2, p. 137–167, 1962.

Houser, F. N. *See* Ekren, E. B. 00903

01343 **Houston, R. S.; Murphy, J. F.** Titaniferous black sandstone deposits of Wyoming: Wyoming Geol. Survey Bull. 49, 120 p., 1962.

Includes information on the vanadium content of samples.

01344 **Hsing, Feng-Ming.** Genesis of the titanomagnetite deposits of Panchihua [in Chinese]: Ti-chih lun-p'ing, v. 19, p. 421–425, 1959; abs. *in*, Chem. Abs., v. 54, col. 6421, 1960.

Hueber, H. *See* Dittler, E. 00420

Huff, L. C. *See* Smith, J. F., Jr. 00697

01345 **Huff, L. C.; Lesure, F. G.** Diffusion features of uranium-vanadium deposits in Montezuma Canyon, Utah: Econ. Geology, v. 57, no. 2, p. 226–237, 1962.

00008 **Huleatt, W. P.; Hazen, S. W., Jr.; Traver, W. M., Jr.** Exploration of vanadium region of western Colorado and eastern Utah: U.S. Bur. Mines Rept. Inv. 3930, 30 p., 1946.

Hultgren, Ralph. *See* Pauling, Linus. 00631

00987 **Hummel, K.** Vein-shaped, vanadium-rich secondary coal in the Ladinic strata of Codevole-Gebiets southern Alps [in German]: Centralbl. Mineralogie, Geologie u. Paläontologie, Abt. B, p. 10–15, 1932; abs. *in* Annot. Bibliography Econ. Geology, v. 5, p. 291–292, 1932.

Hunt, W. F. *See* Larsen, E. S., Jr. 00606

Hunter, R. G. *See* Headlee, A. J. W. 01306

Hurst, T. L. *See* Koerner, E. L. 00929

00009 **Hutchinson, W. S.; Boericke, H.; Hess, F. L.** Report of the subcommittee on vanadium, *in* International control of minerals: New York, Mining and Metallurgical Society of America, *and* American Institute of Mining Metallurgical Engineers, p. 151–171, 1925.

01346 **Huttl, J. B.** Mammoth-St. Anthony's complex operations: Eng. Mining Jour., v. 142, no. 12, p. 42–45, 1941.

Includes a brief description of the occurrence and production of base-metal vanadate minerals.

00255 **Hutton, C. O.** The titaniferous ironsands of Patea, with an account of the heavy residues in the underlying sedimentary series: New Zealand Jour. Sci. and Technology, v. 21, Sec. B, no. 4, p. 190–205, 1940.

01347 **Hutton, C. O.** The ironsands of Fitzroy, New Plymouth: New Zealand Jour. Sci. and Technology, v. 26, Sec. B, no. 6, p. 291–302, 1944–45.

01348 **Hutton, C. O.** Vanadium in the Taranaki titaniferous iron-ores: New Zealand Jour. Sci. and Technology, v. 27, Sec. B, no. 1, p. 15–16, 1945.

01349 **Hutton, C. O.** Sengierite from Bisbee, Arizona: Am. Mineralogist, v. 42, p. 408–411, 1957.

01350 **Hyden, H. J.** Distribution of uranium and other metals, *in* Uranium and other metals in crude oils: U.S. Geol. Survey Bull. 1100-B, p. 17–97, 1961.

Information on the amount and occurrence of vanadium and other metals is included.

Ignatova, L. I. *See* Kurbatov, I. D. 00594

01351 **Iles, M. W.** On the occurrence of vanadium in the Leadville ores: Am. Jour. Sci., 3d ser., v. 23, p. 381, 1882.

The occurrence of base-metal vanadate minerals in oxidized ore in the Leadville area is reported.

Iliev, A. *See* Uzunov, I. 01035

01352 **Imreh, Lazlo; Nicolini, Pierre.** Les minéralisations cuprifères du "continental intercalaire" d'Agadez (République du Niger) [Copper mineralization of "continental interbeds" in Agadez (Republic of Niger)]: France Bur. Recherches Géol. et Minières Bull., no. 3, p. 51–108, 1962; abs. *in* Chem. Abs., v. 58, col. 6585, 1963.

Describes deposits of uranium and copper with some vanadium in sandstone.

00923 **Iriye, Toshiaki.** Geochemical investigations of green tuff. IV. Vanadium [in Japanese]: Nippon Kagaku Zasshi, v. 85, no. 12, p. 854–858, 1964; abs. *in* Chem. Abs., v. 63, col. 381, 1965.

01353 **Isachsen, Y. W.** Ore deposits of the Big Indian Wash–Lisbon Valley area, *in* Guidebook to the geology of Utah: Utah Geol. Soc. Guidebook, no. 9, p. 95–105, 1954.

Some of the deposits described contain some vanadium.

01354 **Isachsen, Y. W.** Geology of uranium deposits of the Shinarump and Chinle formations on the Colorado Plateau, *in* Geology of uranium and thorium: New York, United Nations, Internat. Conf. Peaceful Uses Atomic Energy, Proc., Aug. 8–20, 1955, v. 6, p. 350–367, 1956; revised *in* U.S. Geol. Survey Prof. Paper 300, p. 263–280, 1956.

Some of the deposits described contain vanadium.

01082 **Ishibashi, M.** Minute elements in sea-water [in Japanese(?)]: Kasumigaseki, Chiyoda-ku, new ser., v. 1, p. 88–92, 1953; abs. *in* Chem. Abs., v. 48, col. 6175, 1954.

01083 **Ishikawa, Hideo; Kuroda, Rokuro; Sudo, Toshio.** Minor elements in some altered zones of "Kuroko" (Black Ore) deposits in Japan: Econ. Geology, v. 57, p. 785–789, 1962.

The distribution of vanadium and other elements and their possible use in geochemical prospecting are described.

01125 **Ishikawa, Hideo; Sudo, Toshio.** Distribution of trace elements in the altered zones of certain Kuroko deposits [in Japanese with English summary]: Kozan Chishitsu, v. 7, p. 112–117, 1957; abs. *in* Chem. Abs., v. 53, col. 1001, 1959.

The distribution of vanadium and other elements and their possible use in geochemical prospecting are described.

Itkina, E. S. *See* Gulyayeva, L. A. 00241

Itkina, E. S. *See* Gulyayeva, L. A. 01296

01355 **Ito, Jun.** Synthesis of vanadium silicates; haradaite, goldmanite and roscoelite [in English]: Mineralog. Jour. [Japan], v. 4, no. 4, p. 299–316, 1965.

01356 **Itsikson, M. I.; Rusanov, A. K.** Scattered elements in cassiterite deposits of the Far East. (According to spectral-analytical data) [In Russian]: Akad. Nauk SSSR Izv. Ser. Geol., 1946, no. 5, p. 119–130, 1946; abs. *in* Chem. Zentralbl., v. 1, p. 1168, 1947.

The vanadium content of samples is about equal to the crustal average or less.

01357 **Iwasaki, Iwaji; Katsura, Takashi.** Vanadium content of volcanic rocks, I.: Kyûshû Univ., Repts. Research Sci. Dept., v. 1, p. 76–85, 1950; abs. *in* Chem. Abs., v. 46, col. 68, 1952.

Iyer, V. G. *See* Swarup, D. 00786

Izett, G. A. *See* Bergendahl, M. H. 00135

Izett, G. A. *See* Davis, R. E. 00356

00010 **Izmodenov, A. I.; Lachko, O. A.** Industrial experiments on beneficiation of complex ores of Volkovo deposit [in Russian]: TSvet. Metally, v. 32, no. 1, p. 19–21, 1959; abs. *in* Chem. Abs., v. 53, col. 12114, 1959.

Describes treatment to make a concentrate containing 59.8 percent Fe and 1.12 percent V_2O_5 from complex ore containing 18.4 percent Fe, 0.34 percent V_2O_5, 5.5 percent P_2O_5, and 0.8 percent Cu.

Jackson, E. J. *See* Langton, G. 00604

01222 **Jackson, O. A. E.** The production of electrolytic zinc and vanadic oxide at Broken Hill, Northern Rhodesia: Chem. Metall. Mining Soc. South Africa Jour., v. 36, no. 7, p. 173–182, 1936; abs. *in* Annot. Bibliography Econ. Geology, v. 9, p. 56, 1936.

Includes a description of the ore and ore bodies.

00271 **Jacob, K. D.; Hill, W. L.; Marshall, H. L.; Reynolds, D. S.** The composition and distribution of phosphate rocks with special reference to the United States: U.S. Dept. Agriculture Tech. Bull. 364, 90 p., 1933.

Includes some analytical data on vanadium content of domestic and foreign phosphate rocks. All reported are very low in vanadium except those in Idaho and adjacent states.

Jacob, K. D. *See* Hill, W. L. 01199

00077 **Jaffé, F. C.** Phosphate rock in the western United States: Colorado School Mines Mineral Industries Bull., v. 4, no. 5, 11 p., 1961.

A brief summary of the occurrence and possible byproduct recovery of vanadium is included.

00272 **Jambor, J. L.** Volborthite from British Columbia: Am. Mineralogist, v. 45, p. 1307–1309, 1960.

00273 **Jambor, J. L.** Vanadium-bearing interlava sediment from the Campbell River area, British Columbia [abs.]: Canadian Mining Jour., v. 81, no. 10, p. 133, 1960.

00274 **Jambor, J. L.; Lachance, G. R.** On kolovratite: Canadian Mineralogist, v. 7, pt. 2, p. 311–314, 1962.

00275 **James, A. H.; Dennen, W. H.** Trace ferrides in the magnetite ores of the Mount Hope mine and the New Jersey Highlands: Econ. Geology, v. 57, p. 439–449, 1962.

Describes the abundance and geochemical significance of vanadium and other trace metals in the wall rocks and non-titaniferous magnetite ores.

00924 **James, H. L.** Chemistry of the iron-rich sedimentary rocks, *in* Data of geochemistry [6th ed.]: U.S. Geol. Survey Prof. Paper 440-W, 61 p., 1961.

James, W. T. *See* Junner, N. R. 00282

01198 **Jamotte, A.** Sur la présence de sulvanite (sulfure de cuivre et de vanadium) au Katanga méridional [On the presence of sulvanite (a sulfide of copper and vanadium) from Katanga méridional]: Soc. Belge Géologie, Paléontologie et Hydrologie Bull., v. 48, p. 500–504, 1938.

Janda, I. *See* Brandenstein, M. 00164

00276 **Janda, I.; Schroll, Erich.** Geochemische Untersuchungen an Graphitgesteinen [Geochemical studies of graphitic rocks], *in* Geochemical cycles: Internat. Geol. Cong., 21st, Copenhagen 1960, Rept., v. 1, p. 40–53, 1960.

Gives data on the content of 24 elements in 104 samples of graphitic rocks and discusses their geochemical relations.

00011 **Japan Geological Survey.** Vanadium [in English], *in* Geology and mineral resources of Japan, 1st ed.: Japan Geol. Survey, p. 194, 1956; 2d ed., p. 203, 1960.

Includes a brief description of the vanadium-bearing iron-sand beach deposits.

00277 **Jarkovský, Jan; Kupčo, Gejzo.** Príspevok ku geochémii stopových prvkov, najmä vanádu [The geochemistry of trace elements, especially vanadium (with German summ.)]: Geol. Práce, Zpravy, 1956, no. 7, p. 101–108, 1956.

Presents analytical data from 16 samples of bituminous shale (about 0.1 percent V_2O_5) and coal (tr to 0.1 percent V_2O_5) and discusses geochemical relations.

Jarkovsky, Jan. *See* Cambel, Bohuslav. 00896

Jenkins, J. N. *See* Perrin, T. S. 00318

Jenkins, W. S. *See* Parsons, C. S. 01209

01084 **Jenson, M. L.** Sulfur isotopes and the origin of sandstone-type uranium deposits: Econ. Geology, v. 53, p. 598–616, 1958.

01085 **Jicha, H. L., Jr.** Paragenesis of the ores of the Palomas (Hermosa) district, southwestern New Mexico: Econ. Geology, v. 49, p. 759–778, 1954.

A brief description of the occurrence of vanadate minerals in oxidized base-metal deposits is included.

00278 **Johan, Zdeněk.** Kuprit s obsahem vanadia z Popelek u Lomnice nad Popelkou [A vanadium-containing cuprite from Popelky near Lomnice on Popelka (with English summ.)]: Acta Univ. Carolinae Geol., 1960, no. 1, p. 51–59, 1960.

Describes the occurrence of vanadium-bearing cuprite of hydrothermal origin and the relation of vanadium to the cuprite crystal structure.

Johan, Zdeněk. *See* Padera, K. 00617

00012 **Johnson, H. S., Jr.** Uranium resources of the San Rafael district, Emery County, Utah, a regional synthesis: U.S. Geol. Survey Bull. 1046-D, p. 37–54, 1957.

Briefly describes the geology and uranium deposits, some of which contain vanadium, and appraises undiscovered resources on the basis of stratigraphic position, geologic habits, and size distribution of known deposits.

00013 **Johnson, H. S., Jr.** Uranium resources of the Green River and Henry Mountains districts, Utah—A regional synthesis: U.S. Geol. Survey Bull. 1087-C, p. 59–104, 1959.

Briefly describes the geology and uranium deposits, some of which contain vanadium, and appraises undiscovered resources on the basis of stratigraphic position, geologic habits, and size distribution of known deposits.

00925 **Johnson, H. S. Jr.; Thordarson, William.** Uranium deposits of the Moab, Monticello, White Canyon, and Monument Valley districts, Utah and Arizona: U.S. Geol. Survey Bull. 1222-H, p. H1–H53, 1966.

Johnston, J. D. *See* Parsons, C. S. 01209

00015 **Johnston, J. F. W.** On the discovery of vanadium in Scotland, and on the vanadate of lead, a new mineral species: Edinburgh Jour. Sci., new ser., v. 5, p. 166–169, 318–325, 1831; abs. *in* Neues Jahrb. Mineralogie, Geognosie, Geologie u. Petrefaktenkunde, 1833, p. 199, 1833.

00014 **Johnstone, S. J.** Minerals for the chemical and allied industries: London, Chapman and Hall, Ltd., 652 p., 1954.

Summarizes data on vanadium materials available to and used by industry.

00279 **Jǿng, W. F., de; Lange, J. J., de.** X-ray study of pucherite: Am. Mineralogist, v. 21, p. 809, 1936.

Joseph, T. L. *See* Wood, C. E. 00947

00280 **Jost, Konrad.** Über den Vanadiumgehalt der Sedimentagesteine und sedimentären Lagerstätten [Vanadium content of sedimentary rocks and sedimentary deposits]: Chemie der Erde, v. 7, no. 2, p. 177–290, 1932.

00281 **Jost, Konrad.** Vorkommen und Konzentrationsverlauf des Vanadiums in der sedimentären Abfolge [Occurrence and concentration of vanadium in sedimentary series]: Metallwirtschaft, v. 11, no. 38, p. 511–514, 1932.

Joswig, Werner. *See* Takéuchi, Yoshio. 01027

00016 **Julihn, C. E.; Moon, L. B.** Summary of Bureau of Mines exploration projects on deposits of raw material resources for steel production: U.S. Bur. Mines Rept. Inv. 3801, 35 p., 1945.

Includes a tabulation of tonnage and grade of vanadium-bearing reserves shown by USBM exploration in graphitic schists of Alabama; sandstone deposits of Colorado and Utah; shale at Mercur Dome, Utah; and shale in Wyoming.

00282 **Junner, N. R.; James, W. T.** Chemical analyses of Gold Coast rocks, ores and minerals: Gold Coast Geol. Survey Bull. 15, p. 1–56, 1947.

Many analyses are given, some of which show vanadium.

00256 **Kaiser, E. P.; Herring, B. F.; Rabbitt, J. C.** Minor elements in some rocks, ores, and mill and smelter products: U.S. Geol. Survey TEI Rept. 415, 119 p., 1954. Issued by U.S. Atomic Energy Comm. Tech. Inf. Service, Oak Ridge, Tenn.

Kaiser, E. P. *See* Fryklund, V. C., Jr. 01253

Kalmurzaev, K. E. *See* Adyshev, M. M. 00890

Kargin, V. A. *See* Kurbatov, I. D. 00595

00257 **Kashirtseva, M. F.** Rasprostranenie malykh elementov v medistykh peschanikakh zapadnogo Priural'ya [Distribution of trace elements in cupriferous sandstones of the western Urals]: Sovetskaya Geologiya, 1962, no. 7, p. 136–142, 1962; abs. *in* Chem. Abs., v. 57, col. 13437, 1962.

The genesis and mode of accumulation of unusual amounts of vanadium and other elements in these deposits are discussed.

00258 **Katchenkov, S. M.** Malye khimicheskie elementy v osadochnykh porodakh i neftyakh [Chemical microelements in sedimentary rocks and in petroleum]: Vses. Neft. Nauchno-Issled. Geol.-Razved. Inst. Trudy, nov. ser., no. 143, 271 p., 1959; abs. *in* Chem. Abs., v. 54, cols. 19349–19352, 1960.

Contains a comprehensive discussion and a vast amount of analytical data on the abundance and association of trace elements in rocks of many types and ages in central Russia (region of the Russian platform). The text is divided into the following main parts: Distribution of chemical elements in Paleozoic deposits of the Volga-Ural region, in the Permian and Meso-Cenozoic deposits of the Ural-Emba region, in the Meso-Cenozoic deposits of the northeastern Caucasus, in main types of rocks in platform and geosynclinal regions, in natural waters and in petroleum.

00259 **Katchenkov, S. M.** O raspredelenii khimicheskikh elementov v glinakh i glinistykh mineralakh [Distribution of chemical elements in clays and clay minerals: Vses. Neft. Nauchno-Issled. Geol.-Razved. Inst. Trudy, nov. ser., no. 174, p. 98–108, 1961; abs. *in* Chem. Abs., v. 56, col. 13861, 1962.

Describes the geochemical relations that influence the accumulation of trace elements in clays during sedimentation and diagenesis.

00260 **Katchenkov, S. M.** K geokhimii elementov semeystva zheleza v neftyakh [Geochemistry of elements of the iron group in oil]: Vses. Neft. Nauchno-Issled. Geol.-Razved. Inst. Trudy, nov. ser., no. 212, p. 23–26, 1963; abs. *in* Chem. Abs., v. 60, col. 14286, 1964.

The relation of vanadium and nickel in oils to the paleogeographic and climatic conditions of sedimentation of the source beds is discussed.

00261 **Katchenkov, S. M.; Katchenkova, N. S.** Malye elementy v zole kaustobiolitov [Trace elements in the ashes of caustobioliths]: Vses. [Neft.] Nauchno-Issled. Geol.-Razved. Inst. Trudy, nov. ser., no. 155, p. 90–96, 1960; abs. *in* Chem. Abs., v. 55, col. 16296, 1961.

Presents analytical data on the average content of trace elements in samples of coal, organic-rich shale, and oil and their ashes from many places in western Europe and Asia and discusses the geochemical relations of vanadium with other elements. The average content of vanadium increases from coal ash (0.001 percent V) to shale ash (0.1 percent V) to oil ash (0.5 percent V).

Katchenkova, N. S. *See* Katchenkov, S. M. 00261

01086 **Katsura, Takashi.** Geochemical investigations of volcanoes in Japan [in Japanese]: Nippon Kagaku Zasshi, v. 77, 1956; abs. *in* Chem. Abs., v. 51, col. 15352, 1957, and v. 52, col. 995, 1958.

The vanadium content of three groups of volcanic rocks is discussed on pages 358–363, 1076–1081, and 1196–1201.

Katsura, Takashi. *See* Iwasaki, Iwaji. 01357

00262 **Katushenok, I. I.** O mestorozhdeniyakh vanadistykh titanomagnetitov na Kuril'skikh ostrovakh [Deposits of vanadium-containing titaniferous magnetites on the Kuril Islands]: Akad. Nauk SSSR Sakhalin. Kompleks. Nauchno-Issled. Inst., Soobshch., 1959, no. 7, p. 3–32, 1959.

The beach-sand deposits containing heavy minerals are described.

00263 **Kavardin, G. I.** K mineralogii sploshnykh titanomagnetitovykh rud Tsaginskogo mestorozhdeniya [Mineralogy of the dense titanomagnetite ores of the Tsaginsk deposit]: Voprosy Geologii i Mineralogii Kol'skogo Poluostrova, no. 2, p. 229–244, 1960; abs. *in* Chem. Abs., v. 56, col. 11265, 1962.

Describes the mineral composition of these ores, which contain about 0.43 percent V_2O_5.

00264 **Kavardin, G. I.** O sul'fidnom medno-nikelevom rudoproyavlenii v Tsaginskom massive gabbro-labradoritov [The copper-nickel sulfide ores in the Tsaginsk gabbro-labradorite massif]: Voprosy Geologii i Mineralogii Kol'skogo Poluostrova, no. 3, p. 39–49, 1960; abs. *in* Chem. Abs., v. 55, col. 15239–15240, 1961.

The deposit is a vanadium-bearing titaniferous magnetite with copper and nickel minerals.

Keith, M. L. *See* Degens, E. T. 00407

01159 **Keith, M. L.; Cruft, E. F.; Dahlberg, E. C.** Trace metals in stream sediment of southeastern Pennsylvania; I. Geochemical prospecting guide based on regional distribution of zinc, copper, nickel, cobalt, chromium, and vanadium: Pennsylvania Univ., Mineral Ind. Expt. Sta. Bull. no. 82, 14 p., 1967.

00265 **Keithley, H. S.** Apache vanadium mine (Gila Co., Arizona): Rocks and Minerals, v. 20, no. 12, p. 591, 1945.

Keller, W. D. *See* Muilenburg, G. A. 00735

00266 **Kelley, D. R.; Kerr, P. F.** Clay alteration and ore, Temple Mountain, Utah: Geol. Soc. America Bull., v. 68, p. 1101–1116, 1957.

Describes the type and occurrence of clay minerals associated with uranium-vanadium deposits in sandstone.

00267 **Kelley, D. R.; Kerr, P. F.** Urano-organic ore at Temple Mountain, Utah: Geol. Soc. America Bull., v. 69, p. 701–756, 1958.

The uranium ore in sandstone also contains vanadium.

Kelley, K. K. *See* Mah, A. J. 00701

00268 **Kelley, V. C.** Regional tectonics of the Colorado Plateau and relationship to the origin and distribution of uranium: New Mexico Univ. Pubs. Geology, no. 5, 120 p., 1955.

00269 **Kelley, V. C.; Silver, Caswell.** Geology of the Caballo Mountains: New Mexico Univ. Pubs. Geology, no. 4, 286 p., 1952.

A description of the base-metal vanadate deposits is included.

00283 **Kelly, S. F.** Geological studies of vanadium-uranium deposits by geophysical exploration methods: Mining Cong. Jour., v. 27, no. 8, p. 27–35, 1941.

00556 **Kelsey, C. H.; Barnes, W. H.** The crystal structure of metarossite: Canadian Mineralogist, v. 6, pt. 4, p. 448–466, 1960, *and* ibid., pt. 5, p. 697, 1961.

01205 **Kemp, D. M.; Smales, A. A.** The determination of vanadium in rocks and meteorites by neutron-activation analysis [in English]: Anal. Chim. Acta, v. 23, p. 397–410, 1960.

00557 **Kennedy, V. C.** Origin of uranium-vanadium deposits in the Lisbon Valley area, San Juan County, Utah [abs.]: Geol. Soc. America Bull., v. 71, no. 12, pt. 2, p. 1904, 1960; also *in* Econ. Geology, v. 55, p. 1339–1340, 1960.

00558 **Kennedy, V. C.** Geochemical studies of mineral deposits in the Lisbon Valley area, San Juan County, Utah: U.S. Geol. Survey open-file report 617, 157 p., 1961.

Discusses the content of major and minor elements and their geologic distribution and genetic implications in deposits of uranium-vanadium, copper and manganese.

Kerr, P. F. *See* Kelley, D. R. 00266

Kerr, P. F. *See* Kelley, D. R. 00267

Kerr, P. F. *See* Vaes, J. F. 01104

01210 **Kerr, P. F.** Uranium emplacement in the Colorado Plateau: Geol. Soc. America Bull., v. 69, p. 1075–1112, 1958.

Some of the deposits described also contain vanadium.

Kerr, P. F. *See* Graf, D. L. 01277

00559 **Ketelaar, J. A. A.** Die Kristallstruktur des Vanadinpentoxyds [The crystal structure of vanadium pentoxides]: Zeitschr. Kristallographie, v. 95, p. 9–27, 1936; abs. *in* Mineralog. Abs., v. 6, p. 410–411, 1937.

00560 **Ketelaar, J. A. A.** Crystal structure and shape of colloidal particles of vanadium pentoxide: Nature [London], v. 137, p. 316, 1936.

00561 **Keyes, C. R.** Vanadinite deposits of the Elephant Butte [New Mexico]: Pan-Am. Geologist, v. 44, no. 1, p. 67–68, 1925.

00284 **Keys, W. S.; Dodd, P. H.** Lithofacies of continental sedimentary rocks related to significant uranium deposits in the western United States, *in* Survey of raw material resources: Geneva, United Nations, Internat. Conf. Peaceful Uses Atomic Energy, 2d, Proc., Sept. 1–13, 1958, v. 2, p. 367–378, 1958.

Describes by text and table the lithologic characteristics of host rocks for uranium deposits in sandstone, some of which are commerical sources of vanadium; uranium reserves and U:V ratios are given for groups of deposits. The localization and origin of the deposits are discussed.

00562 **Keys, W. S.** Deep drilling in the Temple Mountain Collapse, San Rafael Swell, Utah, *in* Geology of uranium and thorium: New York, United Nations, Internat. Conf. Peaceful Uses Atomic Energy, Proc., Aug. 8–20, 1955, v. 6, p. 371–378, 1956; revised *in* U.S. Geol. Survey Prof. Paper 300, p. 285–298, 1956.

The geology and the occurrence of uranium-vanadium minerals in the collapse structure are described.

01153 **Khabelashvili, A. I.** Vanadium-bearing carbonaceous-silicious formation in the Ishim River bend, central Kazakhstan [in Russian]: Akad. Nauk Kazakh. SSR, Izv., ser. geol., v. 23, no. 3, p. 10–22, 1966; abs. *in* Chem. Abs., v. 66, abs. no. 12997f, 1967.

00563 **Khaldna, Yu. L.** O soderzhanii vanadiya v goryuchikh slantsakh Estonskoy SSR [The vanadium content in oil shale of the Estonian S.S.R.]: Tartu Ülikool Toimetised, Uchenye Zapiski, 1958, no. 62, p. 219–225, 1958; abs. *in* Chem. Abs. v. 54, col. 22216, 1960.

Relates the low vanadium content (0.005 percent) of the oil shales to weathering conditions in the rocks from which the shales were derived.

Khamrabaev, I. Kh. *See* Gamaleev, I. E. 00536

00564 **Kholodov, V. N.; Lisitsin, A. K.; Komarova, G. V.; Kondrat'yeva, I. A.** Epigene zoning of uranium mineralization in petroliferous carbonate rocks: Akad. Nauk SSSR Izv. Geol. Ser., English translation, 1961, no. 11, p. 43–56, 1961, [1962].

The deposits also contain some vanadium.

01154 **Kholodov, V. N.** Tipy kontsentratsiy vanadiya v osadochnykh porodakh i nekotorye voprosy ego geokhimii [Types of vanadium concentrations in sedimentary rocks and some problems of its geochemistry]: Geologiya Rudn. Mestorozhd., v. 9, no. 3, p. 54–69, 1967; abs. *in* Chem. Abs., v. 68, abs. no. 23681r, 1968.

01160 **Kholodov, V. N.** The evolution of vanadium concentration types with time [in Russian]: Akad. Nauk. SSSR Doklady, v. 177, no. 1, p. 197–200, 1967; English translation will appear *in* Akad. Nauk USSR Doklady, Earth sci. sec., v. 177, no. 1–6(?), p. unknown at this date, 1967; abs. *in* Chem. Abs., v. 68, abs. no. 23553a, 1968.

00565 **Kim, Chong Hwan; Yun, Sang Kyu.** Uranium-bearing crystalline graphite deposit, southeastern area of Konggi-up, Chungchong-namdo: Korea Geol. Survey Bull., no. 2, p. 219–233, 1958.

Describes deposits of graphitic schist and gneiss, which have an average vanadium content of 0.08 percent.

00285 **Kimball, Gordon.** Discovery of carnotite: Eng. Mining Jour., v. 77, p. 956, 1904.

King, D. *See* Campana, B. 00182

00566 **King, J. W.** Uranium deposits in the Black Hills: Am. Inst. Mining Metall. Petroleum Engineers Trans., v. 205, p. 41–46, 1956.

The deposits in sandstone have a U:V ratio of about 1:1.5.

00567 **King, J. W.** Geology and ore deposits of Mesa V, Lukachukai district, Arizona: U.S. Atomic Energy Comm., RMO-754, 17 p., 1951.

The occurrence of uranium–vanadium deposits in sandstone is described.

01211 **King, J. W.** High-grade uraniferous lignites in Harding County, South Dakota, *in* Geology of uranium and thorium: New York, United Nations, Internat. Conf. Peaceful Uses Atomic Energy, Proc., Aug. 8–20, 1955, v. 6, p. 473–483, 1956; revised *in* U.S. Geol. Survey Prof. Paper 300, p. 419–431, 1956.

The V_2O_5 content of these lignites ranges from 0 to 0.07 percent and averages about 0.05 percent.

King, R. U. *See* Fischer, R. P. 00101

King, R. U. *See* Beroni, E. P. 00137

00568 **King, R. U.; Leonard, B. F.; Moore, F. B.; Pierson, C. T.** Uranium in the metal-mining districts of Colorado: U.S. Geol. Survey Circ. 215, 10 p., 1953.

The known uranium deposits are classified by types and their general distribution is given. Only the disseminated deposits in sedimentary rocks (mainly sandstone) contain much vanadium.

00574 **King, W. H.; Wilson, S. R.** Diamond-drill and auger sampling of vanadiferous shale, Mercur Dome Mine, Tooele County, Utah: U.S. Bur. Mines Rept. Inv. 4572, 8 p. [processed], 1949.

00569 **Kingsbury, A. W. G.; Hartley, J.** New occurrences of vanadium minerals (mottramite, descloizite, and vanadinite) in the Caldbeck area of Cumberland: Mineralog. Mag. [London], v. 31, no. 235, p. 289–295, 1956.

00570 **Kirikov, A.** The Tyuya-Muyun radium deposit [in Russian with English summ.]: Russian Geol. Kom., Trudy, Mém. new ser., v. 181, 65 p., 1929; abs. *in* Annot. Bibliography Econ. Geology, v. 2, p. 301, 1929.

Describes the geologic occurrence, genesis, and mineralogy of this uranium–vanadium deposit in limestone.

00571 **Kiss, Jean.** Recherches sur les bauxites de la Hongrie [Studies on Hungarian bauxites]: Acta Geol. [Budapest], v. 3, nos. 1–3, p. 45–88, 1955.

Data on the content of vanadium and other trace elements are included.

00579 **Kiss, Jean.** Uraniferous chromium ore and its paragenetic role in the Mecsek Permian aggregate, *in* Survey of raw material resources: Geneva, United Nations, Internat. Conf. Peaceful Uses Atomic Energy, 2d, Proc., Sept. 1–13, 1958, v. 2, p. 396–401, 1958.

The content, mineral occurrences, and geochemical relations of chromium, uranium, and vanadium in a sandstone containing a conspicuous amount of a green micaceous chromium-bearing mineral are described.

00926 **Kittel, D. F.** Geology of the Jackpile mine area, *in* Geology and technology of the Grants uranium region: New Mexico Bur. Mines Mineral Resources Mem. 15, p. 167–176, 1963.

00572 **Kittl, Erwin.** Wulfenite of Rio Negro [in Spanish (?)]: Soc. Argentina Minería y Geología, Rev. Minera, v. 23, p. 20–24, 1957.

A description of the occurrence of base-metal vanadates is included.

00927 **Kittl, Erwin; Villarroel, H. S.** Vanadinita de Rio Negro [Vanadinite from Rio Negro (Argentina)(with English summary]: Acta Geol. Lilloana, v. 6, no. 2, p. 139–144, 1965.

00575 **Kjellberg, Björn.** Några tekniska rön beträffande Kramsta, Gruvbergets och Storsveds vanadinförande titanjarnmalmsförekomster i Järvsö socken av Gävleborgs län [Technical studies on vanadiferous iron ores from Jarvso, Sweden]: Tekn. Tidskr., Arg. 60, Bergsvet., p. 25–28, 1930; abs. *in* Annot. Bibliography Econ. Geology, v. 3, p. 301–302, 1930.

Kleber, W. *See* Fischer, E. 00228

00576 **Kleinkopf, M. D.** Spectrographic determination of trace elements in lake waters of northern Maine: Geol. Soc. America Bull., v. 71, p. 1231–1242, 1960.

Areas containing anomalous concentrations of various metals in lake waters are shown on maps; 1.25 ppb V is considered anomalous.

00577 **Klemic, Harry.** Uranium occurrences in sedimentary rocks of Pennsylvania: U.S. Geol. Survey Bull. 1107-D, p. 243–288, 1962.

Vanadium minerals are present in some uranium occurrences in sandstone, but generally the vanadium content is low.

00578 **Klemic, Harry; Warman, J. C.; Taylor, A. R.** Geology and uranium occurrences of the northern half of the Lehighton, Pennsylvania, quadrangle and adjoining areas: U.S. Geol. Survey Bull. 1138, 97 p., 1963.

Vanadium-bearing minerals occur, usually in small amounts, in the uranium occurrences.

00286 **Klingner, F. E.** The Tsumeb mine in the Otavi mining district (German Southwest Africa): Zeitschr. Prakt. Geologie, v. 46, p. 189–194, 1938.

Includes history of the Tsumeb mine and copper, lead, and silver production data for 1906–1937, and incomplete data on vanadium.

00580 **Knitzschke, Gerhard.** Vererzung, Hauptmetalle und Spurenelemente des Kupferschiefers in der Sangerhäuser und Mansfelder Mulde [Mineralization, chief metals and trace elements in the copper slate of the Sangerhausen and Mansfeld troughs]: Zeitschr. Angew. Geologie, v. 7, no. 7, p. 349–356, 1961; abs. *in* Chem. Abs., v. 55, col. 23204, 1961.

The abundance and geochemical relations of vanadium and other metals are discussed.

Knopf, Adolf. *See* Westgate, L. G. 01041

00581 **Kobell, Franz von.** Grundzüge der Mineralogie [Outline of mineralogy]: Nürnberg, Germany, Johann Leonhard Schrag, 348 p., 1838.

00582 **Kobell, Franz von.** Ueber den Aräoxen, ein neues Blei-Zink-Vanadat [On Aräoxen, a new lead-zinc-vanadate]: Jour. Prakt. Chemie, v. 50, p. 496–500, 1850.

00287 **Koch, G. S., Jr.; Link, R. F.; Hazen, S. W., Jr.** Statistical interpretation of sample assay data from Mi Vida uranium mine, Big Indian district, San Juan County, Utah: U.S. Bur. Mines Rept. Inv. 6550, 40 p., 1964.

The ore also contains vanadium, and the described method of analyzing sample data is considered applicable for vanadium in this deposit and similar ones.

00928 **Kochergin, I. A.; Pyatunin, V. K.; Gays, S. N.** Elementy-primesi v rudakh Sokolovsko-Sarbayskoy gruppy magnetitovykh mestorozhdeniy [Minor elements in ores of the Sokolov-Sarbay group of magnetite deposits]: Kazakh. Nauchn.—Issled. Inst. Mineral'n. Syr'ya, Trudy, no. 7, p. 16–32, 1962; abs. *in* Chem. Abs., v. 60, cols. 15612–15613, 1964.

Kodina, L. A. *See* Manskaya, S. M. 00703

00929 **Koerner, E. L.; Hurst, T. L.; Saunders, Elerington.** Recovery of vanadium values from ferrophosphorus: U.S. Patent No. 3,259,455 (Cl. 23–15), July 5, 1966, Appl. May 9, 1962, 5 p., abs. *in* Chem. Abs., v. 65, col. 11835, 1966.

00573 **Koga, Akito.** Chemical studies on the hot springs of Beppu. XXIII. Distribution of vanadium [in Japanese (?)]: Nippon Kagaku Zasshi, v. 80, p. 1249–1254, 1959; abs. *in* Chem. Abs., v. 54, col. 7010, 1960.

Kojima, Takashi. *See* Taira, Toshio. 00789

01002 **Kolchina, A. G.** Use of radiometric methods in prospecting for deposits of nonferrous metals. IV. Vanadium [in Russian], *in* Metod. Ukazaniya po Primeneniyu Radiometr. Metodov pri Poiskakh i Razvedke Rud Neradioaktivn. Elementov, no. 2: Moscow [?], Gos. Geol. Kom. SSSR, p. 71–80, 1965; abs. *in* Chem. Abs., v. 65, col. 13416, 1966.

Komarova, G. V. *See* Kholodov, V. N. 00564

Kondrat'yeva, I. A. *See* Kholodov, V. N. 00564

00583 **Kontorovich, A. E.** Redkie i rasseyannye elementy v plastovykh vodakh neftenosnykh otlozheniy Zapadno-Sibirskoy nizmennosti [Rare and dispersed elements in formation waters of petroleum pools in the Western Siberian lowland]:

Litologiya i Polezn. Iskop., 1963, no. 2, p. 282–287, 1963; abs. *in* Chem. Abs., v. 60, col. 11797, 1964.

Compares average trace element content of water in oil-bearing rocks, in rocks without oil, and surface waters.

Kopchenova, E. V. *See* Arkhangel'skiy, A. D. 00061

Kopchenova, E. V. *See* Arkhangel'skiy, A. D. 00062

00288 **Kornilov, I. I.; Matveeva, N. M.** Metallochemistry of vanadium [in Russian]: Uspekhi Khimii, v. 31, p. 1076–1103, 1962.

Korobov, D. S. *See* Vyshemirskaya, O. P. 01039

00584 **Koroleva, N. N.** Mineralogical composition of paragenetic complexes in one Karamazar polymetallic deposit and distribution of admixture element in paragenetic complexes [in Russian]: Tashkend Sredneaz. Nauchno-Issled. Inst. Geologii i Mineral'n. Syr'ya, Uch. Zapiski, no. 10, p. 48–54, 1963; abs. *in* Chem. Abs., v. 60, col. 6635, 1964.

Early minerals in the deposit are enriched in elements (including vanadium) that occur as trace elements in the country rock; later minerals have elements commonly associated with sulfides—indium, antimony, and bismuth.

Koschmann, A. H. *See* Loughlin,G. F. 00389

00585 **Kostrikin, V. M.** Germaniy v ural'skom asfal'tite [Germanium in the Ural asphaltite]: Mineral'noe Syr'e, 1963, no. 7, p. 185–187, 1963; abs. *in* Chem. Abs., v. 60, col. 326, 1964.

Includes data on the vanadium content of the ash.

Kostrikin, V. M. *See* Zil'bermints, V. A. 00974

Kouvo, Olavi. *See* Long, J. V. P. 00383

Kovaleva, T. A. *See* Gulyayeva, L. A. 01148

Kozlov, N. A. *See* Sokolov, V. A. 00755

Kozlovskaya, S. V. *See* Levin, B. Yu. 00372

Kral, V. E. *See* Reeves, R. G. 00545

01212 **Kral, V. E.** Buena Vista iron deposit, Churchill County, Nevada: U.S. Bur. Mines Rept. Inv. 4094, 5 p., 1947.

A composite sample assayed 0.31 percent V_2O_5.

00289 **Krasnykh, I. F.** Kompleksnoe ispol'zovanie vanadiya, titana i zheleza titanomagnetitov v KNR [Utilization of vanadium, titanium, and iron of titanomagnitites in the Chinese Republic]: Stal', v. 16, no. 6, p. 523–530, 1956; English translation *in* Stal' in English, 1959, no. 11, p. 822–824, 1959; abs. *in* Chem. Abs., v. 50, col. 15370–15371, 1956.

00586 **Krauskopf, K. B.** Sedimentary deposits of rare metals, *in* Fiftieth Anniversary Volume, Economic Geology: p. 411–463, 1955.

The distribution of rare metals in sedimentary rocks and the processes and environment of enrichment are described. Vanadium is strongly enriched in organic sediments, especially black shale and petroleum.

00587 **Krauskopf, K. B.** Factors controlling the concentrations of thirteen rare metals in sea water: Geochim. et Cosmochim. Acta, v. 9, nos. 1–2, p. 1–32B, 1956.

Suggests that organic reaction is probably the principal process that removes vanadium from sea water.

Kreek, Justin. *See* Hazlett, G. W. 01305

Krejci-Graf, Karl. *See* Borchert, Hermann. 00155

Krejci-Graf, Karl. *See* Goldschmidt, V. M. 00243

00588 **Krishnan, M. S.** The iron ores of India [in English]: Internat. Geol. Cong., 19th, Algiers 1952, Symposium sur les gisements de fer du monde, v. 1, p. 503–532, 1952.

Describes several titaniferous magnetite bodies that have yielded samples rich in V_2O_5.

01187 **Kropachev, A. M.; Lunev, B. S.** K geokhimii allyuviya Glazovskoy sineklizy [Geochemistry of alluvium in the Glazovsk syncline]: Uchenye Zapiski [Perm], no. 121, p. 113–116, 1964; abs. *in* Chem. Abs., v. 63, col. 12923, 1965.

00290 **Krusch, Paul.** The metallic raw materials, their conditions of occurrence and their economic importance; Pt. 1, vanadium, uranium, radium [in German]: Stuttgart, Germany, Ferdinand Enke, 148 p., 1937; abs. *in* Annot. Bibliography Econ. Geology, v. 10, 1937.

00589 **Kulibin, V. A.** Kusin titano-magnetites from the viewpoint of concentration [in Russian]: Sovet. Metallurgiya, v. 6, p. 123–132, 1934; abs. *in* Chem. Abs., v. 29, col. 87, 1935.

00590 **Kul'tiasov, S. V.; Dubinkina, R. P.** A new variety of vanadium-containing oellacherite [in Russian]: Vses. Mineralog. Obshch., Zapiski, 2d ser., v. 75, p. 187–192, 1946; abs. *in* Chem. Abs., v. 43, col. 6120, 1949.

01087 **Kun, Nicolas de.** The mineralogenetic provinces of Africa: Econ. Geology, v. 58, p. 774–790, 1963.

The distribution of metals, including vanadium, is related to geographic regions and periods of mineralization.

00291 **Kunaev, A.** Vanadium and manganese recovery from Kustanay iron-phosphorus ores [in Russian]: Akad. Nauk Kazakh. SSR Vestnik, v. 15, no. 2, p. 71–85, 1959; abs. *in* Chem. Abs., v. 53, col. 11137, 1959.

Reports the method used and the vanadium content of the products of stages of operation to recover vanadium from high-phosphorus sedimentary iron-ore concentrates containing 0.12–0.14 percent vanadium.

01238 **Kunaev, A. M.; Beisembaev, B. B.; Voleinik, V. V.** Extraction of vanadium and phosphorus by hydrometallurgical treatment of iron-phosphorus alloys [in Russian]: Akad. Nauk Kazakh. SSR, Inst. Metallurgii, Obogashch. i Ogneuporov, Trudy v. 18, p. 3–8, 1966; abs. *in* Chem. Abs., v. 65, col. 8421, 1966.

00591 **Kuo, Cheng-Chi.** Jiningite, a new variety of thorite [in Chinese]: K'o Hsüeh T'ung Pao, Scientia, no. 6, p. 206–207, 1959; abs. *in* Am. Mineralogist, v. 45, p. 755, 1960.

Kupčo, Gejzo. *See* Jarkovský, Jan. 00277

00592 **Kupferberger, W.** The fluorspar, lead, and zinc deposits of the Western Transvaal: Geol. Soc. South Africa Trans., v. 30, p. 5–56, 1928.

Mentions the occurrence of a base-metal vanadate.

00593 **Kurbatov, I. D.** Über Vanadiumverbindungen und das neue Mineral "Usbekit" der radioaktiven Lager in Ferghana [Vanadium compounds and the new mineral

uzbekite from the radioactive deposit in Fergana]: Centralbl. Mineralogie, Geologie u. Paläontologie, 1926, Abt. A, p. 345–353, 1926; abs. *in* Chem. Abs., v. 21, p. 3584, 1927.

00594 **Kurbatov, I. D.; Ignatova, L. I.** O novom minerale uzbekite iz Kara-Chagyra [On uzbekite, a new mineral from Kara-Chagyr]: Akad. Nauk SSSR Doklady, Comptes Rendus, [ser.] A, 1926, p. 175–177, 1926.

00595 **Kurbatov, I. D.; Kargin, V. A.** O khimicheskom sostave odnoy raznovidnosti uzbekita [Chemical composition of a variety of uzbekite]: Akad. Nauk SSSR Doklady, Comptes Rendus, [ser.] A, 1927, p. 75–80, 1927; abs. *in* Chem. Abs., v. 24, p. 41, 1930.

Kurbatskaya, A. P. *See* Demenkova, P. Ya. 00415

Kurmaev, R. Kh. *See* Amirova, S. A. 01109

Kurmaev, R. Kh. *See* Amirova, S. A. 01133

00596 **Kuroda, Kazuo.** Vanadium, chromium, and molybdenum contents of the hot springs of Japan [in Japanese]: Chem. Soc. Japan Bull., v. 14, p. 307–310, 1939.

00597 **Kuroda, Kazuo.** Radium, vanadium, chromium, and molybdenum contents of the hot springs of Yunohanazawa, and their seasonal variations [in Japanese]: Chem. Soc. Japan Bull., v. 15, p. 65–70, 1940.

00598 **Kuroda, Kazuo.** Analysis of the mineral water of Kinkei in the province of Totigi [in Japanese]: Chem. Soc. Japan Bull., v. 16, p. 234–237, 1941; abs. *in* Chem. Abs., v. 36, col. 859, 1942.

00599 **Kuroda, Kazuo.** Vanadium, chromium, and molybdenum contents of some mineral springs in Japan [in Japanese]: Chem. Soc. Japan Bull., v. 17, p. 213–215, 1942; abs. *in* Chem. Abs., v. 41, col. 4594, 1947.

Kuroda, Rokuro. *See* Ishikawa, Hideo. 01083

Kuznetsova, N. N. *See* Rogova, V. P. 01182

00292 **Kvalheim, Aslak.** On the spectrochemical determination of vanadium in iron ores and slags [in English]: Norsk Geol. Tidsskr., v. 21, no. 4, p. 245–267, 1942.

00600 **Kyle, J. J.** On a vanadiferous lignite found in the Argentine Republic, with analysis of the ash: British Assoc. Advance. Sci. Rept. 1892, p. 686–687, 1892; *also in* Chem. News, v. 66, p. 211–212, 1892.

(The so-called lignite is probably asphaltite.—RPF)

Lachance, G. R. *See* Jambor, J. L. 00274

Lachko, O. A. *See* Izmodenov, A. I. 00010

00601 **Lacroix, Alfred.** Sur quelques vanadates des environs de Saïda (Oran) [Some vanadates from the neighborhood of Saïda (Oran)]: Soc. Francaise Minéralogie et Cristallographie Bull., v. 31, p. 44–46, 1908.

The vanadate minerals from the oxidized zone of a lead deposit in dolomite are briefly described.

01088 **Lacroix, Alfred.** Minéralogie de la France et de ses anciens territoires d'outre-mer [The mineralogy of France and its former overseas territories]: Paris, France, Librairie scientifique et technique Albert Blanchard, v. 6, 254 p., 1964.

Includes descriptions of vanadium-bearing minerals and references to their occurrences in France and former French possessions.

00602 **Ladame, G. Ch.** Nuove prospettive nel campo della uttilizzazione della sabbie ferrifere nazionali [New prospects in the field of the utilization of Italian ferruginous sands]: Ricerca Sci., v. 12(?), no. 6, p. 736, 1941; abs. [in German] *in* Zentralbl. Mineralogie, Geologie u. Paläontologie (Neues Jahrb. Mineralogie, Ref.), 1943, v. 2, p. 153, 1943.

Discusses attempts to recover heavy minerals from Italian beach sands; some vanadium was recovered from slag from magnetite concentrates.

Lakin, H. W. *See* Davidson, D. F. 00352

Lakin, H. W. *See* Davidson, D. F. 00353

Lakin, H. W. *See* Davidson, D. F. 00354

Lakin, H. W. *See* Ward, F. N. 00848

00293 **Landergren, Sture.** On the geochemistry of Swedish iron ores and associated rocks. A study on iron-ore formation [in English]: Sveriges Geol. Undersökning, Ser. C, no. 496, Årsbok 42, no. 5, 182 p., 1948.

Gives extensive analytical data and ratios of significant elements in the deposits and host rocks and discusses their geochemical significance; includes much data on vanadium.

00294 **Landsberg, H. H.; Fischman, L. L.; Fisher, J. L.** Resources in America's future; patterns of requirements and availabilities 1960–2000: Baltimore, Johns Hopkins Press, 1017 p., 1963.

Summarizes data on production, uses, consumption trends, and raw material supply of vanadium and other commodities.

00603 **Lang, A. H.** Canadian deposits of uranium and thorium (interim account): Canada Geol. Survey, Econ. Geology Ser. No. 16, 173 p., 1952.

Includes a brief description of the vanadium-bearing shale on Quadra Island, British Columbia, and the occurrence of uranium, titanium, and vanadium in the Goldfields district, Saskatchewan.

Lange, J. J., de. *See* Jong, W. F., de. 00279

00604 **Langton, G.; Jackson, E. J.** Recovery of ilmenite, rutile, and zircon at Umgababa, *in* Papers and discussions: Commonwealth Mining Metall. Cong., 7th, South Africa 1961, Trans., v. 3, p. 1073–1091, 1961.

Ilmenite and rutile concentrates contain about 0.3–0.5 percent V_2O_5.

Larsen, E. S., 3d. *See* Garrels, R. M. 00246

Larsen, E. S., 3d. *See* Garrels, R. M. 00247

00605 **Larsen, E. S., Jr.** Alkalic rocks of Iron Hill, Gunnison County, Colorado: U.S. Geol. Survey Prof. Paper 197-A, p. 1–64, 1942.

A little information on the vanadium content of the titaniferous magnetite deposit is included.

00606 **Larsen, E. S., Jr.; Hunt, W. F.** Two vanadiferous aegirites from Libby (Montana): Am. Jour. Sci., 4th ser., v. 36, p. 289–296, 1913.

Larsen, E. S., Jr. *See* Pardee, J. T. 00629

00295 **Larsh, P. A.** Caballo Mountain vanadium mines [New Mexico]: Eng. Mining Jour., v. 92, pt. 1, p. 118, 1911.

00607 **Larsh, P. A.** Vanadium in old silver mines of New Mexico: Eng. Mining Jour., v. 91, pt. 2, p. 1248, 1911.

00608 **Larsh, P. A.** Lucky Bill lead-vanadium mine [Grant County, New Mexico]: Eng. Mining Jour., v. 96, pt. 2, p. 1103–1105, 1913.

00296 **Larson, C. B.; Welker, K. K.** Vanadium resources of Peru: U.S. Bur. Mines Mineral Trade Notes, v. 25, no. 1, Spec. Suppl. no. 16, 58 p., 1947.

Larumbe, Fernando. *See* Linares, Enrique. 01003

00609 **Lasaulx, A., von.** Ardennit, ein neues Mineral [Ardennite, a new mineral]: Neues Jahrb. Mineralogie, Geologie u. Paläontologie, 1872, p. 930–934, 1872; *also in* ibid., 1873, p. 124–127, 1873.

00610 **Lasky, S. G.** The ore deposits of Socorro County, New Mexico: New Mexico Bur. Mines Mineral Resources Bull. 8, p. 41–43, 1932.

The occurrence of vanadate minerals in the oxidized ore of some deposits is briefly described.

01197 **Lasky, S. G.** Geology and ore deposits of the Bayard area, Central mining district, New Mexico: U.S. Geol. Survey Bull. 870, 144 p., 1936.

A brief description of the occurrence of base-metal vanadates is included.

00358 **Latysh, I. K.** Mineral composition and conditions of concentration of titanium-magnetite ores in the Visim deposit (middle Urals) [in Russian]: Akad. Nauk SSSR Ural'. Filial 1960, Gorno-Geol. Inst. Trudy, no. 50, p. 3–76, 1960; abs. *in* Chem. Abs., v. 56, col. 12572, 1962.

The mineral association and geochemical and paragenetic relations of iron, titanium, and vanadium in this rather low-grade and somewhat unusual deposit are described.

Laub, D. C. *See* Tschanz, C. M. 00810

00359 **Laverty, R. A.; Gross, E. B.** Paragenetic studies of uranium deposits of the Colorado Plateau, *in* Geology of uranium and thorium: New York, United Nations, Internat. Conf. Peaceful Uses Atomic Energy, Proc., Aug. 8–20, 1955, v. 6, p. 533–539, 1956; revised *in* U.S. Geol. Survey Prof. Paper 300, p. 195–201, 1956.

01089 **Lawthers, Robert.** Chapter 2, Mineralogy and geology of titanium deposits, and Chapter 3, Resources, *in* Titanium, a materials survey: U.S. Bur. Mines Inf. Circ. 7791, 202 p. 1957.

The geology and resources of many vanadium-bearing deposits are discussed, although data on the vanadium content are given only for some of these deposits.

Lazarev, B. L. *See* Freidenzon, E. Z. 00911

00360 **Leatherbee, Brigham.** Vanadium in New Mexico: Mining Mag. [London], v. 5, p. 282, 1911.

00363 **Lebedeff, V.; Choubert, G.** Nouvelles observations sur les minéraux du bassin du Niari (A.É.F.) [New observations on the minerals of the Niari basin (French Equatorial Africa)]: Acad. Sci. [Paris] Comptes Rendus, v. 198, p. 484–486, 1934.

Describes the occurrence of oxidized lead-zinc-copper ore and associated vanadate minerals.

Lebedev, A. P. *See* Lebedev, P. I. 00367

00367 **Lebedev, P. I.; Lebedev, A. P.** On the geochemistry of titanium and vanadium in western Siberia. The Azhinsk gabbro complex of Oirotia [in Russian with English

summ.]: Akad. Nauk SSSR, Comptes Rendus (Doklady), nouv. sér., v. 3, p. 294–300, 1934; abs. *in* Mineralog. Abs., v. 6, p. 321–322, 1937.

00364 **Leconte, J. R.** Sur la présence de vanadates d'Urane dans certaines formations filoniennes de Sidi-Ayad (massif primaire d'Aouli, Maroc central) [On the presence of vanadates of uranium in certain veins in Sidi-Ayad (primary massive of Aouli, central Morocco)]: Acad. Sci. [Paris] Comptes Rendus, v. 243, no. 21, p. 1650–1651, 1956.

Leja, J. *See* O'Brien, R. N. 00315

00365 **Lekas, M. A.; Dahl, H. M.** The geology and uranium deposits of the Lisbon Valley anticline, San Juan County, Utah, *in* Geology and economic deposits of east central Utah: Intermtn. Assoc. Petroleum Geologist, 7th Ann. Field Conf. 1956, [Guidebook], p. 161–168, 1956.

This report briefly describes the distribution of the deposits, some of which contain vanadium, and the lithology of the host sandstone beds.

Lekas, M. A. *See* Wood, H. B. 00948

00297 **Lekontsev, A. N.** Devanadatsiya chuguna v Konvertere s vduvaniyem pylevidnykh okisliteley [Removal of vanadium from iron in a converter with injection of pulverized oxidizers]: Stal', [v. 20], no. 8, p. 701–703, 1960; abs. *in* Tech. Translations, v. 5, p. 208, 1961.

00366 **Lengyel, Endre.** A Szarvaskö környéki titán-vanádium-vasérchutatás újabb eredményei [Recent results of study of the titanium-vanadium-iron ores near Szárvaskö (also in French with Russian summ.)]: Földtani Intézet Évkönyve, v. 46, no. 2, p. 251–381, 1957; abs. *in* Chem. Abs., v. 51, col. 11947–11948, 1957.

Describes segregated bodies of titaniferous magnetite, which contains 0.09–0.17 percent V_2O_5, in ultrabasic rock.

00368 **Lengyel, Endre.** A Ti-Fe-V ore enrichment in the gabbro-peridotite range in the Bukk Mountains, Hungary [in English]: Acta Geol. [Budapest], v. 7, p. 169–171, 1961; abs. *in* Chem. Abs., v. 57, col. 4366, 1962.

00298 **Lennemann, W. L.** Uranium milling methods: Eng. Mining Jour., v. 157, no. 6a, p. 122–132, 1956.

Includes some information on byproduct vanadium recovery.

Leonard, B. F. *See* King, R. U. 00568

00369 **Leone, Marco.** Concentrazioni anomale di vanadio nelle Dolomie di Sciacco [Abnormal vanadium concentrations in Sciacca (Sicily) dolomites]: Riv. Mineraria Siciliana, v. 13, p. 46–54, 1962; abs. *in* Chem. Abs., v. 58, col. 9997, 1963.

Lesure, F. G. *See* Huff, L. C. 01345

00370 **Leudeman, L. W.; Bates, T. F.** Mineralogical study of several hydrous vanadates: Pennsylvania State Univ., College Mineral Industries, Tech. Rept. 8 (Naval Research contract N6-ONR-26914), 226 p., 1956.

00361 **Leutwein, Friedrich; Rösler, H. J.** Geochemische Untersuchungen an paläozoischen und mesozoischen Kohlen Mittel-und Ostdeutschlands [Geochemical investigations of Paleozoic and Mesozoic coals in central and eastern Germany]: Freiberger Forschungshefte, ser. C-19, 196 p., 1956; abs. *in* Chem. Abs., v. 50, col. 17377, 1956.

The content and distribution of trace elements in more than 1,000 samples in coal ash are reported, and the possible recovery of vanadium, germanium, beryllium, and boron from ash is discussed.

00362 **Leutwein, Friedrich.** Geochemische Untersuchungen an den Alaun- und Kieselschiefern Thüringens [Geochemical studies of the alum- and silica-shales of Thuringia (with English, French, and Russian summs.)]: Archiv Lagerstättenf., v. 82, 45 p., 1951; abs. *in* Chem. Abs., v. 46, col. 9481, 1952.

Presents analytical data from 120 samples and discusses the geochemical relations of several metals. Also discusses metallurgical tests to recover vanadium, which averages 0.07 percent in the shale.

00371 **Leutwein, Friedrich.** Geochemie und Vorkommen des Vanadiums [Geochemistry and occurrence of vanadium]: Freiberger Geol. Gesell. Ber., v. 18, p. 73–83, 1941; abs. *in* Chem. Abs., v. 37, col. 6607, 1943.

Reviews analytical data on vanadium content of bauxites and red earths (0.008–0.075 percent V), clays (0.011–0.014 percent V) and sedimentary iron ores (0.01–0.1 percent V).

Levanto, A. E. *See* Paarma, Heikki. 00316

00299 **Levenets, N. P.; Pobegailo, V. M.; Polyakov, A. Yu.; Samarin, A. M.** Pilot-plant testing of the new technique of refining Kerch pig iron [in Russian], *in* Stal'iz Kerchenskikh rud: Moscow, Izd-vo Akademiya Nauk SSSR, Institut Metallurgii, p. 3–20, 1962; abs. *in* Chem. Abs., v. 58, col. 282, 1963.

A discussion of the recovery of vanadium is included.

00372 **Levin, B. Yu; Kozlovskaya, S. V.; Starkova, A. G.** The average chemical composition of meteorites [in Russian]: Meteoritika, v. 14, p. 38–53, 1956; abs. [in English] *in* Geochim. et Cosmochim. Acta, v. 13, p. 76, 1958; abs. *also in* Chem. Abs., v. 52, col. 7974, 1958.

Levinson, A. A. *See* Heinrich, E. W. 01308

Levish, Murray. *See* Moore, G. W. 01152

00373 **Lewis, R. Q., Sr.; Campbell, R. H.** Geology and uranium deposits of Elk Ridge and vicinity, San Juan County, Utah: U.S. Geol. Survey Prof. Paper 474-B, 69 p., 1965.

00374 **Lewis, R. Q., Sr.; Trimble, D. E.** Geology and uranium deposits of Monument Valley, San Juan County, Utah: U.S. Geol. Survey Bull. 1087-D, p. 105–131, 1959.

The uranium-bearing sandstone deposits, which also contain vanadium, are described.

01196 **Liebenberg, C. J.** The trace elements of the rocks of the Bushveld Igneous Complex. Pt. 2—The different rock types: Pretoria Univ. Pub. nuwe reeks no. 13, 75 p., 1961; abs. *in* Chem. Abs., v. 55, col. 18469, 1961.

Liebetrau, Lothar. *See* Faulhaber, Engelbert. 00905

00375 **Lietz, Joachim.** Beiträge zur Kenntnis der Pyromorphit-Mimetesit-Vanadinit-Gruppe [Contribution to the knowledge of the pyromorphite-mimetite-vanadinite group]: Zeitschr. Kristallographie, v. 77, p. 437–498, 1931.

Linares, E. *See* Gordillo, C. E. 01170

00376 **Linares, Enrique.** The "Eva Perón" deposit, Malargue, Mendoza, *in* Geology of uranium and thorium: New York, United Nations, Internat. Conf. Peaceful Uses Atomic Energy, Proc., Aug. 8–20, 1955, v. 6, p. 75–81, 1956.

The sandstone-bearing uranium deposit, which contains a little vanadium and copper, is described.

00377 **Linares, Enrique; Toubes, R. O.** Los minerales radiactivos de la Republica Argentina [The radioactive minerals of the Argentine Republic]: Jornadas Geol. Argentinas, Anales, 1st, San Juan 1960, v. 3, p. 191–205 [1960] 1962; abs. *in* Chem. Abs., v. 58, col. 7726, 1963.

01003 **Linares, Enrique; Toubes, R. O.; Larumbe, Fernando.** Volborthita, $Cu_3(VO_4)_2.3H_2O$, de Chihuido del Medio (Prov. de Neuquen) [Volborthite, $Cu_3(VO_4)_2.3H_2O$, from Chihuido del Medio, Neuquen Province]: Acta Geol. Lilloana, v. 6, no. 2, p. 169–176, 1965 [with English summary].

01185 **Linares, Enrique; Gordillo, C. E.; Toubes, R. O.; Winchell, H.** Huemulite, $Na_4MgV_{10}O_{28}.24H_2O$, a new hydrated sodium and magnesium vanadate from the Huemul Mine, Mendoza, Argentina [in Spanish]: Argentine, Com. Nac. Energ. Atom., [Rept.] CNEA no. 189, 21 p., 1967; abs. *in* Chem. Abs., v. 67, no. 22, abs. no. 101753m, 1967.

01186 **Linares, Enrique; Toubes, R. O.; Gordillo, C. E.** Huemulita, 3,5 (V_2O_5).1,5 (Na_2O).1,0 (MgO).16 H_2O, un nuevo mineral de vanadio hidratado de la Republica Argentina [Huemulite, MgO.1.5 $Na_2O.3.5V_2O_5.16H_2O$, a new hydrous vanadium mineral from the Argentine Republic]: Acta Geol. Lilloana, v. 6, no. 2, p. 157–167, 1965.

00378 **Lindberg, M. L.; Weeks, A. D.; Thompson, M. E.; Elston, D. P.; Meyrowitz, Robert.** Hendersonite, a new calcium vanadyl vanadate from Colorado and New Mexico: Am. Mineralogist, v. 47, p. 1252–1272, 1962.

Lindberg, M. L. *See* Weeks, A. D. 01106

00379 **Lindgren, Waldemar.** The gold belt of the Blue Mountains of Oregon: U.S. Geol. Survey 22d Ann. Rept., pt. 2, p. 551–776, 1901.

The presence of roscoelite in several mines and calciovolborthite in one prospect is reported.

00380 **Lindgren, Waldemar; Hamilton, L. F.; Palache, Charles.** Melanovanadite, a new mineral from Mina Ragra, Pasco, Peru: Am. Jour. Sci., 5th ser., v. 3, p. 195–203, 1922.

01129 **Lindgren, Waldemar.** Copper, silver, lead, vanadium, and uranium ores in sandstone and shale: Econ. Geology, v. 6, p. 568–581, 1911.

01130 **Lindgren, Waldemar.** Concentration and circulation of the elements from the standpoint of economic geology: Econ. Geology, v. 18, p. 419–442, 1923.

The geochemical migration of certain elements, including vanadium, from igneous rocks to ore deposits and sedimentary rocks is discussed.

Lindsay, J. R. *See* Staples, L. W. 01025

Link, R. F. *See* Koch, G. S., Jr. 00287

Lisitsin, A. K. *See* Kholodov, V. N. 00564

01004 **Lister, G. F.** The composition and origin of selected iron–titanium deposits: Econ. Geology, v. 61, p. 275–310, 1966.

The vanadium content of several deposits in Quebec, Ontario, and Minnesota is given and geochemical relations are discussed.

Litsey, L. R. *See* Boardman, R. L. 00886

00381 **Litvinenko, A. U.** Oso'ennosti stroeniya rudnykh zalezhey Kerchenskogo mestorozhdeniya i zakonomernosti raspredeleniya v nikh zheleza i margantsa [Structural peculiarities of the lodes in the Kerch deposit and the regularities of

iron and manganese distribution]: Geologiya Rudn. Mestorozhd., 1959, no. 4, p. 37–64, 1959; abs. *in* Chem. Abs., v. 54, col. 22193, 1960.

Includes some information on the vanadium content of the ore.

00382 **Livingstone, D. A.** Chemical composition of rivers and lakes, *in* Data of geochemistry: U.S. Geol. Survey Prof. Paper 440–G, p. G1–G64, 1963.

Discusses the available data on vanadium in lake and river waters, most of which contain less than 1 ppb V.

01090 **Logomerac, Vladimir.** [Vanadium; its importance and production from Yugoslav raw materials]: Tehnički Pregled, v. 3, p. 306–312, 1951; abs. *in* Chem. Abs., v. 49, col. 804, 1955.

Residues from treating bauxite by the Bayer process are considered the most likely source of vanadium in Yugoslavia.

Lombardozzi, V. P. *See* Fester, G. A. 01220

00383 **Long, J. V. P.; Vuorelainen, Yrjö; Kouvo, Olavi.** Karelianite, a new vanadium mineral: Am. Mineralogist, v. 48, p. 33–41, 1963.

Longchambon, H. *See* Longchambon, Louis. 00385

00384 **Longchambon, Louis; Bloch, J. M.; Durand, Georges.** La montmorillonite dans la genèse de la vanadinite [(The role of) montmorillonite in the formation of vanadinite]: Acad. Sci. [Paris] Comptes Rendus, v. 244, no. 13, p. 1799–1801, 1957.

00385 **Longchambon, Louis; Longchambon, H.** Sur la vanadinite d'Hérival (Vosges) [The vanadinite of Hérival (Vosges)]: Acad. Sci. [Paris] Comptes Rendus, v. 195, no. 26, p. 1397–1398, 1932.

00386 **Longobardi, Ernesto.** El contenido mineral y particularmente vanadífero de los petróleos [The mineral content, especially vanadium, of petroleums]: Soc. Cient. Argentina Anales, v. 117, p. 5–18, 1934; abs. *in* Chem. Abs., v. 28, col. 4577, 1934.

00387 **Longobardi, Ernesto; Camus, N.** Existencia de vanadio en algunos petróleos argentinos [Occurrence of vanadium in some Argentine petroleums]: Soc. Cient. Argentina Anales, v. 72, p. 283–286, 1911; abs. *in* Chem. Abs., v. 6, p. 3177, 1912.

Loring, D. H. *See* Nicholls, G. D. 00482

Lositskaya, I. F. *See* Gulyayeva, L. A. 01148

00388 **Lotspeich, F. B.; Markward, E. L.** Minor elements in bedrock, soil, and vegetation at an outcrop of the Phosphoria formation on Snowdrift Mountain, southeastern Idaho: U.S. Geol. Survey Bull. 1181–F, 42 p., 1963.

Discusses the content and distribution of vanadium and other elements relative to their movement during weathering and their use in geochemical prospecting.

Loughlin, G. F. *See* Butler, B. S. 00176

00389 **Loughlin,G. F.; Koschmann, A. H.** Geology and ore deposits of the Cripple Creek district, Colorado: Colorado Sci. Soc. Proc., v. 13, no. 6, p. 217–435, 1935.

The occurrence of vanadium-bearing mica, roscoelite, with the gold-tellurium ores is briefly described.

00390 **Love, J. D.** Preliminary report on uranium deposits in the Pumpkin Buttes area, Powder River Basin, Wyoming: U.S. Geol. Survey Circ. 176, 37 p., 1952.

Includes data on the vanadium content of the deposits.

00391 **Love, J. D.** Uranium in the Mayoworth area, Johnson County, Wyoming; a preliminary report: U.S. Geol. Survey Circ. 358, 7 p., 1954.

The occurrence of uranium-vanadium minerals in marine limestone is described.

01005 **Love, J. D.** Vanadium and associated elements in the Phosphoria Formation in the Afton area western Wyoming: U.S. Geol. Survey Prof. Paper 424-C, p. C279-C-282, 1961. Also *in* Anatomy of the western phosphate field: Intermtn. Assoc. Geologists 15th Ann. Field Conf., p. 115-118, 1967.

00392 **Lovering, T. S.** Geology and ore deposits of the Breckenridge mining district, Colorado: U.S. Geol. Survey Prof. Paper 176, 64 p., 1934.

Vanadinite is listed as a mineral in the oxidized zone in the district, but its occurrence is not described.

00393 **Lovering, T. S.; Goddard, E. N.** Geology and ore deposits of the Front Range, Colorado: U.S. Geol. Survey Prof. Paper 223, 319 p., 1950.

The presence of the vanadium-bearing mica, roscoelite, in some gold-telluride veins is reported.

Lovering, T. S. *See* Morris, H. T. 00733

00394 **Lovisato, Domenico.** Vanadinite, descloizite, mimetite, and stolzite from the copper mine of Bena (d)e Padru in Ozieri (Sassari) [in Italian]: Accad. Lincei, Cl. Sci. Fis. Mat. e Nat., Atti Rend., 5th ser., v. 13, p. 43-50, 1904; abs. *in* Neues Jahrb. Mineralogie, Geologie u. Paläontologie, 1905, v. 2, p. 367-368, 1905.

00395 **Lovisato, Domenico; Struever, G.** New kind of vanadate in the copper formation of Bena (d)e Padru near Ozieri in the Province of Sassari [in Italian]: Accad. Lincei, Cl. Sci. Fis. Mat. e Nat., Atti Rend., 5th ser., v. 19, pt. 2, p. 326-333, 1910; abs. *in* Chem. Abs., v. 5, p. 1728, 1911.

00996 **Lowell, W. R.** Phosphatic rocks in the Deer Creek-Wells Canyon area, Idaho, *in* Contributions to economic geology, 1952-53: U.S. Geol. Survey Bull. 982-A, p. 1-52, 1953.

Some data on vanadium content of phosphate rock and shale are included.

Lowell, W. R. *See* Swanson, R. W. 00785

Luedke, R. G. *See* Smith, J. F., Jr. 00697

00301 **Lukashev, V. P.** K poiskam promyshlennykh mestorozhdeniy redkikh elementov v Priazov'e [On the search for rare element deposits in the region adjoining the Azov Sea]: Problemy Sovet. Geologii, v. 7, no. 2, p. 177-182, 1937.

Information is given on the occurrences and resources of vanadium and other commodities.

Luk'yanov, S. M. *See* Gerasimov, A. G. 01118

00397 **Luna, I. R., de; Freitas, Fernando.** Geology and metallogeny of the uranium deposits of the Mavudzi Valley, Tete (Portuguese East Africa) [in English], *in* Association des Services Geologiques Africains: Internat. Geol. Cong., 19th Algiers 1952, Comptes Rendus, Pt. 20, p. 293-307, 1954.

Data on the vanadium content of davidite are included.

Lunev, B. S. *See* Kropachev, A. M. 01187

Luyt, J. F. M. *See* Nel, H. J. 01095

00300 **Lydolph, P. E.** Geography of the U.S.S.R.: New York, John Wiley and Sons, Inc., 451 p., 1964.

No data on vanadium are given, but the iron-ore reserves of some vanadium-bearing deposits are given in a table on p. 359 (after Cherdanstev, G. N., and others, Ekonomicheskaya geografiya SSSR: Obshchiy Obzor, Moscow, 1958, p. 278–279).

00406 **MacKevett, E. M., Jr.** Geology and ore deposits of the Kern River uranium area, California: U.S. Geol. Survey Bull. 1087–F, p. 169–222, 1960.

A little vanadium is reported in a few deposits.

MacKevett, E. M., Jr. *See* Hall, W. E. 01360

00303 **MacMillan, R. T.; Dinnin, J. I.; Conley, J. E.** Proposed process for treatment of low-grade titaniferous ores: U.S. Bur. Mines Rept. Inv. 4638, 19 p., 1950.

Includes the results of metallurgical tests to recover V_2O_5 and other compounds from titaniferous magnetite ore at Tahawus (Lake Sanford), New York.

00304 **MacMillan, R. T.; Heindl, R. A.; Conley, J. E.** Soda sinter process for treating low-grade titaniferous ore: U.S. Bur. Mines Rept. Inv. 4912, 62 p., 1952.

Includes description of metallurgical tests to extract vanadium from titaniferous magnetite ore from Tahawus (Lake Sanford), New York.

01142 **Magak'yan, I. G.** Ore deposits; economic types of useful metallic mineral deposits [2d ed.] [in Russian]: Erevan, Armenian SSR, izd-vo Akademiya Nauk Armyanskoy SSR, Institut Geologicheskikh Nauk, 547 p., 1961.

Magin, G. B., Jr. *See* Marvin, R. F. 00705

00701 **Mah, A. D.; Kelley, K. K.** Heats and free energies of formation of oxides of vanadium: U.S. Bur. Mines Rept. Inv. 5858, 11 p., 1961.

01006 **Mah, A. D.** Thermodynamic properties of vanadium and its compounds: U.S. Bur. Mines Rept. Inv. 6727, 84 p., 1966.

Mahoney, S. R. *See* Allsman, P. T. 00035

Mahoney, S. R. *See* Allsman, P. T. 00037

Majors, F. H. *See* Allsman, P. T. 00035

Majors, F. H. *See* Allsman, P. T. 00037

Maksimov, G. S. *See* Myasnik, S. L. 01184

Mal'tsev, N. A. *See* Amirova, S. A. 01133

Malyshev, I. I. *See* Panteleev, N. A. 00628

00702 **Mansfield, G. R.; Girty, G. H.** Geography, geology, and mineral resources of part of southeastern Idaho: U.S. Geol. Survey Prof. Paper 152, 453 p., 1927.

A detailed description of the phosphate deposits is included, with a brief discussion of their vanadium content and potential recovery.

00703 **Manskaya, S. M.; Kodina, L. A.** Aromatic monomers of lignin in lignites and their possible role in concentration of uranium, germanium, and vanadium [in Russian with English summ.]: Geokhimiya, 1963, no. 4, p. 370–383, 1963; abs. *in* Chem. Abs., v. 59, col. 3659, 1963.

Mapel, W. J. *See* Pillmore, C. L. 00514

Marchand, B. de C. *See* Wagner, P. A. 00845

00704 **Marin, D. A.** Recursos minerales de España [Mineral resources of Spain]: Soc. Geog. Nac. [Madrid] Bol., v. 78, p. 85–183, 234–283, 1942.

Includes information on the occurrence of vanadium and other mineral commodities in Spain.

01091 **Markham, N. L.** The willemite–hemimorphite relation: Econ. Geology, v. 55, p. 844–847, 1960.

Some geologic conditions relating to the origin of vanadium minerals in the Berg Aukas mine, Otavi district, South-West Africa, are discussed.

Markward, E. L. *See* Lotspeich, F. B. 00388

Marsh, J. A. *See* Pinnell, D. B. 00320

Marsh, O. T. *See* Bush, A. L. 00175

Marshall, H. L. *See* Jacob, K. D. 00271

Marshall, H. L. *See* Hill, W. L. 01199

Maruyama, Shūji. *See* Miyamoto, Hiromichi. 00726

00705 **Marvin, R. F.; Magin, G. B., Jr.** Synthesis of calcium vanadate minerals and related compounds, *in* Geochemistry and mineralogy of the Colorado Plateau uranium ores: U.S. Geol. Survey Prof. Paper 320, p. 103–111, 1959.

Marvin, R. F. *See* Weeks, A. D. 00864

00305 **Mason, Brian.** The utilization of New Zealand ironsands as a source of iron, titanium, and vanadium: New Zealand Jour. Sci. and Technology, v. 26, sec. B, no. 5, p. 227–238, 1945.

00739 **Mason, Brian.** Principles of geochemistry: New York, John Wiley and Son; London, Chapman and Hall, 276 p., [1952].

00706 **Masters, J. A.** Geology of the uranium deposits of the Lukachukai Mountains area, northeastern Arizona: Econ. Geology, v. 50, no. 2, p. 111–126, 1955.

The uranium-bearing sandstone deposits described also yield vanadium.

Masters, J. A. *See* Zitting, R. T. 00977

00707 **Masursky, Harold.** Uranium-bearing coal in the eastern part of the Red Desert area, Wyoming: U.S. Geol. Survey Bull. 1099-B, p. B1–B152, 1962.

Includes data on the content of vanadium and other trace elements in many samples of coal.

00708 **Matignon, Camille.** Un nouveau minerai de vanadium [A new vanadium mineral]: Rev. Sci. [Paris], 5th ser., v. 6, p. 597–598, 1906.

Matsubara, Minoru. *See* Taira, Toshio. 00789

Matveeva, N. M. *See* Kornilov, I. I. 00288

00709 **Maufe, H. B.** Report of the Director for the year 1927: Southern Rhodesia Geol. Survey Rept., 1927, 18 p., 1928.

A brief reference to the vanadate deposits in the Lomagundi district is included.

Mazzola, E. *See* Fester, G. A. 00089

00398 **McAllister, J. F.** Geology of mineral deposits in the Ubehebe Peak quadrangle, Inyo County, California: California Div. Mines and Geology Spec. Rept. 42, 63 p., 1955.

The presence of a base-metal vanadate mineral is reported.

McAuley, W. S. *See* Stanfield, K. E. 00765

00399 **McCauley, J. F.** Uranium in Pennsylvania: Pennsylvania Topog. and Geol. Survey Bull. M-43, 71 p., 1961.

Some deposits contain vanadium-bearing minerals.

00400 **McGhee, G. W.** Vanadium discovery in Baraga County, Michigan: Mining Eng. World [Chicago], v. 41, p. 1088, 1914.

00302 **McKay, E. J.** Criteria for outlining areas favorable for uranium deposits in parts of Colorado and Utah: U.S. Geol. Survey Bull. 1009-J, p. 265-282, 1955.

Most of these uranium deposits also yield vanadium ore.

McKay, E. J. *See* Troyer, M. L. 00808

McKay, E. J. *See* Sharp, W. N. 01144

00401 **McKelvey, V. E.; Davidson, D. F.; O'Malley, F. W.; Smith, L. E.** Stratigraphic sections of the Phosphoria formation in Idaho, 1947-48—Pt. 1: U.S. Geol. Survey Circ. 208, 49 p., 1953.

Some data on the vanadium content of phosphate rock and shale are included.

00402 **McKelvey, V. E.; Armstrong, F. C.; Gulbrandsen, R. A.; Campbell, R. M.** Stratigraphic sections of the Phosphoria formation in Idaho, 1947-48—Pt. 2: U.S. Geol. Survey Circ. 301, 58 p., 1953.

Some data on the vanadium content of phosphate rock and shale are included.

00403 **McKelvey, V. E.; Everhart, D. L.; Garrels, R. M.** Origin of uranium deposits, *in* Fiftieth Anniversary Volume, Economic Geology: p. 464-533, 1955.

The geochemistry of uranium and the principal types of uranium deposits, including uranium-vanadium deposits in sandstone, are discussed.

00404 **McKelvey, V. E.; Smith, L. E.; Hoppin, R. A.; Armstrong, F. C.** Stratigraphic sections of the Phosphoria formation in Wyoming, 1947-48: U.S. Geol. Survey Circ. 210, 35 p., 1953.

Some data on the vanadium content of phosphate rock and shale are included.

00405 **McKelvey, V. E.; Strobell, J. D., Jr.** Preliminary geologic maps of the Paris-Bloomington vanadium area, Bear Lake County, Idaho: U.S. Geol. Survey Mineral Inv. Field Studies Map MF-41, with section and text, 1955.

McKeown, F. A. *See* Sharp, W. N. 01144

00322 **McKinstry, Hugh.** Review of "El vanadio en el Peru", by Hernández Aquije, Silvio (*in* Minería, año 2, no. 5, p. 19-30; no. 6, p. 31-49, 1954; año 4, no. 8, p. 21-22; no. 9, p. 23-29, 1955): Econ. Geology, v. 52, no. 3, p. 324-325, 1957.

00700 **McLaren, D. C.** Vanadium: Mining Mag. [London], v. 71, no. 4, p. 203-212, 1944.

General discussion of uses, sources, and beneficiation of vanadium ores.

Medvedev, L. D. *See* Adyshev, M. M. 00890

00710 **Mehmel, Martin.** Beziehungen zwischen Kristallstruktur und chemischer Formel des Apatits [Relations between the crystal structure and chemical formula of apatites]: Zeitschr. Physikal. Chemie, Abt. B, v. 15, p. 223–241, 1932; abs. *in* Mineralog. Abs. v. 5, p. 316–317, 1934.

Information on the crystal structure of vanadinite is included.

00711 **Meijer, H. J. de L.** Studies in the organic chemistry of vanadium: Utrecht, Schotanus and Jens, 152 p., 1963; *in* Chem. Abs., v. 60, col. 545, 1964.

00712 **Melkov, V. G.** On an urano-vanadate from the Mayli-Su deposit in Kirgizia [in Russian with English summ.]: Vser. Mineralog. Obshch., Zapiski, v. 74, no. 1, p. 41–47, 1945; abs. *in* Geol. Soc. America Bibliography and Index of Geology Exclusive of North America, v. 13, p. 183, 1948; *and* Chem. Abs., v. 41, col. 5059, 1947.

The mixture of tyuyamunite and carnotite in limestone is described.

Mellon, M. G. *See* Wallace, G. W. 00847

00713 **Mempel, G.** Neue Funde von Uran-Vanadium-Kernen mit Entfarbungshöfen [A new discovery of uranium-vanadium nodules with bleached halos]: Geol. Rundschau, v. 49, p. 263–276, 1960.

00306 **Merenmies, Martti.** A vanadium plant in Otanmäki (Finland) [in Finnish (?)]: Tekn. Tidskr., v. 87, p. 723–724, 1957; abs. *in* Chem. Abs., v. 51, col. 17663, 1957.

00714 **Mero, J. L.** Mineral resources in the ocean floor: Mining Cong. Jour., v. 46, no. 10, p. 48–53, 1960.

Gives some data on the amount of vanadium in manganese nodules, red clay, and animal remains.

00715 **Mero, J. L.** Sea floor phosphorite: California Div. Mines, Mineral Inf. Service, v. 14, no. 11, p. 2, 8, 1961.

Phosphorite samples from 54 localities on the floor of the Pacific Ocean average 0.05 percent vanadium.

01092 **Mero, J. L.** Ocean-floor manganese nodules: Econ. Geology, v. 57, p. 747–767, 1962.

Merwin, H. E. *See* Hillebrand, W. F. 01192

Merwin, H. E. *See* Hillebrand, W. F. 01333

Meyrowitz, Robert. *See* Lindberg, M. L. 00378

Meyrowitz, Robert. *See* Thompson, M. E. 00794

Meyrowitz, Robert. *See* Thompson, M. E. 00795

Meyrowitz, Robert. *See* Thompson, M. E. 00796

Meyrowitz, Robert. *See* Moench, R. H. 01093

Meyrowitz, Robert. *See* Weeks, A. D. 01106

Meyrowitz, Robert. *See* Stern, T. W. 01123

Michel, Eugen. *See* Weiss, Armin. 00869

00716 **Miesch, A. T.** Composition of sandstone host rocks of uranium deposits: Am. Inst. Mining Metall. Petroleum Engineers Trans., v. 223, p. 178–184, 1962.

00717 **Miesch, A. T.** Distribution of elements in Colorado Plateau uranium deposits—a preliminary report: U.S. Geol. Survey Bull. 1147–E, 57 p., 1963.

The geochemical relations of vanadium and other elements introduced with uranium into the deposits and the implications relative to the source of these elements are discussed.

00718 **Miholic, Stanko.** The origination of the bauxites on limestone [in German (?)]: Berg–u. Hüttenm. Monatsh., v. 101, p. 38–40, 1956.

Describes bauxite containing 0.14–0.23 percent V_2O_5 that was formed on limestone.

01163 **Mikhaylova, G. A.** Vtorichnaya vanadievaya mineralizatsiya v Kuznetskom Ala-Tau [Secondary vanadium mineralization in Kuznetsk Ala-Tau]: Irkutsk. Gos. Nauchn.-Issledov. Inst. Redkikh Metal., Sb. Nauchn. Tr., 1958, no. 7, p. 57–64, 1958; abs. *in* Chem. Abs., v. 54, col. 17164, 1960.

01162 **Mikheev, V. I.** The structure of arsenosulvanite [in Russian, with English summ.]: Vser. Mineralog. Obshch., Zapiski, v. 70, p. 165–184, 1941; abs. *in* Am. Mineralogist, v. 40, p. 368–369, 1955.

00719 **Mill, B. V.** Hydrothermal synthesis of garnets containing V^{3+}, In^{3+}, and Sc^{3+} [in Russian]: Akad. Nauk SSSR Doklady, nov. ser., v. 156, no. 4, p. 814–816, 1964.

The composition of one synthesized garnet is the same as that of goldmanite (see Moench and Meyrowitz, 1964).

00720 **Miller, B. L.; Singewald, J. T., Jr.** The mineral deposits of South America: New York, McGraw-Hill, 598 p., 1919.

A description of the vanadium-bearing asphaltite deposits of Peru is included.

Million, Isadore. *See* Clark, E. L. 00201

01146 **Millman, A. P.** The descloizite-mottramite series of vanadates from Minas do Lueca, Angola: Am. Mineralogist, v. 45, p. 763–773, 1960.

Gives comparative mineralogic data on vanadates from several localities and describes the rather unique occurrence of vanadium minerals at Minas do Lueca, Angola.

01007 **Millson, M. F.; Montgomery, D. S.** The vanadyl porphyrin complexes of the Athabasca oil sands: Geochim. et Cosmochim. Acta, v. 30, no. 2, p. 207–222, 1966.

01008 **Milovskii, A. V.** Chromium, vanadium, and nickel in ortho- and para-metamorphic rocks: Geochemistry Internat. 1964 [v. 2], no. 5, p. 875–879, 1964.

00307 **Mine and Quarry Engineering.** Iron ore in the U.S.S.R.: Mine and Quarry Eng., v. 29, no. 8, p. 353–357, 1963.

An informative review of the iron ore resources of the USSR is given; however, it does not include much information specifically relating to vanadium resources.

00721 **Mine and Quarry Engineering.** Descloizite: Mine and Quarry Eng., v. 28, p. 254–255, 1962.

00308 **Mines Register.** Active mining companies: Mines Register, 1962–1963, p. 290, 1963.

00309 **Mining Journal [London].** Titanium and vanadium from New Zealand iron sands: Mining Jour. [London], v. 245, no. 6269, p. 436–437, 1955.

00722 **Mining World [Seattle].** Oceania—Union Carbide prospecting big Australian V_2O_5 deposits: Mining World [Seattle], v. 23, no. 1, p. 56, 1961.

Mitchell, R. L. *See* Black, W. A. P. 00146

Mitchell, R. L. *See* Nockolds, S. R. 00487

00310 **Mitra, R. K.; Chatterjee, G. P.** Vanadium- and titanium-bearing iron ore of Mayurbhanj: Indian Inst. Metals Trans., v. 9, p. 111–121, 1955–56; abs. *in* Chem. Abs., v. 51, col. 9440, 1957.

00723 **Mitskevich, B. F.** Opyt primeneniya biogeokhimicheskogo metoda poiskov na Ukraine [Biochemical prospecting in the Ukraine]: Byul. Nauchn.-Tekh. Inf., Ministerstva Geologii i Okhrany Nedr SSSR, 1962, no. 1, p. 31–33, 1962; abs. *in* Chem. Abs., v. 60, col. 13026–13027, 1964.

00724 **Mittempergher, Mario.** The uraniferous ore deposit of Val Rendena [in Italian]: Italy Com. Naz. Energia Nucleare, Studi e ricerche div. geomineraria, no. 1, p. 163–185, 1958; also *in* Convegno di Geologia Nucleare, Atti 6, 22 p., 1958; abs. *in* Chem. Abs., v. 55, col. 13194, 1961.

This uranium deposit in sandstone also contains vanadium.

00725 **Miyamoto, Hiromichi.** Chemical compositigns of titaniferous iron sand in Japan [in Japanese with English summ.]: Japan Geol. Survey Rept., Spec. no. (E), p. 73–111, 1960.

Gives iron, titanium, and vanadium content of iron sands and their specific gravities and chemical and magnetic characteristics.

00726 **Miyamoto, Hiromichi; Maruyama, Shūji.** Report on titaniferous iron ore deposits at Unjō district, Iwate Prefecture [in Japanese with English summ.]: Japan Geol. Survey Bull., v. 10, no. 10, p. 47(885)–53(891), 1959.

The vanadium content of nine ore samples ranges from 0.08 to 0.19 percent.

Mobley, C. M. *See* Stokes, W. L. 00773

01009 **Moench, R. H.; Schlee, J. S.** Geology and uranium deposits of the Laguna district, New Mexico: U.S. Geol. Survey Prof. Paper 519, 117 p., 1967.

01093 **Moench, R. H.; Meyrowitz, Robert.** Goldmanite, a vanadium garnet from Laguna, New Mexico: Am. Mineralogist, v. 49, p. 644–655, 1964.

Moench, R. H. *See* Hilpert, L. S. 01336

00727 **Mogensen, Fredrik.** A ferro-orthotitanate ore from Södra Ulvön [in English]: Geol. Fören., Stockholm, Förh., v. 68, no. 4, p. 578–588, 1946.

Principally a mineralogic description of this vanadium-bearing titaniferous magnetite deposit.

00728 **Momoi, Hitoshi.** A new vanadium garnet, $(Mn, Ca)_3V_2Si_3O_{12}$, from the Yamato mine, Amami Islands, Japan [in English]: Kyushu Daigaku Rigakubu Mem., ser. D, Geology, v. 15, p. 73–78, 1964.

Momoi, Hitoshi. *See* Yoshimura, Toyofumi. 00961

00311 **Monro, A. D.; Gibbs, H. S.** Vanadium and titanium in Taranaki ironsand: New Zealand Jour. Sci. and Technology, v. 19, p. 523–526, 1938.

00729 **Monro, A. D.; Beavis, G.** The constitution of Taranaki ironsand: New Zealand Jour. Sci. and Technology, v. 27, Sec. B, no. 3, p. 237–241, 1945.

A mineralogic study of the distribution of vanadium and titanium in the iron sands.

Montgomery, D. S. *See* Millson, M. F. 01007

Moon, L. B. *See* Julihn, C. E. 00016

Moore, F. B. *See* King, R. U. 00568

Moore, F. B. *See* Granger, H. C. 01279

Moore, G. W. *See* Gill, J. R. 01076

01152 **Moore, G. W.; Levish, Murray.** Uranium-bearing sandstone in the White River Badlands, Pennington County, South Dakota: U.S. Geol. Survey Circ. 359, 7 p., 1955.

Small amounts of uranium-vanadium minerals were identified in this occurrence.

00730 **Moore, P. B.** Cell data of orientite and its relation to ardennite and zoisite: Canadian Mineralogist, v. 8, p. 262–265, 1965.

01138 **Morachevskiy, Yu. V.; Belyaeva, L. I.** O sostave uranovanadatov [On the composition of uranovanadates]: Geokhimiya, 1956, no. 7, p. 20–24, 1956 [1960]; translated *in* Geochemistry, 1956, no. 7, p. 663–668, 1956 [1960].

Moreau, J. *See* Semet, M. 01012

00731 **Moreno Martín, F.** The chemical composition of Spanish vanadinite [in Spanish]: Soc. Española Física y Química Anales v. 30, p. 377–383, 1932.

Morignat, Bernard. *See* Branche, Georges. 00163

00732 **Moritz, H.** Die sulfidischen Erze der Tsumeb-Mine vom Ausgehenden bis zur XVI. Sohle (–460 m) [The sulfide ores of the Tsumeb mine from the outcrop to the sixteenth level (–460 meters)]: Neues Jahrb. Mineralogie, Geologie u. Paläontologie Abh. Beil.-bd. 67, Abt. A, p. 118–154, 1933; abs. *in* Chem. Abs., v. 28, col. 6399, 1934.

Contains data on the amount of vanadium and other trace elements in the sulfide minerals.

00733 **Morris, H. T.; Lovering, T. S.** Stratigraphy of the East Tintic Mountains, Utah, *with a section on* Quaternary deposits, by H. D. Goode: U.S. Geol. Survey Prof. Paper 361, 145 p., 1961 [1962].

Includes a description and assay data (V_2O_5, U, and P_2O_5) of the vanadium-bearing phosphatic shale member of the Deseret Limestone.

Morton, P. K. *See* Troxel, B. W. 00807

00734 **Mourlot, A. I.** Analyse d'une houille vanadifére [Analysis of a vanadiferous coal]: Acad. Sci. [Paris] Comptes Rendus, v. 117, p. 546–548, 1893.

Reports 38.5 percent V_2O_5 in coal ash from Mendoza Province, Argentina. (The so-called "coal" is probably asphaltite.—RPF)

Mrose, M. E. *See* Carron, M. K. 00184

Mrose, M. E. *See* Evans, H. T., Jr. 00459

Mrose, M. E. *See* Evans, H. T., Jr. 00460

Mrose, M. E. *See* Evans, H. T., Jr. 00461

00735 **Muilenburg, G. A.; Keller, W. D.** Carnotite and radioactive shale in Missouri: Am. Mineralogist, v. 35, p. 323–324, 1950.

Briefly describes carnotite coating of fractures in limestone overlaid by a thin bed of uranium- and vanadium-bearing shale.

00736 **Mukherjee, Satyamay.** On the vanadium-bearing titaniferous magnetites of Nausahi, Keonjhar, dt. Orissa: Geol. Mining Metall. Soc. India Quart. Jour., v. 30, no. 3, p. 109–123, 1958; abs. *in* Geol. Soc. America Bibliography and Index Exclusive of North America, v. 24, p. 383, 1961.

Mullens, T. E. *See* Craig, L. C. 00214

00738 **Munoz Lumbier, Manuel.** El vanadio [Vanadium]: Mexico Dirección General Minas y Petróleo, Bol. Petroleo y Minas, v. 13, no. 6, p. 3–6, 1942.

Describes the occurrence and properties of some vanadate minerals and shows by map their distribution in Mexico.

Muñoz Reyes, Jorge. *See* Ahlfeld, Federico. 01223

00312 **Muraoka, Makoto.** Vanadiferous deposits in Manchuria: U.S. Geol. Survey Pacific Geol. Survey Rept. [190], 6 p., 1953.

Murata, K. J. *See* Carron, M. K. 00184

Murata, K. J. *See* Gordon, MacKenzie, Jr. 00244

00737 **Murdoch, Joseph.** X-ray investigation of colusite, germanite, and reniérite: Am. Mineralogist, v. 38, p. 794–801, 1953.

Murphy, J. F. *See* Houston, R. S. 01343

01184 **Myasnik, S. L.; Samoilov, P. I.; Maksimov, G. S.; Uskov, E. D.; Stakhanov, V. V.; Voitsekhovich, E. B.** Kratkaya geologicheskaya kharakteristika Gusevogorskogo mestorozhdeniya i tekhnologicheskaya otsenka rudnogo syr'ya [Brief geological characteristics of the Guseva Gora deposit and technological evaluation of its ores]: Gornyy Zhurn., 1966, no. 2, p. 14–17; abs. *in* Chem. Abs., v. 64, col. 17270, 1966.

Myers, A. T. *See* Erickson, R. L. 00452

01010 **Nagorskiy, M. P.** Admixtures in iron-ore basin, in Western Siberian iron-ore basin [in Russian]: Novosibirsk, Akademiya Nauk SSSR, Sibirskoe otdelenie; Institut geologii i geofiziki, p. 340–342, 1964; abs. *in* Chem. Abs., v. 63, col. 9676, 1965.

Naguib, A. G. *See* Higazy, R. A. 00007

Naito, Hideo. *See* Sugawara, Ken. 00780

00740 **Nakamura, M. T.; Sherman, G. D.** Vanadium content of Hawaiian Island soils: Hawaii Agr. Expt. Sta. Tech. Bull. 45, 20 p., 1961; abs. *in* Chem. Abs., v. 60, col. 1060, 1964.

00741 **Nason, F. L.** The importance of the iron ores of the Adirondack region: Am. Iron and Steel Inst. Yearbook, 1922, p. 168–207, 1922.

Data on the vanadium content of titaniferous magnetite ores are included.

00992 **Nat. Res. Coun., M.A.B.** Report on vanadium, Pt. 1—Report of the raw materials group: Nat. Research Council, Materials Advisory Bd., Comm.

Refractory Metals, Panel Repts. MAB-154-M(1), v. 2, p. 225-255, 1959; listed *in* U.S. Govt. Research Repts., v. 34, p. 623, 1960.

The geology and world resources of vanadium, domestic production, potential and estimated costs, and metallurgy of several types of vanadium raw materials are briefly reviewed.

Naumov, V. P. *See* Berger, G. S. 01128

01237 **Navarini, Aldo.** Calculations of reserves and attempts to concentrate the iron-titanium minerals of the Bahia San Blas deposit, Province of Buenos Aires [Spanish with English summ.]: Acta Geol. Lilloana, v. 5, p. 115-126, 1965.

Analysis of a concentrate gave 0.44 percent V_2O_5.

Nayak, V. K. *See* Rao, A. B. 00542

00742 **Nazarenko, V. A.** The occurrence of vanadium, beryllium, and boron in the ash of some coals [in Russian with German summ.]: Akad. Nauk SSSR, Biogeokhim. Lab., Trudy, v. 4, p. 265-271, 1937; abs. *in* Chem. Abs., v. 32, col. 7700, 1938.

00743 **Nedovizin, A. A.** Vanadium-bearing sedimentary rocks in the Chu-Ili Mountains [in Russian]: Akad. Nauk Kazakh. SSR, Izv., Ser. Geol., 1963, no. 6, p. 88-92, 1963; abs. *in* Chem. Abs., v. 60, col. 7823-7824, 1964.

The occurrence of carbonaceous shale containing appreciable vanadium (0.1-0.5 percent) and more than average amounts of molybdenum, zinc, lead, copper, and nickel is described.

01094 **Negre, Georges.** The discovery of vanadium [in French(?)]: Industrie Chimique, v. 34, p. 151-152, 1947; abs. *in* Chem. Abs. v. 42, col. 2147, 1948.

01095 **Nel, H. J.; Luyt, J. F. M.** Vanadium-rich magnetite seams of the Bushveld igneous complex, South Africa [abs]: Econ. Geology, v. 59, p. 1416, 1964.

00744 **Nenadkevich, K. A.** Turanit i alait—dva novykh vanadievykh minerala [Turanite and alaite—two new vanadium minerals]: Akad. Nauk, Leningrad [Acad. Imp. Sci. St.-Petersbourg], Bull., 6th ser., v. 3(?), p. 185-186, 1909; abs. *in* Neues Jahrb. Mineralogie, Geologie u. Paläontologie, 1910, v. 1, p. 193-194, 1910.

00745 **Nenadkevich, K. A.** Tyuyamunit—novyy mineral'nyy vid [Tyuyamunite—a new mineral]: Akad. Nauk, Leningrad [Acad. Imp. Sci. St.-Petersbourg], Bull., 6th ser., v. 6, pt. 2, p. 945-946, 1912; abs. *in* Neues Jahrb. Mineralogie, Geologie u. Paläontologie, 1914, v. 2, p. 211, 1914.

00746 **Nenadkevich, K. A.; Volkov, P. A.** O novom minerale—tangeite iz Tyuyamuyun [A new mineral—tangeite from Tyuyamuyun]: Akad. Nauk SSSR, Doklady, Comptes Rendus, [ser.] A, p. 43-46, 1926; abs. *in* Mineralog. Abs., v. 3, p. 234, 1928.

Nessler. *See* Fischer, H. 00229

00747 **Neubronner, Karl.** The occurrence of vanadium and molybdenum in a Swabian oil shale: Chemiker-Zeitg., v. 49, p. 409-410, 1925; abs. *in* Chem. Abs., v. 19, p. 2270, 1925.

Neuschel, S. K. *See* Fleischer, Michael. 01241

00480 **New Mexico Bur. Mines, Mineral Res.** Geology and technology of the Grants uranium region: New Mexico Bur. Mines and Mineral Resources Mem. 15, 277 p., 1963.

Contains 38 papers, some of which describe the occurrence of vanadium with the uranium deposits.

00748 **Newhouse, W. H.** The source of vanadium, molybdenum, tungsten, and chromium in oxidized lead deposits: Am. Mineralogist, v. 19, p. 209–220, 1934.

00749 **Newland, D. H.** Geology of the Adirondack magnetic iron ores: New York State Mus. Bull. 119, 182 p., 1908.

Includes data on the vanadium content of several deposits.

00479 **Newman, W. L.; Elston, D. P.** Distribution of chemical elements in the Salt Wash member of the Morrison formation, Jo Dandy area, Montrose County, Colorado: U.S. Geol Survey Bull. 1084–E, p. 117–150, 1959.

Discusses the geochemical relations and content of vanadium and other elements in the uranium–vanadium ore–bearing sandstone.

00750 **Newman, W. L.** Distribution of elements in sedimentary rocks of the Colorado Plateau—A preliminary report: U.S. Geol. Survey Bull. 1107–F, p. 337–445, 1962.

Unmineralized sedimentary rocks of the Colorado Plateau region were sampled and analyzed for the suite of elements common in the sandstone–bearing uranium vanadium deposits; the distribution and geochemical relations of these elements are described.

00481 **Nichiporuk, Walter; Chodos, A. A.** The concentrations of vanadium, chromium, iron, cobalt, nickel, copper, zinc, and arsenic in meteoritic iron sulfide nodules: Jour. Geophys. Research, v. 64, no. 12, p. 2451–2463, 1959.

00482 **Nicholls, G. D.; Loring, D. H.** The geochemistry of some British carboniferous sediments: Geochim. et Cosmochim. Acta, v. 26, p. 181–223, 1962.

Discusses the occurrence and amount of vanadium and other elements in these rocks, mainly shale.

00483 **Nicolini, Pierre.** Recherches bibliographiques sur la géologie du vanadium [Bibliographical research on the geology of vanadium (with English abs.)]: Chronique Mines d'outre mer et Recherche Minière, v. 28, no. 291, 36 p., 1960.

The geochemistry of vanadium and its geologic types of deposits, based on a review of literature, are described.

Nicolini, Pierre. *See* Imreh, Lazlo. 01352

Nielsen, A. H. *See* Bøgvad, Richard. 00152

00484 **Noble, E. A.** Genesis of uranium belts of the Colorado Plateau, *in* Genetic problems of uranium and thorium deposits: Internat. Geol. Cong., 21st, Copenhagen 1960, Rept., v. 15, p. 26–39, 1960.

Suggests a source and mode of concentration of uranium, vanadium, and other metals in the uranium deposits in sandstone.

01149 **Noble, E. A.** Formation of ore deposits by water of compaction: Econ. Geology, v. 58, p. 1145–1156, 1963.

A source of metals and a mode of transport is suggested to explain the origin of uranium–vanadium deposits in sandstone and some other ore deposits of uncertain genesis.

00485 **Nockolds, S. R.; Allen, R.** The geochemistry of some igneous rock series—Pt. 2: Geochim. et Cosmochim. Acta, v. 5, p. 245–285, 1954.

00486 **Nockolds, S. R.; Allen, R.** The geochemistry of some igneous rock series—Pt. 3: Geochim. et Cosmochim. Acta, v. 9, p. 34–77, 1956.

00487 **Nockolds, S. R.; Mitchell, R. L.** The geochemistry of some Caledonian plutonic rocks, a study of the relationship between the major and trace elements of igneous rocks and their minerals: Royal Soc. Edinburgh Trans., v. 61, pt. 2, p. 533–575, (1944–1948), 1948.

00624 **Nockolds, S. R.; Allen R.** The geochemistry of some igneous rock series—Pt. 1: Geochim. et Cosmochim. Acta, v. 4, p. 105–142, 1953.

00313 **Noel, H. M.** Recovery of vanadium: U.S. patent 2,372,109, March 20, 1945; abs. *in* Chem. Abs., v. 39, col. 4580, 1945.

00314 **North, Victor.** A study of methods for the determination of vanadium: U.S. Geol. Survey Bull. 950, p. 83–89, 1946.

00488 **Northrop, S. A.** Minerals of New Mexico [revised ed.]: Albuquerque, Univ. New Mexico Press, 665 p., [1959].

Includes a description of vanadium-bearing minerals and their distribution in New Mexico.

01096 **Notestein, F. B.** Some chemical experiments bearing on the origin of certain uranium-vanadium ores: Econ. Geology, v. 13, p. 50–64, 1918.

00489 **Novák, František; Hoffman, Vladimir.** Geochemistry of vanadium in the Sovolusk ore deposit (Iron Mountains, Bohemia) [in Czechoslovak with English summ. (?)]: Sb. Geol. Ved, Technologie, Geochemie, 1962, no. 1, p. 7–29, 1962; abs. *in* Chem. Abs., v. 59, col. 317, 1963.

Describes a deposit of alunite that contains 0.75 percent V_2O_5; a graphitic sedimentary rock contains more vanadium than other types of country rock and ore deposits in the area.

Nye, T. S. *See* Stroud, R. B. 00777

00490 **Oakeshott, G. B.** Titaniferous iron-ore deposits of the western San Gabriel Mountains, Los Angeles County, California: California Div. Mines Bull. 129, pt. P, p. 245–266, 1948.

00491 **Oana, Sinya.** Chemical investigations of deep-sea deposits, III—Vanadium, chromium, and molybdenum contents of deep-sea deposits [in Japanese]: Nippon Kwagaku Kwaishi, v. 59, p. 1234–1236, 1938; abs. *in* Chem. Abs., v. 33, col. 1636, 1939.

00315 **O'Brien, R. N.; Leja, J.** Recovery of vanadium from petroleum ash: Am. Soc. Mech. Engineers, Paper 62-WA-196, 7 p., 1962; abs. *in* Chem. Abs., v. 59, col. 3695, 1963.

Oertell, E. W. *See* Grundy, W. D. 01285

00492 **Oftedal, Ivar.** Vanadium in dem Apatitvorkommen von Ødegården in Bamble, [Vanadium in the apatite deposit of Ødegården in Bamble, Norway]: Norsk Geol. Tidsskr., v. 19, no. 4, p. 340–341, 1940; abs. *in* Annot. Bibliography Econ. Geology, v. 18, p. 69, 1945.

00493 **Ohmachi, Hokuichirō.** Summarized data of titaniferous iron sand deposits in the world [in Japanese]: Japan Geol. Survey Rept., Spec. no. (E), p. 67–72, 1960.

Summarizes world occurrences of titanium-iron sand deposits but contains only a little information on their vanadium content.

Olsen, H. *See* Etchart, L. M. 00453

O'Malley, F. W. *See* McKelvey, V. E. 00401

Orcel, Jean. *See* Arambourg, Camille. 00058

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Gives analyses of ash of vanadium-bearing bitumens from occurrences in the USSR and other parts of the world, with special note of those from the southern Urals and the Novaya Zemlya Islands, USSR.

00495 **Orlov, N. A.; Uspenskiy, V. A.** Vanadiy v ugleo'raznykh bitumakh [Vanadium in carbonaceous bitumens]: Zhurn. Priklad. Khimii, v. 6, p. 1010–1022, 1933.

A review of the occurrences of vanadium-bearing bitumens in the USSR and other parts of the world, to aid in the discovery of usable sources in the USSR.

Ortega, Armando. *See* Angelelli, Victorio. 00044

Orzechowski, Piotr. *See* Gregorowicz, Zbigniew. 00478

00496 **Osipov, L. A.** Geologicheskie osobennosti Uygursayskogo mestorozhdeniya [Principal geologic features of the Uygur-Say deposit]: Problemy Sovet. Geologii, 1941, no. 3, p. 36–48, 1941.

Describes a deposit of uranium in sandstone with some vanadium.

00497 **Osório Ferreira, Evaldo.** Jazimentos de minerais metalíferos no Brasil (síntese) [Summary of metallic mineral deposits of Brazil]: Brazil Div. Geologia e Mineralogia, Bol. 130, 122 p., 1949.

A brief description of vanadium occurrences and minerals is included.

Osterwald, D. B. *See* Osterwald, F. W. 00498

00498 **Osterwald, F. W.; Osterwald, D. B.** Wyoming mineral resources: Wyoming Geol. Survey Bull. 45, 215 p., 1952.

A brief discussion of reported occurrences of vanadium in Wyoming is included.

Osterwald, F. W. *See* Walker, G. W. 00846

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00500 **Ostroumov, E. A.; Volkov, I. I.** K voprosu o vzaimosvyazi fosfora, vanadiya i organicheskogo veshchestva v otdlozheniyakh chernogo morya [The relationship between phosphorus, vanadium and organic matter in the Black Sea deposits]: Geokhimiya, 1957, no. 6, p. 518–528, 1957; translated *in* Geochemistry, 1957, no. 6, p. 609–619, 1957 [1961]; abs. *in* Chem. Abs., v. 52, col. 13563, 1958.

Otsuka, Yoshinao. *See* Taira, Toshio. 00789

01173 **Outokumpu and Otanmäki Cos.** (Geol. Staffs). The Otanmäki mine [in English], *in* Mining geology, Finland: Internat. Geol. Cong., 21st, Copenhagen 1960, Guide to Excursions nos. A-36, C-31, p. 13–18, 1960.

The geology, ore, and resources of the vanadium-bearing titaniferous-magnetite deposit are described.

Overstreet, W. C. *See* Theobald, P. K., Jr. 01031

00615 **Paakkonen, Veikko.** Otanmaki; the ilmenite-magnetite ore field in Finland [in English]: Finland Geol. Tutkimus. Bull. 171, 71 p., 1956.

The geology of the vanadium-bearing titaniferous magnetite deposits and surrounding area are described.

00316 **Paarma, Heikki; Levanto, A. E.** Underground exploration at Otanmäki mine: Mine and Quarry Eng., v. 24, no. 12, p. 545–554, 1958.

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00616 **Paarma, Heikki.** The ilmenite-magnetite ore deposit of Otanmäki [in English], *in* The mines and quarries of Finland: Finland Geol. Tutkimus. Geotek. Julkaisuja, no. 55, p. 36–42, 1954.

Describes the geology and mineralogy of this vanadium-bearing deposit.

00617 **Paděra, K.; Johan, Zdeněk.** Nálezy vanadičňanu v Čechách [Discovery of vanadium occurrences in Czechoslovakia]: Casopis Mineralogii i Geologii, v. 2, no. 2, p. 187, 1957.

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00618 **Page, L. R.; Redden, J. A.** The carnotite prospects of the Craven Canyon area, Fall River County, South Dakota: U.S. Geol. Survey Circ. 175, 18 p., 1952.

00619 **Page, L. R.; Stocking, H. E.; Smith, H. B.** (and others). Contributions to the geology of uranium and thorium by the U.S. Geological Survey and Atomic Energy Commission for the United Nations International Conference on Peaceful Uses of Atomic Energy, Geneva, Switzerland, 1955: U.S. Geol. Survey Prof. Paper 300, 739 p., 1956.

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Palache, Charles. *See* Lindgren, Waldemar. 00380

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The occurrence of a carbonaceous sandstone containing appreciable uranium, vanadium, and copper is described.

00626 **Pallister, H. D.; Thoenen, J. R.** Flake-graphite and vanadium investigations in Clay, Coosa, and Chilton Counties, Alabama: U.S. Bur. Mines Rept. Inv. 4366, 84 p., 1948.

00627 **Panizo, J. V.** Una nueva especie mineral peruana; la melanovanadita [A new Peruvian mineral; melanovanadite]: Soc. Ing. Inf. y Mem. Bol., v. 32, p. 5–10, 1930.

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The geology and possible origin of a lead–vanadate deposit are described.

00632 **Pavlenko, D. M.** Novye dannye o geologii i genezise mestorozhdeniya Tyuya–Muyun v Uzbekistane [New data on the geology and genesis of the Tyuya–Muyun deposit in Uzbekistan (with English summ.)]: Problemy Sovet. Geologii, v. 4, no. 10, p. 123–142, 1933.

Describes new data indicating a post–host rock age of igneous intrusion and therefore ascribes a hydrothermal origin to the uranium–vanadium deposit in limestone.

Pavlidis, Yu. A. *See* Vasil'chikov, N. V. 01179

00634 **Pavlov, N. N.** The magnetite ore deposit Baleginsk in Transbaikalia [in Russian with English summ.]: Russia V. Geologo-Razved. Ob"edinenie, Dal'nevost. Geologo-Razved. Trest, Trudy, no. 1(58), 112 p., 1931; abs. *in* Annot. Bibliography Econ. Geology, v. 5, p. 267, 1932.

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Pavlova, M. *See* Uzunov, I. 01035

Pechkovskii, V. V. *See* Amirova, S. A. 01109

Peirce, H. W. *See* Davidson, D. F. 00355

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Deposits of vanadium and other metals are described.

Peters, Cl. *See* Goldschmidt, V. M. 01271

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00507 **Petterd, W. F.** Catalogue of the minerals of Tasmania: Hobart, Tasmania, Tasmania Dept. Mines, 221 p., 1910.

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00508 **Pettijohn, F. J.** Chemical composition of sandstones—excluding carbonate and volcanic sands, *in* Data of geochemistry [6th ed.]: U.S. Geol. Survey Prof. Paper 440-S, p. S1-S21, 1963.

A summary of the literature on the average vanadium content of sandstone is included.

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The geology of the vanadium-bearing asphaltite deposit at Mina Ragra is described.

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Data are included on the amount of vanadium and other elements in beds that contain uranium-vanadium deposits.

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Pierson, C. T. *See* Bush, A. L. 00174

Pierson, C. T. *See* King, R. U. 00568

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Pommer, A. M. *See* Garrels, R. M. 00246

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Puffett, W. P. *See* Weir, G. W. 00868

Pushkash, I. I. *See* Freidenzon, E. Z. 00911

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Sharp, J. V. A. *See* Dickson, R. E. 00095

00677 **Sharp, W. N.; Gibbons, A. B.** Geology and uranium deposits of the southern part of the Powder River Basin, Wyoming: U.S. Geol. Survey Bull. 1147–D, 60 p., 1964.

Some vanadium occurs in the uranium deposits in sandstone.

01144 **Sharp, W. N.; McKeown, F. A.; McKay, E. J.; White, A. M.** Geology and uranium deposits of the Pumpkin Buttes area, Powder River Basin, Wyoming, *in* Geology of uranium and thorium: New York, United Nations, Internat. Conf. Peaceful Uses Atomic Energy, Proc., Aug. 8–20, 1955, v. 6, p. 403–406, 1956; *revised in* U.S. Geol. Survey Prof. Paper 300, p. 371–374, 1956.

Some vanadium occurs in the uranium deposits in sandstone.

00678 **Shawe, D. R.** Significance of roll ore bodies in genesis of uranium–vanadium deposits on the Colorado Plateau, *in* Geology of uranium and thorium: New York, United Nations, Internat. Conf. Peaceful Uses Atomic Energy, Proc., Aug. 8–20, 1955, v. 6, p. 335–337, 1956; *revised in* U.S. Geol. Survey Prof. Paper 300, p. 239–241, 1956.

00679 **Shawe, D. R.; Archbold, N. L.; Simmons, G. C.** Geology and uranium–vanadium deposits of the Slick Rock district, San Miguel and Dolores Counties, Colorado, *in* Survey of raw material resources: Geneva, United Nations, Internat. Conf. Peaceful Uses Atomic Energy, 2d, Proc., Sept. 1–13, 1958, p. 515–522, 1958; *revised in* Econ. Geology, v. 54, p. 395–415, 1959.

Shawe, D. R. *See* Bowers, H. E. 00888

01015 **Shawe, D. R.** Zonal distribution of elements in some uranium–vanadium roll and tabular ore bodies on the Colorado Plateau: U.S. Geol. Survey Prof. Paper 550–B, p. B169–B175, 1966.

01016 **Shawe, D. R.; Granger, H. C.** Uranium ore rolls—an analysis: Econ. Geology, v. 60, p. 240–250, 1965.

Some of the deposits described contain commercial amounts of vanadium.

00680 **Shcherba, G. N.** Redkie metally vostochnogo Kazakhstana, geneticheskie tipy mestorozhdeniy [Rare metals of eastern Kazakhstan, genetic types of the deposits]: Akad. Nauk Kazakh. SSR Izv. Ser. Geol., 1958, no. 4, p. 20–37, 1958.

Gives a genetic classification for deposits of vanadium and other metals.

Shcherbak, O. V. *See* Rozhkova, EV. 00550

00681 **Shcherbakov, D. I.** Mestorozhdeniya radioaktiviykh rud i mineralov Fergany [Radioactive ore deposits and minerals of Fergana]: Akad. Nauk Kom. po Izucheniyu est. Proizvod. sil Soyuza, Materialy no. 47, 59 p., 1924; abs. *in* Neues Jahrb. Mineralogie, Geologie u. Paläontologie, 1925, v. 1, p. 562–563, 1925.

Shcherbakov, D. I. *See* Fersman, A. E. 01124

Shcherbina, V. V. *See* Borisenko, L. F. 00156

00682 **Shcherbina, V. V.** Rasprostranenie vanadiya v titanomagnetitakh i vo vmeshchayushchikh porodakh [Distribution of vanadium in titanomagnetites and in the enclosing rocks]: Akad. Nauk SSSR, Sovet po Izucheniyu Proizvoditel'nykh sil, Trudy no. 2, Ser. Ural'., p. 163–176, 1936.

01017 **Shcherbina, V. V.** Osnovnye cherty geokhimii vanadiya [Main characteristics of vanadium geochemistry]: Bŭlgar. Akad. Nauk., Geol. Inst., Izv. v. 14, p. 51–68, 1965 [with English summary]: abs. *in* Chem. Abs., v. 64, col. 475, 1966.

Sheffey, N. B. *See* Zubovic, Peter. 00979

Sheffey, N. B. *See* Zubovic, Peter. 00980

Sheffey, N. B. *See* Zubovic, Peter. 00981

Sheffey, N. B. *See* Zubovic, Peter. 00982

Sheffey, N. B. *See* Zubovic, Peter. 01175

00683 **Sheldon, R. P.; Warner, M. A.; Thompson, M. E.; Peirce, H. W.** Stratigraphic sections of the Phosphoria formation in Idaho, 1949—Pt. I: U.S. Geol. Survey Circ. 304, 30 p., 1953.

Includes some data on the vanadium content of phosphate rock and shale.

Sherman, G. D. *See* Nakamura, M. T. 00740

Sherwood, A. M. *See* Stern, T. W. 00768

Sherwood, A. M. *See* Thompson, M. E. 00797

Sherwood, A. M. *See* Weeks, A. D. 00861

Sherwood, A. M. *See* Weeks, A. D. 00862

Sherwood, A. M. *See* Weeks, A. D. 01150

Shilovskiy, P. P. *See* Danchev, V. I. 00901

00331 **Shimkin, D. B.** Minerals—a key to Soviet power: Cambridge, Mass., Harvard Univ. Press, 452 p., 1953.

Includes incomplete data regarding production and consumption of vanadium and grade and reserves of vanadium-bearing titaniferous magnetites, non-titaniferous iron ores, and sandstone.

01018 **Shimkin, D. B.** Uranium deposits in the U.S.S.R.: Science, v. 109, p. 58–60, 1949.

Data are given on types, locations, and possible sizes of deposits, including some deposits that are vanadium-bearing.

Shimp, N. F. *See* Potter, P. E. 00523

Shitov, V. A. *See* Bur'yanova, E. Z. 00173

01019 **Shnyukov, E. F.** Genezis zheleznykh rud Azovo-Chernomorskoi rudnoi provintzii [Genesis of the iron ores of the Azov-Black Sea ore province]: Kiev, Naukova Dumka, 195 p., 1965; review *in* Econ. Geology, v. 61, no. 2, p. 420, 1966.

00684 **Shoemaker, E. M.** Structural features of the central Colorado Plateau and their relation to uranium deposits: U.S. Geol. Survey Prof. Paper 300, p. 155–170, 1956.

00685 **Short, N. M.** Geochemical variations in four residual soils: Jour. Geology, v. 69, p. 534–571, 1961.

Includes a discussion of the geochemical relations of vanadium.

00686 **Shteynberg, D. S.; Fominykh, V. G.** Titanomagnetites in the Ural igneous rocks and titanomagnetite deposits related to them [in Russian], *in* Magmatizm, metamorfizm, metallogeniya Urala: Ural'. Petrograf. Soveshch., Trudy, v. 1, p. 513–520 [1961] 1963; abs. *in* Chem. Abs., v. 61, col. 15850, 1964.

00687 **Shteynberg, D. S.** Osokino-Aleksandrovskoe zhelezorudnoe mestorozhdenie na Srednem Urale [Osokino-Aleksandrovsk iron ore deposit in the Middle Urals]: Akad. Nauk SSSR Ural'. Filial, Gorno-Geol. Inst. Trudy, 1960, no. 35, p. 39–99, 1960.

Magnetite ores that are vanadium-bearing but low in titanium are described.

00688 **Shteynberg, D. S.; Fominykh, V. G.** O sostave titanomagnetitov Urala [Composition of the Ural titanomagnetites]: Akad. Nauk SSSR Doklady, nov. ser., v. 147, no. 6, p. 1452–1454, 1962; abs. *in* Chem. Abs., v. 58, col. 7725, 1963.

01100 **Shvartsev, S. L.** Nekotorye rezul'taty gidrogeo-khimicheskikh issledovaniy v usloviyakh mnogoletney merzloty [Hydrochemical surveys under permafrost conditions]: Geologiya Rudn. Mestorozhd., v. 5, p. 100–110, 1963; abs. *in* Econ. Geology, v. 59, p. 184, 1964.

The enrichment of certain elements, including vanadium, in subsurface waters near sulfide ore bodies and the application to geochemical prospecting are described.

Sidorenko, G. A. *See* Rogova, V. P. 01182

00332 **Signer, C. M.; Hewitt, W. P.** San Antonio mine—landmark on the path of the Conquistadores: Mining Eng., v. 4, no. 5, p. 459–463, 1952.

Describes the history of the mine and the geology of the silver, lead, tin, and vanadium ores.

Silina, O. M. *See* Ostroumov, E. A. 00499

Sillén, L. G. *See* Sundberg, Ingrid. 00783

00689 **Silva, R. P. da.** Sulla descloizite di Itacarambi (Stato di Minas Gerais, Brasile) [On the descloizite of Itacarambi (Minas Gerais, Brazil)]: Periodico Mineralogia, v. 30, p. 11–119, 1961.

Silver, Caswell. *See* Kelley, V. C. 00269

Simmons, G. C. *See* Shawe, D. R. 00679

00690 **Sims, P. K.** Geology of the Dover magnetite district, Morris County, New Jersey: U.S. Geol. Survey Bull. 982–G, p. 245–305, 1953.

00691 **Sims, P. K.** Geology and magnetite deposits of the Dover district, Morris County, New Jersey: U.S. Geol. Survey Prof. Paper 287, 162 p., 1958.

The two reports above include data on the vanadium content of these deposits.

00692 **Singewald, J. T., Jr.** The titaniferous iron ores in the United States, their composition and economic value: U.S. Bur. Mines Bull. 64, 145 p., 1913.

Analyses give vanadium content of samples from several deposits.

Singewald, J. T., Jr. *See* Miller, B. L. 00720

Sironi, Giuseppe. *See* Colombo, Umberto. 00208

00333 **Skeet, T. H. H.** Vanadium: Mine and Quarry Eng., v. 28, p. 30–35, 1962.

Gives data on production, extraction, and uses of vanadium and briefly reviews the geologic occurrence of the principal sources of vanadium.

00693 **Skerl, A. C.** Vanadium at the Rhodesia Broken Hill: Mining Mag. [London], v. 50, no. 5, p. 280–283, 1934.

Suggests that vanadium in oxidized ore was derived from surrounding sedimentary rocks as no vanadium was found in the primary sulfide ore.

00694 **Skŏcek, Vladimír.** Vanádem obohacene–skvrny v permských sedimentech [Patches enriched in vanadium in Permian sediments (with German summ.)]: Prague Ustředni Ustav Geol. Věstnik, v. 37, no. 5, p. 347–352, 1962; abs. *in* Chem. Abs., v. 58, col. 374, 1963.

00695 **Slater, C. S.; Holmes, R. S.; Byers, H. G.** Trace elements in the soils from the erosion experiment stations, with supplementary data on other soils: U.S. Dept. Agriculture Tech. Bull. 552, 23 p., 1937.

Includes analytical data on vanadium in soils and a brief discussion of its relations.

Slovinskii–Sidak, N. P. *See* Vasil'chikov, N. V. 01179

Smales, A. A. *See* Kemp, D. M. 01205

Smart, R. A. *See* Davidson, D. F. 00355

00696 **Smirnov, S. S.** Nakhodka vanadievykh rud v Suleymansayskom svintsovom mestorozhdenii [Discovery of vanadium minerals in the lead deposit of Suleiman–Sai]: Russia Geol. Kom. Vestnik, v. 3, no. 1, p. 29–30, 1928.

Smith, D. K., Jr. *See* Gruner, J. W. 01288

Smith, D. K., Jr. *See* Gruner, J. W. 01289

Smith, H. B. *See* Page, L. R. 00619

Smith, H. N. *See* Stanfield, K. E. 00765

00697 **Smith, J. F., Jr.; Huff, L. C.; Hinrichs, E. N.; Luedke, R. G.** Geology of the Capitol Reef area, Wayne and Garfield Counties, Utah: U.S. Geol. Survey Prof. Paper 363, 102 p., 1963.

A description of the uranium–vanadium deposits in sandstone is included.

01020 **Smith, J. W.; Stanfield, K. E.** Oil yields and properties of Green River oil shales in Uinta Basin, Utah, *in* Guidebook to the geology and mineral resources of the Uinta Basin, Utah's hydrocarbon storehouse: Intermtn. Assoc. Petroleum Geologists, 13th Ann. Field Conf. [Guidebook], p. 213–221, 1964.

The vanadium content of a composite sample was determined by spectrographic analysis to be 78 ppm.

Smith, L. E. *See* McKelvey, V. E. 00401

Smith, L. E. *See* McKelvey, V. E. 00404

00698 **Smith, L. E.; Hosford, G. F.; Sears, R. S.; Sprouse, D. P.; Stewart, M. D.** Stratigraphic sections of the Phosphoria formation in Utah, 1947–48: U.S. Geol. Survey Circ. 211, 48 p., 1952.

Some data on the vanadium content of phosphate rock and shale are included.

00699 **Smol'yaninov, N. A.** Suleymansayskoe vanadievoe mestorozhdenie [Suleimansai vanadium deposit]: Mineral'noe Syr'e i Ego Pererabotka, v. 3, nos. 11–12, p. 743–750, 1928.

00751 **Smol'yaninov, N. A.; Yanishevskiy, E. M.** Vanadiy v Suleyman-sayskom svintsovom mestorozhdenii [Vanadium in the Suleyman-say lead deposits]: Mineral'noe Syr'e i Ego Pererabotka, v. 3, no. 2, p. 107–109, 1928.

01021 **Snetsinger, Kenneth.** Barium-vanadium muscovite and vanadium tourmaline from Mariposa County, California: Am. Mineralogist, v. 51, p. 1623–1639, 1966; *and* A correction, v. 52, p. 1576, 1967.

Snider, J. J. *See* Eargle, D. H. 00442

00752 **Sobolev, M. N.** Promyshlennost' vanadiya i nachalo razvitiya ee v SSSR [The vanadium industry and the beginning of its development in the USSR]: Moscow, U.S.S.R. Gos. Nauchn.-Tekhnich. Gorno-Geologo-Neft. Izdatel., 54 p., 1933.

Reviews world production and resources of vanadium, and briefly describes the occurrence and reserves of vanadate minerals in the small lead deposit at the Suleimansai mine and describes the possible metallurgical methods of treating the vanadium ore.

01022 **Soehnge, P. G.** The geology of the Tsumeb mine, *in* Haughton, S. H., ed., The geology of some ore deposits in southern Africa, v. 2: Johannesberg, Geological Society of South Africa, p. 367–382, 1964.

The Tsumeb mine has yielded vanadate ore.

Soister, P. E. *See* Troyer, M. L. 00808

00753 **Sokolov, V. A.** A Cambrian "vanadium" sea [in Russian]: Akad. Nauk SSSR, Comptes Rendus (Doklady), nouv. sér., v. 56, no. 1, p. 77–80, 1947; abs. *in* Annot. Bibliography Econ. Geology, v. 22, p. 168, 1949.

00754 **Sokolov, V. A.** Geologiya i litologiya karbonatnykh porod Srednogo Proterozoya Karelii [Geology and lithology of the Middle Proterozoic carbonate rocks of Karelia]: Moscow-Leningrad, U.S.S.R. Akademiya Nauk SSSR, Karelian Filial, 185 p., 1963.

A description of the vanadium-bearing carbonaceous rocks (shungite) is given.

00755 **Sokolov, V. A.; Kozlov, N. A.** O genezise vanadievogo komponenta vanadienosnykh osadochnykh obrazovaniy Yuzhogo Kazakhstana [Genesis of the vanadium component of vanadium-bearing sedimentary formations in the Southern Kazakhstan]: Uchenye Zapiski Kazakh. Univ., v. 27, p. 105–109, 1957; abs. *in* Chem. Abs., v. 54, col. 22216, 1960.

Solchaga, M. A. *See* Fester, G. A. 01220

00756 **Solignac, Marcel.** The zinc and vanadium ores of the lead–zinc deposit of Djebba (Tunisia) [in French]: Cong. Internat. Mines, Métallurgie et Géologie Appl., 7th, Paris 1935, Sec. Géologie Appl., v. 1, p. 121–143, 1935; abs. *in* Annot. Bibliography Econ. Geology, v. 10, p. 43, 1937.

00757 **Solis Plaza, W. A.** Destilacion de una muestra de asfaltita vanadífera de Huari [Distillation of a sample of vanadium-containing asphalt from Huari]: Cong. Peruano Química, 3d, Actas y Trabajos, v. 2, p. 778–780, [1949] 1950.

Solyakov, S. P. *See* Amirova, S. A. 01133

Sommer, J. *See* Fischer, E. 00228

01023 **Soremark, Rune.** Vanadium in some biological specimens: Jour. Nutrition, v. 92, no. 2, p. 183–190, 1967.

00758 **South Africa Geological Survey.** The mineral resources of the Union of South Africa [4th ed.]: South Africa Geol. Survey Handbook no. 1, 622 p., 1959.

A brief review of base-metal vanadates and the vanadium occurrences in chromite and titaniferous magnetite is included.

00759 **South African Mining Eng. Jour.** Uranium production in the U.S.S.R.: South African Mining Eng. Jour., v. 68, pt. 1, no. 3360, p. 1321, 1957.

Reports the production of uranium from vanadium-bearing sandstone deposits in the Ferghana Valley, U.S.S.R.

00760 **Spencer, L. J.** On hopeite and other zinc phosphates and associated minerals from the Broken Hill mines, north-western Rhodesia: Mineralog. Mag. [London], v. 15, no. 68, p. 1–38, 1908.

Includes information on the occurrence of descloizite and vanadinite.

Sprouse, D. P. *See* Smith, L. E. 00698

01024 **Srinivasan, S. R.; Bhoray, S. S.; Bhatnagar, P. P.** The chlorination of vanadium-bearing titaniferous magetite: Indian Inst. Metals Trans., v. 17, p. 177–180, 1964.

00761 **Srivastava, S. N. P.** Some new occurrences of vanadium in Sarjori area, Singhbhum district, Bihar: Indian Sci. Cong. Assoc., 46th, Delhi 1959, Proc., pt. 3, p. 231, 1959.

00762 **Srivastava, S. N. P.** Vanadiferous magnetite ore in the Dhalbhumgarh subdivision, Singhbhum district, Bihar: Jour. Mines, Metals and Fuels, v. 11, no. 4, p. 11–16, 1963.

Stadnichenko, Taisia. *See* Zubovic, Peter. 00979

Stadnichenko, Taisia. *See* Zubovic, Peter. 00980

Stadnichenko, Taisia. *See* Zubovic, Peter. 00981

Stadnichenko, Taisia. *See* Zubovic, Peter. 00982

Stadnichenko, Taisia. *See* Zubovic, Peter. 01175

Stager, H. K. *See* Bush, A. L. 01111

00763 **Stahl, Alfred.** Geologische Grundzüge des Nördlichen Südwestafrikas und Erzlagerstätten des Otavi-Berglandes [Geological characteristics of northern South-West Africa and ore deposits of the Otavi Mountains]: Zeitschr. Prakt. Geologie, v. 24, p. 145–151, 1926.

A description of the base-metal vanadate ore is included; a source of vanadium from the base-metal sulfide minerals is suggested.

00764 **Stahl, Alfred.** Die Vanadinlagerstätten Afrikas, insbesondere Südwestafrikas [Vanadium deposits of Africa, particularly South-West Africa]: Metallwirtschaft., v. 21, p. 297–299, 1942; abs. *in* Zentralbl. Mineralogie, Geologie u. Paläontologie, 1943, v. 2, p. 151–153, 1943.

Stakhanov, V. V. *See* Myasnik, S. L. 01184

00765 **Stanfield, K. E.; Frost, I. C.; McAuley, W. S.; Smith, H. N.** Properties of Colorado oil shale: U.S. Bur. Mines Rept. Inv. 4825, 27 p., 1951.

Includes several analyses that show a low vanadium content of oil-shale samples.

Stanfield, K. E. *See* Smith, J. W. 01020

Stanisheva, G. *See* Vasilev, L. 00831

01025 **Staples, L. W.; Evans, H. T., Jr.; Lindsay, J. R.** Cavansite, a new calcium silicate mineral [abs.]: Geol. Soc. America Program, 1967 Ann. Meeting, New Orleans, p. 211, 1967.

01101 **Stappenbeck, Richard.** Die Erzlagerstätten der Eisenmetalle in Sudamerika [The ore deposits of the iron metals in South America]: Stahl u Eisen, v. 62, p. 369–373, 1942.

Deposits of iron, coal, and ferrous-alloy metals are described and their locations shown on a map.

Starkova, A. G. *See* Levin, B. Yu. 00372

00766 **Stearns, H. T.** Note on the first discovery of vanadinite in Idaho: Am. Mineralogist, v. 8, p. 127–128, 1923.

00767 **Stephenson, R. C.** Titaniferous magnetite deposits of the Lake Sanford area, New York: Mining Technology, v. 9, no. 1 (Tech. pub. 1789), 25 p., 1945; also *in* Am. Inst. Mining Metall. Engineers, Trans., v. 178, p. 397–421, 1948.

Includes information on the occurrence and content of vanadium in the ore.

00768 **Stern, T. W.; Stieff, L. R.; Evans, H. T., Jr.; Sherwood, A. M.** Doloresite, a new vanadium oxide mineral from the Colorado Plateau: Am. Mineralogist, v. 42, p. 587–593, 1957.

01123 **Stern, T. W.; Stieff, L. R.; Girhard, M. N.; Meyrowitz, Robert.** The occurrence and properties of metatyuyamunite, $Ca(UO_2)_2(VO_4)_2 \cdot 3\text{–}5H_2O$: Am. Mineralogist, v. 41, p. 187–201, 1956.

Stewart, J. H. *See* Fischer, R. P. 00468

Stewart, J. H. *See* Fischer, R. P. 00469

Stewart, M. D. *See* Smith, L. E. 00698

Stewart, R. M. *See* Wright, L. A. 00953

Stieff, L. R. *See* Stern, T. W. 00768

Stieff, L. R. *See* Stern, T. W. 01123

00769 **Stigzelius, Herman.** Iron-titanium mine starts up in Finland: Eng. Mining Jour., v. 153, no. 5, p. 126–127, 1952.

This report briefly describes the size and grade of the vanadium-bearing Otanmäki titaniferous magnetite deposit and mine and mill capacity.

Stocking, H. E. *See* Page, L. R. 00619

00770 **Stoiber, R. E.; Dürr, Fritz.** Vanadium in the sublimates, Izalco volcano, El Salvador, [abs.]: Geol. Soc. America, Program 1963 Ann. Meeting, p. 159A, 1963.

Stoitsova, R. *See* Uzunov, I. 01035

00771 **Stokes, W. L.** Carnotite deposits in the Carrizo Mountains area, Navajo Indian Reservation, Apache County, Arizona, and San Juan County, New Mexico: U.S. Geol. Survey Circ. 111, 5 p., 1951.

00772 **Stokes, W. L.** Uranium-vanadium deposits of the Thompsons area, Grand County, Utah—with emphasis on the origin of carnotite ores: Utah Geol. Mineralog. Survey Bull. 46, 51 p., 1952.

00773 **Stokes, W. L.; Mobley, C. M.** Geology and uranium deposits of the Thompson area, Grand County, Utah, *in* Uranium deposits and general geology of southeastern Utah: Utah. Geol. Soc. Guidebook, no. 9, p. 78–94, 1954.

The uranium deposits described also contain commercial amounts of vanadium.

00774 **Stokes, W. L.; Russell, R. T.; Fischer, R. P.; Butler, A. P., Jr.** Geologic map of the Gateway area, Mesa County, Colorado, and the adjoining part of Grand County, Utah: U.S. Geol. Survey Strategic Minerals Inv., Prelim. Map 3-173, 1945.

Includes a brief description of the vanadium-uranium deposits in sandstone.

01102 **Stoll, W. C.** A short review of Peru's mineral resources: Econ. Geology, v. 56, p. 985–990, 1961.

Production and reserve data for the asphaltite deposit at Mina Ragra are given and this deposit and similar ones are briefly described.

00775 **Strakhov, N. M.** K geokhimii P, V i Cu v morskikh bituminoznykh porodakh [The geochemistry of phosphorus, vanadium, and copper in marine bituminous rocks]: Moscow Geologo-Razved. Inst., Trudy, v. 7, p. 3–20, 1937.

Describes phosphorus, vanadium, and copper in Black Sea slimes and in Domanik (Devonian), Artinsk (Permian), and Volga (Jurassic) beds in U.S.S.R.

00776 **Strauss, C. A.** Notes on the microscopic features of the magnetic iron ores of the Bushveld Complex: Geol. Soc. South Africa Trans., v. 49, p. 35–49, 1947.

Includes information on the content of vanadium and the source of the ores.

01026 **Strens, R. G. J.** Synthesis and properties of calcium vanadium garnet (goldmanite): Am. Mineralogist, v. 50, p. 260, 1965.

Strobell, J. D., Jr. *See* McKelvey, V. E. 00405

Strokova, G. S. *See* Bur'yanova, E. Z. 00173

00777 **Stroud, R. B.; Nye, T. S.** Some occurrences of uranium in southwest Brewster County, Big Bend area, Texas: Colorado Mining Assoc., Natl. Western Mining Conf., 60th, Trans., 1957, v. 1, p. 155–159, 1957.

The uranium occurrences in sandstone also contain some vanadium-bearing minerals.

Struever, G. *See* Lovisato, Domenico. 00395

00778 **Strunz, H.** Mineralien der Descloizitgruppe; Konichalcit, Staszizit, Austinit, Duftit, Aräoxen, Volborthit, Pyrobelonit [Minerals of the descloizite group * * * araeoxen, volborthite, pyrobelonite]: Zeitschr. Kristallographie, v. 101, p. 496–506, 1939.

00779 **Studt, F. E.** The geology of Katanga and Northern Rhodesia; an outline of the geology of south-central Africa: Geol. Soc. South Africa Trans., v. 16, p. 44–106, 1914.

The base-metal vanadate minerals with some gold deposits are mentioned in this report.

Sudo, Toshio. *See* Ishikawa, Hideo. 01083

Sudo, Toshio. *See* Ishikawa, Hideo. 01125

00780 **Sugawara, Ken; Naito, Hideo; Yamada, Setsuo.** Geochemistry of vanadium in natural waters [in English]: Jour. Earth Sci. [Nagoya, Japan, Univ.], v. 4, no. 1, p. 44–61, 1956; abs. *in* Chem. Abs., v. 50, col. 13340, 1956.

Gives data on the vanadium content of several types of natural waters and some associated sediments and suggests a possible geochemical relationship.

00781 **Sultanov, A. D.; Balakishieva, B. A.** K geokhimicheskoy kharakteristike otlozheniy Apsheronskogo yarusa severnogo borta Srednekurinskoy vpadiny [Geochemical characteristics of the Apsheron deposits on the northern edge of the central Kurinskaya depression]: Akad. Nauk Azerbaydzhan. SSR, Izv., Ser. Geol.-Geog. Nauk i Nefti, 1961, no. 6, p. 61–68, 1961.

Gives data on the trace-element content of sandstones and shales and suggests modes of accumulation of these elements.

00782 **Sun, Ming-Shan; Weber, R. H.** Santafeite, a new hydrated vanadate from New Mexico: Am. Mineralogist, v. 43, p. 677–687, 1958.

00783 **Sundberg, Ingrid; Sillén, L. G.** The crystal structure of KUO_2VO_4 (synthetic anhydrous carnotite): Arkiv för Kemi, v. 1, p. 337–351, 1949; abs. *in* Mineralog. Abs., v. 11, p. 92, 1952.

00784 **Supreme Comm. for the Allied Powers.** Iron sand resources of Japan: Supreme Commander Allied Powers, Nat. Resources Sec. Rept. 98, 30 p., 1947.

Describes and appraises these deposits and includes data on their vanadium content.

Svyazhin, N. V. *See* Fominykh, V. G. 00909

00785 **Swanson, R. W.; Lowell, W. R.; Cressman, E. R.; Bostwick, D. A.** Stratigraphic sections of the Phosphoria formation in Montana, 1947–48: U.S. Geol. Survey Circ. 209, 31 p., 1953.

Some data on the vanadium content of phosphate rock and shale are included.

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Vanadate deposits: Smirnov, S. S. 00696

Vanadate deposits: Smol'yaninov, N. A. 00699

Vanadate deposits: Smol'yaninov, N. A. 00751

Vanadate deposits: Sobolev, M. N. 00752