

THE CANADIAN MINERALOGIST

VOLUME 34, INDEX

J. DOUGLAS SCOTT

203-44 Brousseau Avenue, Timmins, Ontario P4N 5Y2

AUTHOR INDEX

- Abbott, R.N., Jr., Optical properties of $C2/c$ pyroxenes: a point-dipole explanation, 595
 Acevedo, R.D. with Martin-Izard, A., 1332
 Armbruster, T. with Beran, A., 803
 Back, M.E. with Bermanec, V., 1287
 Bailey, D.K. with Riley, T.R., 389
 Ballirano, P., Merlini, S., Bonaccorsi, E. & Maras, A., The crystal structure of ilotite, a six-layer member of the cancrinite group, 1021
 Barker, D.S., Consequences of recycled carbon in carbonatites, 373
 Barnes, S.-J. with Mäier, W.D., 717
 Barton, P.B., Jr. with Campbell, W.R., 905
 Batuyev, B.N. with Mozgovaya, N.N., 23
 Bell, J.M. with Hughes, J.M., 817
 Bell, K., Dunworth, E.A., Bulakh, A.G. & Ivanikov, V.V., Alkaline rocks of the Turiy Peninsula, Russia, including type-locality turjaite and turjite: a review, 265
 Bell, K. with Simonetti, A., 411
 Beran, A., Libowitzky, E. & Armbruster, T., A single-crystal infrared spectroscopic and X-ray-diffraction study of untwinned San Benito perovskite containing OH groups, 803
 Bergman, S.C. with Woolley, A.R., 175
 Bermanec, V., Holtstam, D., Sturman, D., Criddle, A.J., Back, M.E. & Ščavničar, S., Nežilovite, a new member of the magnetoplumbite group, and the crystal chemistry of magnetoplumbite and hibonite, 1287
 Béziau, D., Monchoux, P. & Tollon, F., Cobaltite–gersdorffite solid solution as a primary magmatic phase in spessartite, Lacaua area, Montagne Noire, France, 503
 Birkett, T.C., Trzcinski, W.E., Jr. & Stirling, J.A.R., Occurrence and composition of some Ti-bearing minerals in the Strange Lake intrusive complex, Quebec–Labrador boundary, 779
 Blaton, N. with Vochten, R., 1317
 Bonaccorsi, E. with Ballirano, P., 1021
 Borodavev, Yu.S. with Mozgovaya, N.N., 23
 Bruckschen, P. with Bruhn, F., 1223
 Bruhn, F., Bruckschen, F., Meijer, J., Stephan, A., Richter D.K. & Veizer, J., Cathodoluminescence investigations and trace-element analyses of quartz by micro-PIXE: implications for diagenetic and provenance studies in sandstone, 1223
 Bulakh, A.G. & Ivanikov, V.V., Carbonatites of the Turi Peninsula, Kola: role of magmatism and metamorphism, 403
 Bulakh, A.G. with Bell, K., 265
 Burns, P.C. & Carpenter, M.A., Phase transitions in the series boracite – tremolite – congoite: phase relations, 881
 Burns, P.C. & Hawthorne, F.C., Static and dynamic Jahn–Teller effects in Cu^{2+} oxy salt minerals, 1089
 Burns, P.C., Miller, M.L. & Ewing, R.C., U^{6+} minerals and inorganic phases: a comparison and hierarchy of crystal structures, 845
 Cabri, L.J. with Campbell, J.L., 37
 Campbell, J.L., Teesdale, W.J., Kjarsgaard, B.A. & Cabri, L.J., Micro-PIXE analysis of silicate reference standards for trace Ni, Cu, Zn, Ga, Ge, As, Rb, Sr, Y, Zr, Nb, Mn and Pb, with emphasis on Ni for application in the Ni-in-garnet geothermometer, 37
 Campbell, W.R. & Barton, P.B., Jr., Occurrence and significance of stalactites within the epithermal deposits at Creede, Colorado, 905
 Carpenter, M.A. with Burns, P.C., 881
 Černý, P. with Wise, M.A., 631
 Chakhmouradian, A.R., On the development of niobium and rare-earth minerals in monticellite–calcite carbonatite of the Oka Complex, Quebec, 479
 Chakhmouradian, A.R. with Mitchell, R.H., 977, 991
 Chambers, A.D. with Coulson, I.M., 1163
 Chao, G.Y. with McDonald, A.M., 107
 Chen, Xiao Ming with Wang, Ru Cheng, 1001
 Cooper, M.A. & Hawthorne, F.C., The crystal structure of keyite, $Cu_2^{2+}(Zn,Cu^{2+})_4Cd_2(AsO_4)_6(H_2O)_2$, an oxy salt mineral with essential cadmium, 623
 Cooper, M.A. & Hawthorne, F.C., The crystal structure of ludlockite, $PbFe^{2+}As_10O_{20}$, the mineral with pentameric arsenite groups and orange hair, 79
 Cooper, M.A. & Hawthorne, F.C., The crystal structure of rapideskrite, $Ca_2(SO_4)(CO_3)(H_2O)_4$, and its relation to the structure of gypsum, 99
 Cooper, M.A. & Hawthorne, F.C., The crystal structure of shigaite, $[AlMn_2^{2+}(OH)_6]_3(SO_4)_2Na(H_2O)_6(H_2O)_6$, a hydrotalcite-group mineral, 91
 Cooper, M.A. & Hawthorne, F.C., The crystal structure of spiroffite, 821
 Cooper, M.A. with Finch, R.J., 1071
 Cooper, M.A. with Pezzotta, F., 741
 Coulson, I.M. & Chambers, A.D., Patterns of zonation in rare-earth-bearing minerals in nepheline syenites of the North Qeqqata Center, South Greenland, 1163
 Criddle, A.J. with Bermanec, V., 1287
 Criddle, A.J. with Roberts, A.C., 49
 Currie, K.L. with Bremner, O., The origin of rare minerals in the Kipawa syenite complex, western Quebec, 435
 Czamanske, G.K. & Loferer, P.J., Cryptic trace-element alteration of anorthosite, Stillwater Complex, Montana, 559
 Deliens, M. with Vochten, R., 1317
 Demainne, D. with Moreau, C., 281
 Demartin, F., Gramaccioli, C.M., Pilati, T. & Sciesa, E., Sigismundite, $(Ba,K,Pb)Na_4(Ca,Sr)(Fe,Mg,Mn)_3Al(OH)_5(PO_4)_2$, a new Ba-rich member of the arrojadite group from Spluga Valley, Italy, 827
 Dilles, J.H. with Laurs, B.M., 1253
 Dostal, J. with Owens, J.V., 959
 Dunworth, E.A. with Bell, K., 265
 Dutrizac, J.E. with Jambar, J.L., 61
 Eby, G.N. with Mitchell, R.H., 173
 Eby, G.N. with Woolley, A.R., 423
 Edgar, A.D. with O'Connor, T.K., 187
 Edgar, A.D. with Woolley, A.R., 175
 Edwards, B.R. & Russell, J.K., Influence of magmatic assimilation on mineral growth and zoning, 1149
 Efimov, A.V. with Mozgovaya, N.N., 23
 Ercit, T.S. with Groat, L.A., 1059
 Erd, R.C. with Foord, E.E., 1011
 Erd, R.C. with Roberts, A.C., 49
 Ewing, R.C. with Burns, P.C., 845
 Ewing, R.C. with Finch, R.J., 1071
 Feingios, M.N. with Jambar, J.L., 1305
 Finch, R.J., Cooper, M.A., Hawthorne, F.C. & Ewing, R.C., The crystal structure of schoepite, $[(UO_2)_2O(OH)_2(H_2O)_2$, 1071
 Fishman, N.S. with Force, E.R., 605
 Fleet, M.E. with Pan, Yuanming, 147
 Foland, K.A. with Henderson, C.M.B., 1241
 Foland, K.A. with Landoll, J.D., 301
 Fontaine, D. with Jébrak, M., 931
 Fontan, F. with Wang, Ru Cheng, 1001
 Foord, E.E., Erd, R.C., Robie, S.B., Lichte, F.E. & King, V.T., Li- and F-bearing alkali amphibole from granitic pegmatite at Hurricane Mountain, Carroll County, New Hampshire, 1011
 Foord, E.E. with Hawthorne, F.C., 1015
 Foord, E.E. with Hughes, J.M., 817
 Force, E.R., Richards, R.P., Scott, K.M., Valentine, P.C. & Fishman, N.S., Mineral intergrowths replaced by "elbow-twinned" rutile in altered rocks, 605
 Fowler, A.D. & L'Heureux, I., Self-organized banded sphalerite and branching galena in the Pine Point ore deposit, Northwest Territories, 1211
 Fowler, A.D. with L'Heureux, I., 1137
 Fowler, A.D. with Shore, M., 1111
 Franz, G., Gilg, H.A., Grundmann, G. & Morteani, G., Metasomatism at a granitic pegmatite – dunite contact in Galicia: the Franqueira occurrence of chrysoberyl (alexandrite), emerald, and phenakite: discussion, 1329
 Gammons, C.H., Hydrothermal synthesis of gold grains with apparent five-fold symmetry, 1
 Gammons, C.H. with Olivo, G.R., 547
 Gault, R.A. with Grice, J.D., 657
 Gault, R.A. with Roberts, A.C., 49
 Gerilla, F., Leblanc, M., Torres-Ruiz, J. & Hach-Alí, P.F., Immiscibility between arsenide and sulfide melts: a mechanism for concentration of noble metals, 485
 Gilg, H.A. with Franz, G., 1329
 Giuliani, G. with Michel, D., 513
 Goetz, S. with Sokolova, E.V., 1039
 Gramaccioli, C.M. with Demartin, F., 827
 Grice, J.D., The crystal structure of shoniokite-(Y), 649
 Grice, J.D., Gault, R.A. & Van Velthuizen, J., Penobsquisite: a new borate mineral with a complex framework structure, 657

- Grice, J.D., Groat, L.A. & Roberts, A.C., Jensenite, a cupric telluride framework structure with two coordinations of copper, 55
- Grice, J.D. with Jambor, J.L., 61, 1305
- Grice, J.D. with Mandarino, J.A., 685
- Grice, J.D. with McDonald, A.M., 107
- Grice, J.D. with Roberts, A.C., 49
- Grice, J.D., Szymański, J.T. & Jambor, J.L., The crystal structure of clinoatacamite, a new polymorph of $\text{Cu}_2(\text{OH})_3\text{Cl}$, 73
- Griffin, W.L., Smith, D., Ryan, C.G., O'Reilly, S.Y. & Win, T.T., Trace-element zoning in mantle minerals: metasomatism and thermal events in the upper mantle, 1179
- Groat, L.A. with Grice, J.D., 55
- Groat, L.A., Hawthorne, F.C., Lager, G.A., Schultz, A.J. & Ercit, T.S., X-ray and neutron crystal-structure refinements of a boron-bearing vesuvianite, 1059
- Groat, L.A. with Roberts, A.C., 49
- Grundmann, G. with Franz, G., 1329
- GUILLINGER, J.R. with McLemore, V.T., 335
- Hach-Alf, P.F. with Gervilla, F., 485
- Hach-Alf, P.F. with Morales-Ruano, S., 939
- Halden, N.M., Determination of Lyapounov exponents to characterize the oscillatory distribution of trace elements in minerals, 1127
- Hassan, I., The thermal behavior of cancrinite, 893
- Hassan, I., Two-dimensional periodic antiphase boundaries in a synthetic aluminate sodalite, $\text{Cs}_8\text{Al}_{12}\text{O}_{37}(\text{CrO}_4)_2$, 1031
- Hawthorne, F.C., Structural mechanisms for light-element variations in tourmaline, 123
- Hawthorne, F.C., Oberti, R., Ottolini, L. & Foord, E.E., Lithium-bearing fluor-arfvedsonite from Hurricane Mountain, New Hampshire: a crystal-chemical study, 1015
- Hawthorne, F.C., Oberti, R. & Sardone, N., Sodium at the A site in clinopyroxenes: the effects of composition on patterns of order, 577
- Hawthorne, F.C. with Burns, P.C., 1089
- Hawthorne, F.C. with Cooper, M.A., 79, 91, 99, 623, 821
- Hawthorne, F.C. with Finch, R.J., 1071
- Hawthorne, F.C. with Groat, L.A., 1059
- Hawthorne, F.C. with Liang, Jian-Jie, 115
- Hawthorne, F.C. with Oberti, R., 1051
- Hawthorne, F.C. with Pezzotta, F., 741
- Henderson, C.M.B. & Foland, K.A., Ba- and Ti-rich primary biotite from the Brome alkaline igneous complex, Monteregian Hills, Quebec: mechanisms of substitution, 1241
- Holm, R.F. with Witke, J.H., 221
- Holtzman, D. with Bermance, V., 1287
- Hughes, J.M., Foord, E.E., Jai-Nhuknan, J. & Bell, J.M., The atomic arrangement of ilmorite-(Y), $\text{Y}_2(\text{SiO}_4)_2(\text{CO}_3)$, 817
- Huston, D.L., Jablonski, W. & Sie, S.H., The distribution and mineral hosts of silver in eastern Australian volcanic massive sulfide deposits, 529
- Ivanikov, V.V. with Bell, K., 265
- Ivanikov, V.V. with Bulakh, A.G., 403
- Jablonski, W. with Huston, D.L., 529
- Jai-Nhuknan, J. with Hughes, J.M., 817
- Jambor, J.L., Dutrizac, J.E., Roberts, A.C., Grice, J.D. & Szymański, J.T., Clinoatacamite, a new polymorph of $\text{Cu}_2(\text{OH})_3\text{Cl}$, and its relationship to paratacamite and "anarakite", 61
- Jambor, J.L., Owens, D.R., Grice, J.D. & Feinglos, M.N., Gallobeudantite, $\text{PbGa}_3(\text{AsO}_4)_2(\text{SO}_4)_2(\text{OH})_6$, a new mineral species from Tsumeb, Namibia, and associated new gallium analogues of the alunite-jarosite family, 1305
- Jambor, J.L. with Grice, J.D., 73
- Jäger, C. with Sokolova, E.V., 1039
- Jenkins, D.M. with Sokolova, E.V., 1039
- Jébrak, M., Maroux, E. & Fontaine, D., Hydrothermal silica - gold stalactites formed by colloidal deposition in the Cirotan epithermal deposit, Indonesia, 931
- Jiang, Shao-Yong, Palmer, M.R., McDonald, A.M., Slack, J.F. & Leitch, C.H.B., Feruvite from the Sullivan Pb-Zn-Ag deposit, British Columbia, 733
- Jiang, Shao-Yong, Palmer, M.R. & Slack, J.F., Mn-rich ilmenite from the Sullivan Pb-Zn-Ag deposit, British Columbia, 29
- Kabakov, Y.K. with Sokolova, E.V., 1039
- Kato, A. with Shimizu, M., 1323
- King, V.T. with Foord, E.E., 1011
- Kjarsgaard, B.A. with Campbell, J.L., 37
- Kojima, S. with Ueno, T., 949
- Krasnov, S.G. with Mozgovaya, N.N., 23
- Kunath-Fandrei, G. with Sokolova, E.V., 1039
- L'Heureux, I. & Fowler, A.D., Isothermal constitutive undercooling as a model for oscillatory zoning in plagioclase, 1137
- L'Heureux, I. with Fowler, A.D., 1211
- Lager, G.A. with Groat, L.A., 1059
- Landoll, J.D. & Foland, K.A., The formation of quartz syenite by crustal contamination at Mont Shefford and other Monteregian complexes, Quebec, 301
- Laurs, B.M., Dilles, J.H. & Snee, L.W., Emerald mineralization and metasomatism of amphibolite, Khaltaro granitic pegmatite - hydrothermal vein system, Haramosh Mountains, northern Pakistan, 1253
- Le Bas, M.J. with McCormick, G.R., 469
- Le Bas, M.J. with Woolley, A.R., 175
- Leblanc, M. with Gervilla, F., 485
- LeCheminant, G.M., Proceedings of the forty-first annual meeting of the Mineralogical Association of Canada, 1341
- Leitch, C.H.B. with Jiang, Shao-Yong, 733
- Liang, Jian-Jie & Hawthorne, F.C., Rietveld refinement of micaceous materials: muscovite $2M_1$, a comparison with single-crystal structure refinement, 115
- Libowitzky, E. with Beran, A., 803
- Lichte, F.E. with Foord, E.E., 1011
- Liu, Lin-Gun with Mernagh, T.P., 1233
- Lloyd, F.E. with O'Connor, T.K., 187
- Lloyd, F.E. with Riley, T.R., 389
- Loftenski, P.J. with Czamanske, G.K., 559
- Lu, Jianchun, Seecombe, P.K. & Walsh, J.L., Conditions of chlorite growth in Hill End Goldfield, New South Wales, Australia: some predictions and evaluations, 9
- Lueth, V.W. with McLemore, V.T., 335
- Maier, W.D. & Barnes, S.-J., Unusually high concentrations of magnetite at Cariba and other Cu-sulfide deposits in the Curaçá Valley, Bahia, Brazil, 717
- Mancini, F., Sillanpää, R., Marshall, B. & Papunen, H., Magnesian hornblende from a metamorphosed ultramafic body in southwest Finland: crystal chemistry and petrological implications, 835
- Mandarino, J.A. & Grice, J.D., New minerals recently approved by the Commission on New Minerals and Mineral Names, International Mineralogical Association, 685
- Manning, P.G., Bioavailability of riverine, sewage plant, and sediment phosphorus in the Bay of Quinte, Lake Ontario, 667
- Maras, A. with Ballifano, P., 1021
- Marcos-Pascual, C. with Martin-Izard, A., 1332
- Marcou, E. with Jébrak, M., 931
- Markov, V.F. with Mozgovaya, N.N., 23
- Marshall, B. with Mancini, F., 833
- Martin, R.F. with Mason, R.A., 1109
- Martin, R.F. with Mungall, J.E., 769
- Martin-Izard, A., Paniagua, A., Moreiras, D., Acevedo, R.D. & Marcos-Pascual, C., Metasomatism at a granitic pegmatite - dunite contact in Galicia: the Franqueira occurrence of chrysoberyl (alexandrite), emerald, and phenakite: reply, 1332
- Mason, R.A. & Martin, R.F., The Origin and Significance of Zoning in Minerals: Preface, 1109
- McCormick, G.R. & Le Bas, M.J., Phlogopite crystallization in carbonatic magmas from Uganda, 469
- McDonald, A.M., The crystal structure of sabinite, $\text{Na}_4\text{Zr}_2\text{TiO}_4(\text{CO}_3)_4$, 811
- McDonald, A.M., Chao, G.Y. & Grice, J.D., Phosinaite-(Ce) from Mont Saint-Hilaire, Quebec: new data and structure refinement, 107
- McDonald, A.M. with Jiang, Shao-Yong, 733
- McHone, J.G., Constraints on the mantle plume model for Mesozoic alkaline intrusions in northeastern North America, 325
- McLemore, V.T., Lueth, V.W., Pease, T.C. & Guilinger, J.R., Petrology and mineral resources of the Wind River laccolith, Cormudas Mountains, New Mexico and Texas, 335
- Meijer, J. with Bruhn, F., 1223
- Menard, T. & Spear, F.S., Interpretation of plagioclase zonation in calcic pelitic schist, South Strafford, Vermont, and the effects on thermobarometry, 133
- Menard, T. with Stowell, H.H., 1195
- Merlino, S. with Ballifano, P., 1021
- Mernagh, T.P. & Liu, Lin-Gun, Raman and infrared spectra of hydrous $\beta\text{-Mg}_2\text{SiO}_4$, 1223
- Michel, D. & Giuliani, G., Habit and composition of gold grains in quartz veins from greenstone belts: implications for mechanisms of precipitation of gold, 513
- Miller, M.L. with Burns, P.C., 845
- Miller, R.R., Structural and textural evolution of the Strange Lake peralkaline rare-element (NYF) granitic pegmatite, Quebec-Labrador, 349
- Mitchell, R.H. & Chakhmouradian, A.R., Compositional variation of loparite from the Lovozero alkaline complex, Russia, 977
- Mitchell, R.H., Chakhmouradian, A.R. & Yakovenchuk, V.N., "Nioboloparite": a re-investigation and discreditation, 991
- Mitchell, R.H. & Eby, G.N., Alkaline Rocks: Petrology and Mineralogy: Preface, 173
- Mitchell, R.H. with Woolley, A.R., 755
- Moffatt, E.A. with Roberts, A.C., 49
- Monchoux, P. with Bézat, D., 503
- Monchoux, P. with Wang, Ru-Cheng, 1001
- Morales-Ruano, S. & Hach-Alf, P.F., Hydrothermal argentopentlandite at El Charcón, southeastern Spain: mineral chemistry and conditions of formation, 939
- Moreau, C., Ohnenstetter, D., Demaiffe, D. & Robineau, B., The Los Archipielago nepheline syenite ring-structure: a magmatic marker of the evolution of the central and equatorial Atlantic, 281
- Moreiras, D. with Martin-Izard, A., 1332
- Morteani, G. with Franz, G., 1329
- Moss, R. & Scott, S.D., Silver in sulfide chimneys and mounds from 13°N and 21°N, East Pacific rise, 697
- Mozgovaya, N.N., Krasnov, S.G., Butayev, B.N., Borodaev, Yu.S., Efimov, A.V., Markov, V.F. & Stepanova, T.V., The first report of cobalt pentlandite from a Mid-Atlantic Ridge hydrothermal deposit, 23
- Mungall, J.E. & Martin, R.F., Extreme differentiation of peralkaline rhyolite, Terceira, Azores: a modern analogue of Strange Lake, Labrador?, 769
- Neiva, A.M.R., Geochemistry of cassiterite and its inclusions and exsolution products from tin and tungsten deposits in Portugal, 745
- Nicholls, J., Location of ray paths for a known wave normal in biaxial crystals, 161
- Oberti, R., Hawthorne, F.C., Zanetti, A., Ottolini, L. & Soto, J.I., Crystal-structure refinement of a highly ordered staurolite, 1051
- Oberti, R. with Hawthorne, F.C., 577, 1015
- O'Connor, T.K., Edgar, A.D. & Lloyd, F.E., Origin of glass in Quaternary mantle xenoliths from Meerfeldermaar, West Eifel, Germany: implications for enrichment in the lithospheric mantle, 187
- Ohnenstetter, D. with Moreau, C., 281

- Olivo, G.R. & Gammons, C.H., Thermodynamic and textural evidence for at least two stages of Au-Pd mineralization at the Caue iron mine, Itabira District, Brazil, 547
- O'Reilly, S.Y. with Griffin, W.L., 1179
- Ottolini, L. with Hawthorne, F.C., 1015
- Ottolini, L. with Oberti, R., 1051
- Owens, D.R. with Jambor, J.L., 1305
- Owens, J.V. & Dostal, J., Contrasting corona structures in mafic granulite from the Blansky Les complex, Bohemian Massif, Czech Republic, 959
- Palmer, M.R. with Jiang, Shao-Yong, 29, 733
- Pan, Yuanming & Fleet, M.E., Intrinsic and extrinsic controls on the incorporation of rare-earth elements in calc-silicate minerals, 147
- Paniagua, A. with Martin-Izard, A., 1332
- Papunen, H. with Mancini, F., 835
- Pearson, J.M. & Taylor, W.R., Mineralogy and geochemistry of fenitized alkaline ultrabasic sills in the Gifford Creek Complex, Gascoyne Province, Western Australia, 201
- Pease, T.C. with McLemore, V.T., 335
- Peeters, O. with Vochten, R., 1317
- Penczak, R.S. with Shaw, C.S.J., 967
- Pezzotta, F., Hawthorne, F.C., Cooper, M.A. & Teerstra, D.K., Fibrous foitite from San Piero in Campo, Elba, Italy, 741
- Pilati, T. with Demartin, F., 827
- Platt, R.G. with Woolley, A.R., 423
- Potter, L.S., Chemical variation along strike in feldspathoidal rocks of the Eastern Alkaline Belt, Trans-Pecos Magmatic Province, Texas and New Mexico, 241
- Richards, R.P., Twinned hambergite from the Gilgit district, northern Pakistan, 615
- Richards, R.P. with Force, E.R., 605
- Richter D.K. with Brühn, F., 1223
- Ridgway, C.K. with Stowell, H.H., 1195
- Riley, T.R., Bailey, D.K. & Lloyd, F.E., Extrusive carbonatite from the Quaternary Rockieskill Complex, West Eifel, Germany, 389
- Roberts, A.C., Grice, J.D., Groat, L.A., Criddle, A.J., Gault, R.A., Erd, R.C. & Moffat, E.A., Jensenite, $\text{Cu}_3\text{Te}^{6+}\text{O}_6\cdot 2\text{H}_2\text{O}$, a new mineral species from the Centennial mine, Tintic District, Juab County, Utah, 49
- Roberts, A.C. with Grice, J.D., 55
- Roberts, A.C. with Jambor, J.L., 61
- Robie, S.B. with Foord, E.E., 1011
- Robineau, B. with Moreau, C., 281
- Rock, N.M.S. with Woolley, A.R., 175
- Russell, J.K. with Edwards, B.R., 1149
- Ryan, C.G. with Griffin, W.L., 1179
- Sardone, N. with Hawthorne, F.C., 577
- Scavoniar, S. with Bermanec, V., 1287
- Schulz, A.J. with Groat, L.A., 1059
- Sciesz, E. with Demartin, F., 827
- Scott, K.M. with Force, E.R., 605
- Scott, S.D. with Moss, R., 697
- Scott, S.D. with Ueno, T., 949
- Scott Smith, B.H. with Woolley, A.R., 175
- Secombe, P.K. with Lu, J., 9
- Shaw, C.S.J. & Penczak, R.S., Barium- and titanium-rich biotite and phlogopite from the Western and Eastern Gabbro, Coldwell alkaline complex, north-western Ontario, 967
- Sheriff, B.L. with Sokolova, E.V., 1039
- Shimizu, M. & Kato, A., Pavonite from the Ikuno mine, Hyogo Prefecture, Japan, 1323
- Shore, M. & Fowler, A.D., Oscillatory zoning in minerals: a common phenomenon, 1111
- Shore, M. with Simonetti, A., 411
- Sie, S.H. with Huston, D.L., 529
- Sillanpää, R. with Mancini, F., 835
- Simonetti, A., Shore, M. & Bell, K., Diopside phenocrysts from nepheline lavas, Napak volcano, eastern Uganda: evidence for magma mixing, 411
- Slack, J.F. with Jiang, Shao-Yong, 29, 733
- Smith, D. with Griffin, W.L., 1179
- Snee, L.W. with Laurs, B.M., 1253
- Sokolova, E.V., Kabalov, Y.K., Sheriff, B.L., Teerstra, D.K., Jenkins, D.M., Kunath-Fandrei, G., Goetz, S. & Jäger, C., Marielite: Rietveld structure-refinement and ^{29}Si MAS and ^{27}Al satellite transition NMR spectroscopy, 1039
- Soto, J.I. with Oberti, R., 1051
- Spear, F.S. with Menard, T., 133
- Stepanova, T.V. with Mozgovaya, N.N., 23
- Stephan, A. with Brühn, F., 1223
- Stirling, J.A.R. with Birkett, T.C., 779
- Stowell, H.H., Menard, T. & Ridgway, C.K., Ca-metasomatism and chemical zonation of garnet in contact-metamorphic aureoles, Juneau Gold Belt, southeastern Alaska, 1195
- Sturman, D. with Bermanec, V., 1287
- Szymanski, J.T. with Grice, J.D., 73
- Szymanski, J.T. with Jambor, J.L., 61
- Taylor, W.R. with Pearson, J.M., 201
- Teerstra, D.K. with Pezzotta, F., 741
- Teerstra, D.K. with Sokolova, E.V., 1039
- Teesdale, W.J. with Campbell, J.L., 37
- Tollon, F. with Bézia, D., 503
- Torres-Ruiz, J. with Gervilla, F., 485
- Trzcienski, W.E., Jr. with Birkett, T.C., 779
- Ueno, T., Scott, S.D. & Kojima, S., Inversion between sphalerite- and wurtzite-type structures in the system Zn-Fe-Ga-S, 949
- Valentine, P.C. with Force, E.R., 605
- van Breemen, O. with Currie, K.L., 435
- Van Velthuizen, J. with Grice, J.D., 657
- Veizer, J. with Brühn, F., 1223
- Vochten, R., Blaton, N., Peeters, O. & Deliens, M., Piretite, $\text{Ca}(\text{UO}_2)_3(\text{SeO}_4)_2(\text{OH})_4\cdot 4\text{H}_2\text{O}$, a new calcium uranyl selenite from Shinkolobwe, Shaba, Zaire, 1317
- Walshe, J.L. with Lu, Jianchun, 9
- Wang, Ru Cheng, Fontan, F., Xu, Shi Jin, Chen, Xiao Ming & Monchoux, P., Hafnian zircon from the apical part of the Suzhou granite, China, 1001
- Win, T.T. with Griffin, W.L., 1179
- Wise, M.A. & Černý, P., The crystal chemistry of the tapholite series, 631
- Wittke, J.H. & Holm, R.F., The association basanitic nepheline – feldspar ijolite – nepheline monzonoyenite at House Mountain volcano, north-central Arizona, 221
- Woolley, A.R., Bergman, S.C., Edgar, A.D., Le Bas, M.J., Mitchell, R.H., Rock, N.M.S. & Scott Smith, B.H., Classification of lamprophyres, lamproites, kimmerrites, and the kalsilitic, melilitic, and leucitic rocks, 175
- Woolley, A.R., Platt, R.G. & Eby, G.N., Relatively aluminous alkali pyroxene in nepheline syenites from Malawi: mineralogical response to metamorphism in alkaline rocks, 423
- Xu, Shi Jin with Wang, Ru Cheng, 1001
- Yakovenchuk, V.N. with Mitchell, R.H., 991
- Zaitsev, A.N., Rhombohedral carbonates from carbonatites of the Khibina Massif, Kola Peninsula, Russia, 453
- Zanetti, A. with Oberti, R., 1051

SUBJECT INDEX

- Alkaline rocks of the Tury Peninsula, Russia, including type-locality turjaite and turjite: a review, (Bell *et al.*), 265**
- Alkaline Rocks Petrology and Mineralogy: Preface, (Mitchell & Eby), 173**
- A single-crystal infrared spectroscopic and X-ray-diffraction study of untwinned San Benito perovskite containing OH groups, (Beran *et al.*), 803**
- Ba- and Ti-rich primary biotite from the Brome alkaline igneous complex, Montérégie Hills, Quebec: mechanisms of substitution, (Henderson & Poland), 1241**
- Barium- and titanium-rich biotite and phlogopite from the Western and Eastern Gabbro, Coldwell alkaline complex, northwestern Ontario, (Shaw & Penczak), 967**
- Bioavailability of riverine, sewage plant, and sediment phosphorus in the Bay of Quinte, Lake Ontario, (Manning), 667**
- Ca-metasomatism and chemical zonation of garnet in contact-metamorphic aureoles, Juneau Gold Belt, southeastern Alaska, (Stowell *et al.*), 1195**
- Carbonatites of the Turi Peninsula, Kola: role of magmatism and of metasomatism, (Bulakh & Ivanikov), 403**
- Cathodoluminescence investigations and trace-element analyses of quartz by micro-PIXE: implications for diagenetic and provenance studies in sandstone, (Bruhn *et al.*), 1223**
- CHEMICAL ANALYSES (see also Electron-microprobe analyses)**
- Minerals**
- biotite, 1244, magnetite, 724, plagioclase, 566, REE in calc-silicate minerals, 147, seafloor hydrothermal sulfides, 26, 704
- Rocks**
- amphibolite, 722, 1262, anorthosite, 566, basanitic nephelinite, 225, 294, calc-silicate, 722, carbonatite, 396, 406, diorite, 305, feldspar ijolite, 225, gabbro, 722, glimmerite, 722, gneiss, 1003, granodiorite, 722, ijolite, 406, larvikite, 305, leucogranite, 1264, marble, 443, melanephelinite, 406, melanoarite, 722, melilite, 406, meltite, 406, mica schist, 1262, nepheline diorite, 305, nepheline monzonoyenite, 225, nepheline syenite, 341, 445, nepheline trachyte, 245, nephelinite, 406, nordmarkite, 305, norite, 722, olivine melanephelinite, 406, pantellerite, 770, peralkaline granite, 445, peralkaline skarn, 445, peridotite, 722, phonolite, 245, 294, pulaskite, 305, pyroxenite, 406, 722, quartz syenite, 770, syenite, 341, 445, 722, syenitic urrite, 225, tourmaline-albite vein, 1277, trondjemite, 445, turrite, 406, ultrabasic sill, 214, uncompaghrite, 406
- Chemical variation along strike in feldspathoidal rocks of the Eastern Alkaline Belt, Trans-Pecos Magmatic Province, Texas and New Mexico, (Potter), 241
- Classification of lamprophyres, lamproites, kimberlites, and the kalsilic, metasilic, and leucitic rocks, (Woolley *et al.*), 175
- Clinoatacamite, a new polymorph of $\text{Cu}_2(\text{OH})_3\text{Cl}$, and its relationship to paracacamite and "anarakite", (Jambor *et al.*), 61
- Cobaltite-gersdorffite solid solution as a primary magmatic phase in spessartite, Lacaune area, Montagne Noire, France, (Bézat *et al.*), 503
- Compositional variation of loparite from the Lovozero alkaline complex, Russia, (Mitchell & Chakhmouradian), 977
- Conditions of chlorite growth in the Hill End Goldfield, New South Wales, Australia: some predictions and evaluations, (Lu *et al.*), 9
- Consequences of recycled carbon in carbonatites, (Barker), 373
- Constraints on the mantle plume model for Mesozoic alkaline intrusions in northeastern North America, (McHone), 325
- Contrasting corona structures in mafic granulite from the Blansky Les complex, Bohemian Massif, Czech Republic, (Owens & Dostal), 959
- COUPLED-ATOM SUBSTITUTIONS**
- coupled atom substitutions in oscillatory zoned minerals, 1116, 1169, 1312
- Oxides**
- cassiterite, 755, ilmenite, 764, ixiolite, 761, magnetoplumbite group, 1291, perovskite, 807, 981, rutile, 764
- Phosphates**
- apatite, 1168
- Silicates**
- anegmatite, 786, andradite (titanian), 274, astrophyllite, 787, beryl, 1269, biotite, 971, 1242, clinoamphibole, 587, eudialyte, 1169, feruvite, 736, fluor-arfvedsonite, 1016, narsarsukite, 790, neptunite, 791, niobophyllite, 788, REE in calc-silicate minerals, 152, titanite, 1172, tourmaline, 124, 736, vesuvianite, 1063
- Sulfides**
- argentopentlandite, 943, pavonite, 1323, sphalerite, 1216, unidentified treasure derivative, 1324
- Cryptic trace-element alteration of anorthosite, Stillwater Complex, Montana, (Czamanske & Loferski), 559
- CRYSTALLOGRAPHY (see also Twinning)**
- aluminosilicate modulated structure, 1031, alunite-jarosite group, 1312, arsenite group topology, 84, Ba-Ti substitution in biotite, 971, 1242, beryl, 1269, boracite, 881, cancrinite group ring-stacking sequence, 1022, cancrinite thermal expansion, 893, conゴolite, 109, eudialyte, 1169, 1312 dynamic Jahn-Teller effect, 1090, ferrotapolite, 638, flutings, 2, gold with pentagonal morphology, 1, II in perovskite, 804, hambergite, 615, hydrous 8-Mg₂SiO₅, 1233, Jahn-Teller effect for Cu²⁺, 57, 75, 625, 1089, magnetoplumbite group, 1293, manganotapolite, 638, Na-ordering in clinopyroxenes, 577, neutron diffraction, 1059, phase transitions in boracite-group minerals, 881, phlogopite zoning, 474, REE in calc-silicate minerals, 152, Rietveld refinement, 115, 1039, rutile, 605, scapolite, 1040, site-scattering refinement, 584, sphalerite-wurtzite inversion, 949, synthetic (Cu,Zn)(OH)₃Cl, 65, taquioite, 635, tourmaline light-element distribution, 123, tremolite, 881, uranyl phases, structural classification, 845, uranyl polyhedra geometry, 846, vesuvianite, 1059
- CRYSTAL STRUCTURE (see also X-ray diffraction)**
- clinoatacamite, 73, fluor-arfvedsonite, 1016, fluor-nybøite, 577, fluor-taramite, 577, gallobeudanite, 1310, hibonite, 1292, ilmorite-(Y), 817, jensenite, 55, katophorite, 577, keyite, 623, liotite, 1021, ludlockite, 79, magnesian hornblende, 835, magnetoplumbite, 1292, marialite, 1039, muscovite-2M₁, 115, nežilovite, 1292, nybøite, 577, pargasite, 577, penobskite, 657, perovskite, 806, phosinate-(Ce), 107, rapidcreekite, 99, sabinaite, 811, scheelite, 1072, shigaite, 91, shomokite-(Y), 649, sigismundite, 830, spinoffite, 821, staurolite (Zn-rich), 1051, taramite, 577, vesuvianite (B-rich), 1060
- Crystal-structure refinement of a highly ordered staurolite, (Oberti *et al.*), 1051
- Determination of Lyapounov exponents to characterize the oscillatory distribution of trace elements in minerals, (Halden), 1127
- Diopside phenocrysts from nephelite lavas, Napak volcano, eastern Uganda: evidence for magma mixing, (Simonetti *et al.*), 411
- ELECTRON-MICROPROBE ANALYSES**
- agirine, 210, 286, 426, 438, aeginaite, 786, allanite, 1268, amphibole, 194, 1245, analcime, 276, 292, "anarakite", 62, andradite (titanian), 274, ankerite, 49, apatite, 211, 395, 1168, 1245, arfvedsonite, 208, 287, 1013, 1017, argentopentlandite, 942, arsenopyrite, 520, astrophyllite, 290, 787, augite, 286, 1245, baferite, 789, beryl, 1269, beudantite, 1309, biotite, 289, 438, 964, 969, 1244, 1271, biotite (Ba-Ti-rich), 967, 1244, biotite (F-rich), 1271, boracite, 884, calcite, 458, cassiterite, 750, catapeltite, 292, celsian, 276, ceriopyrochlore, 482, chlorite, 13, chromite, 488, 728, clinoatacamite, 69, clinopyroxene, 193, 231, 395, 426, 431, 432, 964, cobalt pentlandite, 26, cobaltite, 491, 507, columbite, 1008, congoite, 884, diopside, 412, 426, 438, dolomite, 459, eudialyte, 292, 1171, ferrocolumbite, 754, ferrotantalite, 754, ferrotapolite, 754, feruvite, 736, fluor-arfvedsonite, 1013, 1017, fluor-ferroalcite, 1013, fluornybøite, 583, fluorotapolite, 583, foitite, 743, gallian hidalgite, 1309, galite, 1306, gallobeudanite, 1309, garnet, 438, 964, 1198, gersdorffite, 491, 507, glass in mantle xenoliths, 191, glass in pantellerite, 770, gold, 520, hastingsite, 287, hibonite, 1289, ilmenite, 276, 764, 790, 963, 1245, ilmenite (Mn-rich), 31, ixiolite, 759, jensenite, 52, kataphorite, 438, 583, keyite, 630, kuptielite, 290, kutnáhorite, 459, latrappite, 481, laporite, 980, 993, löllingite, 491, ludlockite, 83, huestite, 982, 994, lävenite, 291, magnesian hornblende, 838, magnesioscorodite, 438, magnetite, 728, 1245, magnetite (titaniiferous), 291, 395, 417, magnetoplumbite, 1289, mangancolumbite, 754, manganotantalite, 1271, marialite, 1043, maucherite, 491, melilite, 271, 395, muscovite-2M₁, 116, 1271, narsarsukite, 790, nepheline, 235, 292, neptunite, 794, nežilovite, 1289, nickeline, 491, niobophyllite, 787, nybøite, 583, olivine, 194, 230, orthopyroxene, 193, 726, 964, paracacamite (nickeliferous), 70, paracacamite (zincian), 62, paragisite, 438, 583, parisite, 1175, 1326, penobskite, 659, pentlandite, 507, phlogopite, 194, 210, 235, 272, 438, 473, 969, phosinate-(Ce), 109, pirette, 1320, plagioclase, 135, 233, 964, 1245, pyrophanite, 291, pyrrhotite, 491, 507, renierite, 1036, rhodochrosite, 461, riebeckite, 208, 1013, rutile, 764, sanidine, 396, schorlomite, 395, shomokite-(Y), 650, siderite, 461, sigismundite, 829, sodalite, 292, spinel, 193, 728, 964, spinoffite, 824, staurolite (Zn-rich), 1054, synchysite, 1175, tantalite, 1008, tapolite, 1008, taramite, 583, titanite, 34, 1174, tremolite, 884, unidentified Ca-Ga arsenate, 1314, unidentified germanite-like, 1306, unidentified Nb-Pb-Ti silicocarbonate, 797, unidentified Pb-Ga phosphate, 1309, unidentified treasure derivative, 1326, unidentified Zr-Ti silicate, 795, vesuvianite (B-rich), 1060, vishnevite, 395, westerveldite, 491, zajacite-(Ce), 1301, zircon (hafnian), 1004
- Emerald mineralization and metasomatism of amphibolite, Khatyrsk granitic pegmatite - hydrothermal vein system, Haramosh Mountains, northern Pakistan, (Lauri *et al.*), 1253
- EXPERIMENTAL (see also Petrology)**
- Analytical Techniques
- ²⁷Al satellite transition NMR spectroscopy, 1039, ²⁹Si MAS NMR spectroscopy, 1039, ⁵⁷Fe Mössbauer, 1292, micro-PIXE, 37, 1223, proton microprobe, 533, 702, 1180, 1223, SIMS, 770, X-ray absorption spectroscopy (XANES), 1243
- Computer Program
- MELTS, 1150, OPT, 597, OPTRFN, 597
- General
- ⁴⁰Ar/³⁹Ar geochronology, 1260, argentopentlandite: conditions of formation, 945, bioavailable phosphorus, 667, cancrinite thermal expansion, 893, cathodoluminescence, 394, 457, 1112, 1127, 1165, 1223, diffusion coefficients for clinopyroxene, 1191, diffusion coefficients for olivine, 1187, diffusion coefficients for pyrope, 1188, diffusion profiles in garnet, 1181, 1188, 1195, electronic polarizabilities of clinopyroxenes, 595, hydrothermal synthesis of gold crystals, 1, hydrous 8-Mg₂SiO₅, 1233, immiscible arsenide-sulfide melts, 485, Lyapounov exponents, 1127, Nomarski interference-contrast microscopy, 1112, phase transitions in boracite-group minerals, 881, point-dipole theory, 595, ray paths in biaxial crystals, 161, synthetic (Cu,Zn)(OH)₃Cl, 64, synthetic marialite, 1041,

- synthetic sphalerite, 951, synthetic wurtzite, 951, trace element mobility in pyrope, 1189, trace elements in geostandards, 38
- Stable Isotopes**
carbon, 216, 461, hydrogen, 1244, oxygen, 216, 461, 935, 1276, sulfur, 497
- System**
 $\text{Fe}-\text{O}-\text{S}-\text{H}_2\text{O}$ equilibrium constants, 21, $\text{Zn}-\text{Fe}-\text{Ga}-\text{S}$, 949
- Extreme differentiation of peralkaline rhyolite, Terceira, Azores: a modern analogue of Strange Lake, Labrador? (Mungall & Martin), 769
- Extrusive carbonatite from the Quaternary Rockskjell Complex, West Eifel, Germany, (Kiley *et al.*), 389
- Feruvite from the Sullivan Pb-Zn-Ag deposit, British Columbia, (Jiang *et al.*), 733
- Fibrous foitite from San Piero in Campo, Elba, Italy, (Pezzotta *et al.*), 741
- Fowler, A.D. & L'Heureux, I., Self-organized banded sphalerite and branching galena in the Pine Point ore deposit, Northwest Territories, (Fowler & L'Heureux), 1211
- Gallobeudantite, $\text{Pb}_2\text{Ga}_3[(\text{AsO}_4)_2(\text{OH})_6]$, a new mineral species from Tsumeb, Namibia and associated new gallium analogues of the alunite-jarosite family, (Jambor *et al.*), 1305
- Geochemistry of cassiterite and its inclusions and exsolution products from tin and tungsten deposits in Portugal, (Neiva), 745
- Habit and composition of gold grains in quartz veins from greenstone belts: implications for mechanisms of precipitation of gold, (Michel & Giuliani), 513
- Hafnian zircon from the apical part of the Suzhou granite, China, (Wang *et al.*), 1001
- Hydrothermal argentopentlandite at El Charcón, southeastern Spain: mineral chemistry and conditions of formation, (Morales-Ruano & Hach-Alf), 939
- Hydrothermal silica – gold stalactites formed by colloidal deposition in the Cirotan epithermal deposit, Indonesia, (Jébrak *et al.*), 931
- Hydrothermal synthesis of gold grains with apparent five-fold symmetry, (Gammons), 1
- Immiscibility between arsenide and sulfide melts: a mechanism for concentration of noble metals, (Gervilla *et al.*), 485
- Influence of magmatic assimilation on mineral growth and zoning, (Edwards & Russell), 1149
- INFRARED-ABSORPTION SPECTRA**
hydroys $\text{B}-\text{Mg}_2\text{SiO}_4$, 1233, jensenite, 53, penobiuscite, 659, perovskite, 805, piroxite, 1320, zajacite-(Ce), 1301
- Interpretation of plagioclase zonation in calcic pelitic schist, South Strafford, Vermont, and the effects on thermobarometry, (Menard & Spear), 133
- Intrinsic and extrinsic controls on the incorporation of rare-earth elements in calc-silicate minerals, (Pan & Fleet), 147
- Inversion between sphalerite- and wurtzite-type structures in the system Zn–Fe–Ga–S, (Ueno *et al.*), 949
- Isothermal constitutive undercooling as a model for oscillatory zoning in plagioclase, (L'Heureux & Fowler), 1137
- Jensenite, a cupric tellurite framework structure with two coordinations of copper, (Grice *et al.*), 55
- Jensenite, $\text{Cu}_3\text{Te}^{6+}\text{O}_6\cdot 2\text{H}_2\text{O}$, a new mineral species from the Centennial mine, Tintic District, Juab County, Utah, (Roberts *et al.*), 49
- Li- and F-bearing alkali amphibole from granitic pegmatite at Hurricane Mountain, Carroll County, New Hampshire, (Foord *et al.*), 1011
- Lithium-bearing fluor-arfvedsonite from Hurricane Mountain, New Hampshire: a crystal-chemical study, (Hawthorne *et al.*), 1015
- Location of ray paths for a known wave normal in biaxial crystals, (Nicholls), 161
- Magnesian hornblende from a metamorphosed ultramafic body in southwest Finland: crystal chemistry and petrological implications, (Mancini *et al.*), 835
- Marielite: Rietveld structure-refinement and ^{29}Si MAS and ^{27}Al satellite transition NMR spectroscopy, (Sokolova *et al.*), 1039
- Metasomatism at a granitic pegmatite – dunite contact in Galicia: the Franqueira occurrence of chrysoberyl (alexandrite), emerald, and phenakite: reply, (Martin-Izard *et al.*), 1332
- Metasomatism at a granitic pegmatite – dunite contact in Galicia: the Franqueira occurrence of chrysoberyl (alexandrite), emerald, and phenakite: discussion, (Franz *et al.*), 1329
- MICROHARDNESS**
nežilovite, 1290
- Micro-PIXE analysis of silicate reference standards for trace Ni, Cu, Zn, Ga, Ge, As, Rb, Sr, Y, Zr, Nb, Mo and Pb, with emphasis on Ni for application in the Ni- in-garnet geothermometer, (Campbell *et al.*), 37
- MINERAL DATA** (see also Electron-microprobe analyses)
aegirine, 210, 286, 428, 438, aenigmatite, 786, "anarakite", 63, andradite (titanian), 274, ankerite, 459, apatite, 211, 1166, arfvedsonite, 208, 287, 1013, 1016, argentopentlandite, 939, arsenopyrite, 520, astrophyllite, 290, 787, augite, 286, baftositite, 789, beryl, 1269, beudanite, 1309, biotite, 289, 438, 962, 1242, 1271, biotite (Ba-Ti-rich), 967, 1242, boracite, 881, calcite, 458, cassiterite, 745, catapleite, 292, ceriopyrochlore, 482, chlorite, 13, chromite, 488, 725, clinopyroxamate, 61, 73, clinopyroxene, 962, cobalt pentlandite, 25, cobaltite, 491, 505, columbite, 1008, congoite, 881, diopside, 412, 428, 438, dolomite, 459, emerald, 1253, 1329, 1332, eudialyte, 292, 1169, ferrocolumbite, 754, ferrotourmalite, 638, 754, feruvite, 733, fluor-arfvedsonite, 1013, 1016, fluor-ferrolakeite, 1013, fluormica, 577, fluoraramite, 577, foidite, 743, gagarinite-(Y), 1302, galena, 1213, gallian hidalgite, 1309, gallite, 1306, gallobeudantite, 1305, garnet, 438, 1181, 1198, gersdorffite, 491, 505, gold, 1, 513, 548, gold (palladian), 550, hambergite, 615, hastingsite, 287, hibonite, 1289, hydrous $\text{B}-\text{Mg}_2\text{SiO}_4$, 1233, iimorite-(Y), 817, ilmenite, 605, 764, 782, 790, 963, ilmenite (Mn-rich), 31, isocubanite, 704, ixiolite, 759, jensente, 49, kataphorite, 438, 577, keyite, 623, kupletskeite, 290, kutnohorite, 459, latrappite, 481, liotite, 1021, loparite, 979, 991, lüllingite, 491, ludlockite, 79, lushtite, 981, lävenite, 291, magnesian hornblende, 835, magnesio-richterite, 438, magnetite, 725, 1245, magnetite (titaniiferous), 291, 395, 417, magnetoplumbite, 1289, manganesecolumbite, 754, manganontantalite, 754, mangantapiolite, 638, marialite, 1039, maucherite, 491, melilite, 271, melonite, 488, muscovite- $2M$, 115, 1271, muscovite (borian, $2M$), 618, narsarsukite, 790, nepheline, 234, neptunite, 791, nežilovite, 1287, nickelite, 491, nioboloparite discredited, 991, niobophyllite, 788, nybøite, 577, orthopyroxene, 962, otjismuite, 1306, palladite, 549, palladseite, 550, paratacamite (nickeliferous), 70, paratacamite (zincian), 62, 1095, parasite, 438, 577, parsite, 1172, pavonite, 1323, Pd–Cu oxide, 549, penobiuscite, 657, pentlandite, 507, perovskite, 804, 977, phlogopite, 194, 210, 235, 272, 438, 469, 970, phosainite-(Ce), 107, piretite, 1317, plagioclase, 135, 962, pyrope, 1181, pyrophanite, 291, pyrrhotite, 491, 507, quartz, 1223, rapakivekite, 99, renierite, 1306, rhodochrosite, 461, riebeckite, 208, 438, 1013, rutile, 605, 764, sabinaite, 811, sandline, 396, scapolite, 1040, schoepite, 1072, schorlomite, 395, shigaite, 91, shoniokite-(Y), 650, siderite, 461, sigismundite, 827, sodalite, 292, sphalerite, 1212, spinel, 962, spirophile, 821, staurolite (Zn -rich), 1051, synchysite, 1172, tantalite, 1008, tapiolite, 633, 1008, taranite, 577, titanite, 34, 782, 1169, tourmaline, 123, 1267, trematite, 881, unidentified Ca-Ga arsenate, 1314, unidentified germanite-like, 1306, unidentified Nb–Pb–Ti silicocarbonate, 794, unidentified Pb–Ga phosphate, 1309, unidentified treasure derivative, 1324, unidentified Zr–Ti silicate, 794, vesuvianite (B-rich), 1060, vishnevite, 395, wadsleyite, 1233, westerveldite, 491, zajacite-(Ce), 1299, zircon (hafnian), 1001
- Mineral intergrowths replaced by "elbow-twinned" rutile in altered rocks, (Force *et al.*), 605
- MINERALOGICAL ASSOCIATION OF CANADA**
Berry medal (Kaiman), 1347, book reviews, 677, 901, 1337, color photographs: astrophyllite, 783, aenigmatite, 783, narsarsukite, 784, neptunite, 784, garnet, 1200, Hawley medal (O'Hanley & Wicks), 1343, Past Presidents' medal (Krogh), 1349, Proceedings of the 41st annual meeting, 1341
- Mineralogy and geochemistry of fenitized alkaline ultrabasic sills of the Gifford Creek Complex, Gascoyne Province, Western Australia, (Pearson & Taylor), 201
- Mn-rich ilmenite from the Sullivan Pb-Zn-Ag deposit, British Columbia, (Jiang *et al.*), 29
- NEW MINERAL SPECIES**
1995 listing of IMA-approved new minerals, 685, clinoatacamite, 61, gallobeudantite, 1305, jensenite, 49, nežilovite, 1287, penobiuscite, 657, piretite, 1317, sigismundite, 827, zajacite-(Ce), 1299
- New minerals recently approved by the Commission on New Minerals and Mineral Names, International Mineralogical Association, (Mandarino & Grice), 685
- Nežilovite, a new member of the magnetoplumbite group, and the crystal chemistry of magnetoplumbite and hibonite, (Bermanec *et al.*), 1287
- "Nioboloparite": a re-investigation and discreditation, (Mitchell *et al.*), 991
- NOMENCLATURE**
($\text{Cu}, \text{Zn})(\text{OH})_3\text{Cl}$ group, 76, alunite-jarosite group, 1305, clinoatacamite, 61, gallobeudantite, 1305, jensenite, 49, kalsilite rocks, 175, keyite formula redefined, 623, kimblerite, 175, lamproite, 175, lamprophyre, 175, leucite rocks, 175, ludlockite formula redefined, 87, magnetoplumbite group, 1287, melilitic rocks, 175, nežilovite, 1287, "nioboloparite" discredited, 991, penobiuscite, 657, piretite, 1317, shigaite formula redefined, 96, sigismundite, 827, tapiolite series, 631, uranyl phases: structural classification, 845, zajacite-(Ce), 1299
- Occurrence and composition of some Ti-bearing minerals in the Strange Lake intrusive complex, Quebec–Labrador boundary, (Birkett *et al.*), 779
- Occurrence and significance of stalactites within the epithermal deposits at Creede, Colorado, (Campbell & Barton), 905
- On the development of niobium and rare-earth minerals in monticellite-albite carbonatite of the Oka Complex, Quebec, (Chakhnouradian), 479
- OPTICAL PROPERTIES**
General
clinopyroxenes, 595, fluor-arfvedsonite, 1014, fluor-ferrolakeite, 1014, gallobeudantite, 1307, penobiuscite, 659, phosainite-(Ce), 108, piretite, 1319, ray paths in biaxial crystals, 161, zajacite-(Ce), 1301
- Reflectance**
argentopentlandite, 941, jensenite, 52, magnetoplumbite, 1290, nežilovite, 1290
- Optical properties of $C2/c$ pyroxenes: a point-dipole explanation, (Abbott), 595
- Origin of glass in Quaternary mantle xenoliths from Meerfeldermaar, West Eifel, Germany: implications for enrichment in the lithospheric mantle, (O'Connor *et al.*), 187
- Oscillatory zoning in minerals: a common phenomenon, (Shore & Fowler), 1111
- Patterns of zonation in rare-earth-bearing minerals in nepheline syenites of the North Qeqqata Center, South Greenland, (Coulson & Chambers), 1163
- Pavonite from the Ikuno mine, Hyogo Prefecture, Japan, (Shimizu & Kato), 1323

Penobscuite: a new borate mineral with a complex framework structure, (Grice *et al.*), 657

PETROLOGY (see also Experimental)

Ag distribution in seafloor sulfides, 697, Ag distribution in VMS deposits, 539, 697, Ag transport in seafloor deposits, 711, amphibolite metasomatism, 1270, 1329, anorthositic, 559, assimilation in melts, 1158, Au-Pd-Se ore oxidation, 554, basanitic nepheline, 227, biotite zoning, 1248, carbonatite autolith, 393, carbonatite, 373, 389, 403, 454, 479, carbonatitic magma, 377, 406, 469, cassiterite geochemistry, 753, chloride geothermometer, 14, chondrite-normalized REE, 151, 215, 250, 447, 569, 1263, cobaltite-gersdorffite solid solution, 503, Coldwell complex, 967, contact-metamorphic aureoles, 1198, corona structures, 960, diopside phenocrysts, 412, diorite, 303, East Pacific Rise, 697, Eastern Alkaline Belt, 241, feldspar ijolite, 228, fenitization, 205, fluid chemistry from East Pacific Rise vents, 711, fluid inclusion data, 11, 1330, 1333, foayite, 454, geobarometry, 14, 144, 841, 964, 1186, geochronology, 313, 329, 444, 1260, geothermometry, 14, 46, 144, 841, 964, 1186, glass in mantle xenoliths, 191, gold precipitation, 513, 547, gold – quartz vein deposit, 513, granitic pegmatite, 1253, H₂O in the mantle, 1239, ijolite, 406, 454, isobaric cooling, 960, isothermal decompression, 960, kalsilite rocks classification, 176, kimberlite classification, 177, Kipawa complex, 435, lamproite classification, 179, lamprophyre classification, 180, larvikite, 305, leucitic rocks classification, 180, lherzolite massif, 486, lherzolite – carbonate liquid partition coefficients, 375, mafic granulite, 960, mantle plume, 325, mantle-recycled carbon, 374, mantle xenoliths, 187, 377, 1179, mellite rocks classification, 176, metaproxenite, 837, Mid-Atlantic Ridge hydrothermal field, 24, Monteregian Hills, 302, 329, 1241, Nd-Sm isotopic data, 312, nepheline diorite, 305, nepheline syenite, 228, 284, 338, 424, nepheline trachyte, 245, nephelinitic lava, 412, nordmarkite, 305, Oka complex, 479, oscillatory zoning, 1111, 1127, 1137, 1169, 1196, 1211, oxygen fugacity, 12, 797, 842, 1250, pantellerite, 770, pegmatite-aplite, 352, peristerite gap, 141, PGE in arsenides, 499, phlogopite zoning, 469, phonolite, 245, Pine Point deposit, 1211, plagioclase-growth model, 1138, 1155, pseudomorphs, 360, pulaskite, 305, pyrope-growth model, 1181, pyroxene-growth model, 1156, pyroxenite, 406, 717, quartz provenance, 1223, Rb-Sr isotopic data, 294, 312, REE in calc-silicate minerals, 147, REE mobility, 1163, reticulated rutile from topotactic replacement of ilmenite, 605, seafloor chimney growth model, 713, seafloor hydrothermal sulfides, 23, 697, sector zoning, 1121, speleothems, 905, 931, spessartite, 503, sphalerite-growth model, 1218, spidergram, 248, stalactites in epithermal ore deposits, 906, 932, Stillwater Complex, 559, Strange Lake complex, 349, 769, 779, 1299, Sullivan sedex deposit, 29, 733, trace-element diffusion in pyrope, 1183, trace-element zoning in garnet, 1183, 1206, turpate, 265, 406, turrite, 265, U-Pb isotopic data, 444, ultrabasic sill, 202, volcanogenic massive sulfide deposit, 529, zoning in minerals, 1111, 1127, 1137, 1149, 1163, 1179, 1195, 1211, 1223, 1242, 1291, 1306

Petrology and mineral resources of the Wind River laccolith, Cormudas Mountains, New Mexico and Texas, (McLemore *et al.*), 335

Phase transitions in the series boracite – tremolite – congoite: phase relations, (Burns & Carpenter), 881

Phlogopite crystallization in carbonatitic magmas from Uganda, (McCormick & Le Bas), 469

Phosinate-(Ce) from Mont Saint-Hilaire, Quebec: new data and structure refinement, (McDonald *et al.*), 107

Piretite, Ca(UO₃)₂(SeO₃)₂(OH)₄H₂O, a new calcium uranyl selenite from Shinkolobwe, Shaba, Zaire, (Vochten *et al.*), 1317

Raman and infrared spectra of hydrous B-Mg₂SiO₄, (Mernagh & Liu), 1233

RAMAN SPECTRA

hydrous B-Mg₂SiO₄, 1233

Relatively aluminous alkali pyroxene in nepheline syenites from Malawi: mineralogical response to metamorphism in alkaline rocks, (Woolley *et al.*), 423

Rhombohedral carbonates from carbonatites of the Khibina Massif, Kola Peninsula, Russia, (Zaitsev), 453

Rietveld refinement of micaceous materials: muscovite 2M₁, a comparison with single-crystal structure refinement, (Liang & Hawthorne), 115

SCANNING-ELECTRON MICROGRAPHS

apatite, 1167, arsenopyrite, 519, cassiterite, 759, ceriopyrochlore, 482, cobalt pentlandite, 26, cobaltite-gersdorffite solid solution, 504, columbite, 1004, eudialyte, 1170, ferrocolumbite, 759, feruvite, 735, foitite, 742, galena, 1213, galloebaudantite, 1307, garnet, 1181, 1198, 1200, gold, 523, 549, gold with pentagonal morphology, 4, ilmenite (Mn-rich), 31, jensenite, 51, joscite B, 519, latrappite, 480, miarolitic cavity in quartz syenite, 771, maucherite – nickelite – westerveldite globule, 490, oscillatory zoning, 1113, palladium, 549, Pd-Cu oxide, 549, piretite, 1318, plagioclase, 137, pyrope, 1181, rutile, 606, 759, seafloor chimney sulfides, 702, sulfide stalactites in epithermal ore deposits, 916, 934, trellis-textured magnetite-ilmenite, 607, trellis-textured rutile, 610, unidentified Nb-Pb-Ti silicocarbonate, 796, unidentified Zr-Ti silicate, 796, zajacite-(Ce), 1300

Sigismundite, (Ba,K,Pb)Na₂(Ca,Sr)(Fe,Mg,Mn)₄Al(OH)₂(PO₄)₁₂, a new Ba-rich member of the arrojadite group from Spluga Valley, Italy, (Demartin *et al.*), 827

Silver in sulfide chimneys and mounds from 13°N and 21°N, East Pacific Rise, (Moss & Scott), 697

Sodium at the A site in clinocamphobolites: the effects of composition on patterns of order, (Hawthorne *et al.*), 577

Static and dynamic Jahn-Teller effects in Cu²⁺ oxysalt minerals, (Burns & Hawthorne), 1089

Structural and textural evolution of the Strange Lake peralkaline rare-element

(NYF) granitic pegmatite, Quebec-Labrador, (Miller), 349

Structural mechanisms for light-element variations in tourmaline, (Hawthorne), 123

TEXTURES

aenigmatite, 783, arsenide globules in pyrrhotite, 488, astrophyllite, 783, Au-Pd-Se ore oxidation, 554, basanitic nepheline, 227, carbonatite autolith, 393, cassiterite zoning, 748, concentrically zoned plagioclase, 137, corona structures, 961, diopside phenocrysts, 413, feldspar ijolite, 228, foitite, 742, galena 1213, glass in mantle xenoliths, 195, gold, 1, 513, 548, narsarsukite, 784, nepheline monzosyenite, 228, nepheline syenite porphyry, 338, neptunite, 784, oscillatory zoning, 1113, pegmatite-aplite, 356, phlogopite zoning, 469, pseudomorphs, 360, speleothems, 905, 931, sphalerite banding, 1212, stalactites in epithermal ore deposits, 913, 934, trellis-textured magnetite-ilmenite, 607, trellis-textured rutile, 610

The association basanitic nepheline – feldspar ijolite – nepheline monzosyenite at House Mountain volcano, north-central Arizona, (Wittke & Holm), 221

The atomic arrangement of iimoriite-(Y), Y₂(SiO₄)(CO₃), (Hughes *et al.*), 817

The crystal chemistry of the tapiolite series, (Wise & Černý), 631

The crystal structure of clinoatacamite, a new polymorph of Cu₂(OH)₃Cl, (Grice *et al.*), 73

The crystal structure of keyite, Cu₃²⁺(Zn,Cu²⁺)₄Cd₃(AsO₄)₄(H₂O)₂, an oxysalt mineral with essential cadmium, (Cooper & Hawthorne), 623

The crystal structure of iotite, a six-layer member of the cancrinite group, (Ballirano *et al.*), 1021

The crystal structure of ludlockite, PbFe³⁺As³⁺O₂, the mineral with pentameric arsenite groups and orange hair, (Cooper & Hawthorne), 79

The crystal structure of rapidcrekite, Ca₂(SO₄)(CO₃)(H₂O)₄, and its relation to the structure of gypsum, (Cooper & Hawthorne), 99

The crystal structure of sabainite, Na₂Zn₂TiO₄(CO₃)₂, (McDonald), 811

The crystal structure of schoepite, [(UO₂)₂O₇(OH)₂]_n(H₂O)₁₂, (Finch *et al.*), 1071

The crystal structure of shigaite, [AlMn³⁺(OH)₆](SO₄)₂Na(H₂O)₆·a hydroxylalite-group mineral, (Cooper & Hawthorne), 91

The crystal structure of shomikovite-(Y), (Grice), 649

The crystal structure of spinoffite, (Cooper & Hawthorne), 821

The distribution and mineral hosts of silver in eastern Australian volcanic massive sulfide deposits, (Huston *et al.*), 529

The first report of cobalt pentlandite from a Mid-Atlantic Ridge hydrothermal deposit, (Mozgová *et al.*), 23

The formation of quartz syenite by crustal contamination at Mont Shefford and other Monteregian complexes, Quebec, (Landoll & Foland), 301

The Los Archipago nepheline syenite ring-structure: a magmatic marker of the evolution of the central and equatorial Atlantic, (Moreau *et al.*), 281

The Origin and Significance of Zoning in Minerals: Preface, (Mason & Martin), 1109

The origin of rare minerals in the Kipawa syenite complex, western Quebec, (Currie & van Breemen), 435

The thermal behavior of cancrinite, (Hassan), 893

Thermodynamic and textural evidence for at least two stages of Au-Pd mineralization at the Caue iron mine, Itabira District, Brazil, (Olivo & Gammans), 547

THERMOGRAVIMETRIC ANALYSIS

biotite, 1243, cancrinitite, 893, piretite, 1320

TRACE-ELEMENT DATA

Ag in chalcocite, 533, 708, Ag in galena, 533, 708, Ag in isocubanite, 708, Ag in marcasite, 708, Ag in pyrite, 708, Ag in sphalerite, 533, 708, Ag in tetrahedrite, 533, amphibolite, 722, 1262, anorthositic, 566, apatite, 211, 1168, basanitic nepheline, 225, beryl, 1269, calc-silicate, 722, diorite, 305, eudialyte, 1171, feldspar ijolite, 225, gabbro, 722, geostandards, 38, glass in pantellerite, 770, glimmerite, 722, gneiss, 722, granodiorite, 722, larvikite, 310, leucogranite, 1264, magnetite, 724, marble, 445, melanorite, 722, mica schist, 1262, nepheline, 210, nepheline monzosyenite, 225, nepheline syenite, 341, 445, nepheline trachyte, 245, nordinarkite, 310, norite, 722, pantellerite, 770, peralkaline granite, 445, peralkaline skarn, 445, peridotite, 722, PGE in Cr-Ni ore, 494, phonolite, 245, plagioclase, 566, pulaskite, 310, pyrope, 1183, pyroxenite, 722, quartz syenite, 770, quartz, 1223, REE in calc-silicate minerals, 147, seafloor hydrothermal sulfides, 26, 702, syenite, 341, 445, 722, syenitic urite, 225, titanite, 1174, tourmaline-albite vein, 1277, trondjemite, 445, ultrabasic sill, 214

Trace-element zoning in mantle minerals: metasomatism and thermal events in the upper mantle, (Griffin *et al.*), 1179

TRANSMISSION ELECTRON MICROGRAPHS

aluminate sodalite modulated structure, 1034

Twinned hambergite from the Gilgit district, northern Pakistan, (Richards), 615

TWINNING (see also Crystallography)

gold, 3, 523, hambergite, 615, loparite, 979, rutile, 605, twinning versus

topotactic replacement in rutile, 612

Two-dimensional periodic antiphase boundaries in a synthetic aluminate sodalite, Ca₈[Al₁₂O₂₄(CrO₄)₂], (Hassan), 1031

U⁶⁺ minerals and inorganic phases: a comparison and hierarchy of crystal structures, (Burns *et al.*), 845

Unusually high concentrations of magnetite at Caraíba and other Cu-sulfide deposits in the Curaçá Valley, Bahia, Brazil, (Maier & Barnes), 717
 X-ray and neutron crystal-structure refinements of a boron-bearing vesuvianite, (Groat *et al.*), 1059

X-RAY DIFFRACTION (see also Crystal Structure)

Cell Dimensions

boracite, 884, ceriopyrochlore, 482, clinoatacamite, 63, 73, congoelite, 884, ferrotapiolite, 638, fluor-arfvedsonite, 1016, gagarinitite-(Y), 1302, gallobeudanite, 1309, hambergite, 618, hibonite, 1289, iimorite-(Y), 817, jensenite, 51, 56, keyrite, 623, latrappite, 481, iotite, 1021, loparite-(Ce), 997, ludlockite, 80, magnesian hornblende, 838, magneto-plumbite, 1289, manganotapiolite, 638, marialite, 1044, muscovite- $2M_1$,

116, muscovite (borian, $2M_1$), 618, nežilovite, 1289, paratacamite (nickeliferous), 70, paratacamite (zincian), 63, pavonite, 1327, penobsquisite, 660, perovskite, 806, phosinate-(Ce), 109, piretite, 1319, rapidcreekite, 99, sabinaite, 811, scheelite, 1072, shigaite, 91, shoniokite-(Y), 651, sigismundite, 830, spiroffite, 821, staurolite (Zn-rich), 1053, synthetic $(\text{Cu}, \text{Zn})(\text{OH})_3\text{Cl}$, 67, tapiroite, 636, trembachite, 884, vesuvianite (B-rich), 1060, zajacite-(Ce), 1302

Powder Data

clinoatacamite, 63, gallobeudantite, 1310, jensenite, 52, loparite-(Ce), 997, nežilovite, 1291, paratacamite (nickeliferous), 70, paratacamite (zincian), 63, pavonite, 1326, penobsquisite, 660, phosinate-(Ce), 109, piretite, 1320, shoniokite-(Y), 650, sigismundite, 830, tapiroite, 637, zajacite-(Ce), 1302

**VOLCANIC-ASSOCIATED MASSIVE SULFIDE DEPOSITS IN ANCIENT AND MODERN
SETTINGS: CLASSIFICATION, PROCESSES AND EXAMPLES**
A SHORT COURSE SPONSORED BY THE SEG AND GAC/MDD
MAY 17-18, 1997
IMMEDIATELY PRECEDING THE OTTAWA '97 GAC-MAC CONFERENCE

This short course will present a review of the current studies on the critical aspects of VMS formation, with an emphasis on relevance to mineral exploration, and will present the results of recent studies on very large or important VMS deposits and districts around the globe. It will be accompanied by an Economic Geology Reviews in Economic Geology volume available at the door, also co-sponsored by the SEG, and the GAC/MDD. Emphasis will be given on discussion and audience participation during the course. The speakers are from North America, Europe and Australia and include many of the pre-eminent scientists who work on seafloor and land-based VMS systems.

Abbreviated titles of the topics to be presented, and the speakers/co-authors are:

INTRODUCTION: Classification of VMS deposits, based on world-wide compilation

PROCESSES:

- Subaqueous volcanism: Environments and controls: H. Gibson and R. Morton
- Structural aspects of hydrothermal venting in seafloor/ophiolite settings: G. Harper et al.
- Magmatic and hydrothermal controls on seafloor venting: M. Perfit, I. Jonasson et al.
- Hydrothermal alteration of oceanic crust: J. Alt
- Fluid chemistry, base and precious metal transport and deposition: B. Seyfried et al.
- Stratigraphy and alteration of bimodal VMS systems: T. Barrett et al.
- Semi-conformable alteration patterns in VMS systems: D. Ames and A. Galley
- Stable isotopes and VMS systems: A review: D. Huston
- Heat and fluid flow modeling and VMS systems: T. Barrie, L. Cathles and A. Erendi

EXAMPLES:

- The giant Kidd Creek deposit: a giant komatiite - rhyolite associated VMS system: T. Barrie, M. Hannington and W. Bleeker
- The Iberian Pyrite Belt of Portugal and Spain: Examples of bimodal - siliciclastic systems: D. de Carvalho, J. Munha and F. Barriga
- Eskay Creek: an unusual precious metal-rich bimodal VMS system: T. Roth, J. Thompson et al.
- Windy Craggy, NW British Columbia: a mafic-siliciclastic VMS system: J. Peter and S. Scott
- VMS deposits in ophiolites and their modern seafloor analogs: R. Koski and A. Galley
- Metalliferous sediments of the Atlantis II Deep, Red Sea: R. Zierenberg
- Massive sulfide deposits at sediment-covered spreading centers: W. Goodfellow et al.

For further information, please contact:

T. Barrie
Geological Survey of Canada
601 Booth
Ottawa, Ontario K1A 0E8
tel: 613-947-2793
fax: 613-996-9820
email: BARRIE@GSC.EMR.CA

M. Hannington
Geological Survey of Canada
601 Booth
Ottawa, Ontario K1A 0E8
tel: 613-996-4865
fax: 613-996-9820
email: MARKH@GSC.EMR.CA



The 11th International Clay Conference

The 34th Annual Meeting of the Clay Minerals Society

June 15-21, 1997

Carleton University
Ottawa, Ontario, Canada

The Mineralogical Association of Canada is one of the sponsoring organizations of the 11th International Clay Conference. The Conference is open to anyone interested in the scientific and practical aspects of clay science. In addition to the general sessions, the following symposia are planned (listed with convenors in parentheses):

1. Mössbauer spectroscopy in clay science: fundamental aspects and application to current topics (D.G. Rancourt)
2. The isotopic geochemistry of clay minerals (F.J. Longstaffe)
3. Multinuclear magnetic resonance of clays (C. Detellier and J.A. Ripmeester)
4. Microbial geochemistry of clay minerals (G. Ferris)
5. Clay barriers and waste management (D. Oscarson)
6. Hydrothermal clays in modern and ancient seafloor deposits (D.E. Ames)
7. The merits of TEM and XRD as applied to layer silicates (H. Vali and R.F. Martin)
8. Clays in industry (H.J. Abercrombie)
9. Teaching clay mineralogy (J.B. Dixon)

In addition to a program of field excursions, a preconference workshop is planned on the theme Synchrotron X-ray methods in clay science, to be organized by D.G. Schulze and J.W. Stucki. Full details, and a copy of the first circular, can be obtained from Dr. Jeanne B. Percival, Secretary-General, 11th ICC, Geological Survey of Canada, 601 Booth Street, Ottawa, Ontario, Canada K1A 0E8. FAX: 613-943-1286. Internet: icc97@gsc.emr.ca.

THE CANADIAN MINERALOGIST

EDITORIAL STAFF, 1957-1996

EDITOR

1957-1975	Leonard G. Berry
1971-1977	John L. Jambor
1975-1982	Louis J. Cabri
1978-	Robert F. Martin

ASSOCIATE EDITORS

1975-1977	P. Bayliss, S.R. Hall, P.B. Read, G.B. Skippen
1976-1978	G. Donnay (1976), M.E. Fleet, D.C. Harris, B.F. Leonard, D.J. Vaughan
1977-1979	G.M. Anderson, G.Y. Chao, J.A. Mandarino, D.G.W. Smith
1978-1980	E.C. Appleyard, K.L. Currie, V.S. Papezik, B.J. Wuensch
1979-1981	G.M. Bancroft, F.C. Hawthorne, W.H. MacLean, A.C. Turnock
1980-1982	P.B. Barton, Jr., J.L. Jambor, G. Perrault, L.T. Trembath
1981-1983	L.C. Coleman, E.P. Meagher, S.D. Scott, R.I. Thorpe, A.C. Turnock (1983)
1982-1984	E. Froese, H.D. Grundy, M.E. Fleet (1983-1984), E.T.C. Spooner, D.J. Vaughan
1983-1985	L.J. Cabri, D.B. Clarke, E.E. Foord, J. Guha, R. Ledoux
1984-1986	P. Černý, L.A. Clark, H. Kodama, A.R. Philpotts, J.T. Szymański
1985-1987	H.T. Evans, Jr., D.D. Hogarth, P.G. Manning, W.E. Trzcienski, Jr., F.J. Wicks
1986-1988	A.H. Clark, T. Feininger, E.E. Foord, W.C. Kelly, R.F.J. Scoates
1987-1989	P. Černý, S.J. Guggenheim, S.E. Haggerty, J.T. Szymański, A.E. Williams-Jones
1988-1990	E.A.J. Burke, R.G. Burns, G.K. Czamanske, C.V. Guidotti, J.D. Scott
1989-1991	E.E. Foord, P.C. Goodell, J.D. Grice, C. Klein, Jr., C.M. Lesher, Jr.
1990-1992	R.N. Abbott, B. Bonin, T.M. Gordon, S.E. Haggerty, J.T. Szymański
1991-1993	G. Calas, J. Chisholm, L.S. Hollister, E. Makovicky, M.A. Zientek
1992-1994	S.J. Barnes, C.A. Francis, R.L. Mason, R.C. Peterson, J.C. Rucklidge
1993-1995	B. Bonin, E.E. Foord, R.H. Mitchell, R.C. Rouse, M. St-Onge
1994-1996	T.B. Barrett, S.L. Chryssoulis, G. Cressey, Y. Moëlo, A.C. Roberts
1995-1997	G.N. Eby, T.S. Ercit, F.C. Hawthorne, R.R. Keays, P.E. Rosenberg, A.G. Trudu
1996-1998	B. Bonin, E.E. Foord, J.M. Hughes, G.T. Nixon, P.F. Zanazzi

MANAGING EDITOR

1982-1990	Sandra E. Doig
1990-	Vicki Loschiavo

SUBSCRIPTION MANAGER

1972-1975	Donald C. Harris
1975-1983	Robert I. Gait
1984-1990	Joseph A. Mandarino
1990-	Robert Pinard

Proceedings of the Russian Mineralogical Society*

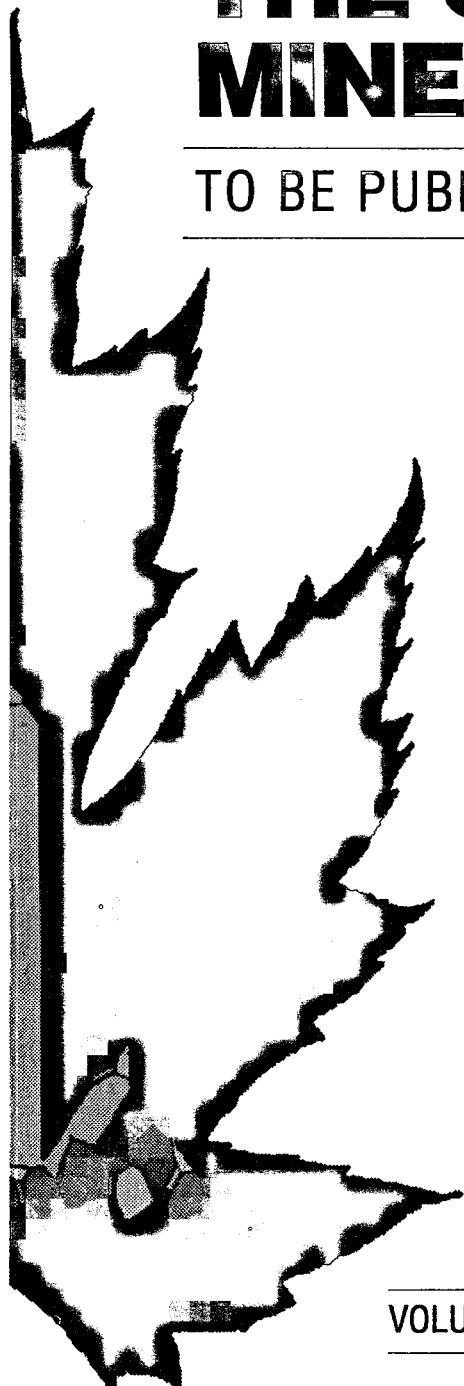
Number 4



1996

Recrystallization and blastesis of shock-metamorphosed rocks in impact structures		
V.L. MASAITIS & M.S. MASHCHAK	1	
Behavior of Al and Ti during the formation of highly aluminous metasomatic rocks in the Urals massive sulfide deposits		
A.I. GRABEZHEV & V.V. ZAYKOV	19	
Summary mineral composition of the Earth's crust		
A.G. BULAKH	23	
MINERALS AND MINERAL PARAGENESSES		
On the Debye-Scherrer pattern of picropharmacolite		
E.K. VASILEV	29	
Gem and collection-quality tourmaline from the Pamirs (crystal morphology, coloring, crystal chemistry)		
A.A. ZOLOTAREV	32	
Sericite with noncentrosymmetric structure from the Banska St'avnitsa gold – silver – polymetallic deposit (Slovakia)		
A.P. ZHUKHLISTOV, E.M. DRAGULESKU, V.L. RUSINOV, V.A. KOVALENKER, B.B. ZVYAGIN & O.V. KUZMINA	47	
New data on kalborsite		
I.V. PEKOV & N.V. CHUKANOV	55	
New data on calcium borates: korzhinskite and sibirskite		
S.V. MALINKO & V.T. DUBINCHUK	60	
NEW MINERALS		
Pyatenkoite-(Y) $\text{Na}_5(\text{Y},\text{Dy},\text{Gd})(\text{Ti},\text{Nb})\text{Si}_6\text{O}_{18} \cdot 6\text{H}_2\text{O}$ – a new mineral		
A.P. KHOMYAKOV, G.N. NECHELYUSTOV & R.K. RASTSVETAEEVA	72	
Intersilite $\text{Na}_6\text{MnTi}[\text{Si}_{10}\text{O}_{24}(\text{OH})](\text{OH})_3 \cdot 4\text{H}_2\text{O}$ – a new mineral with a new type of the band-layered silicon-oxygen radical		
A.P. KHOMYAKOV, A. ROBERTS, G.N. NECHELYUSTOV, N.A. YAMNOVA & D.YU. PUSHCHAROVSKY	79	
DISCUSSIONS, CRITICISM, BIBLIOGRAPHY		
Information modeling of mineral aggregates and criteria of their self-organization		
Yu.L. GULBIN	86	
On the applicability of Shannon's entropy as a measure of the petrographic ordering of texture		
D.C. YEGOROV & G.YU. IVANYUK	95	
Optical anomalies in crystals		
A.G. SHTUKENBERG & YU.O. PUNIN	104	
CHRONICLES		
The Fedorov scientific sessions in 1993–1995		
121		
The 60th anniversary of N.P. Yushkin, Honorary member of the Mineralogical Society		
123		

THE NEXT THEMATIC ISSUE OF
**THE CANADIAN
MINERALOGIST**
TO BE PUBLISHED IN APRIL 1997



**NATURE AND
ORIGIN OF
PRIMITIVE
MAGMAS AT
SUBDUCTION
ZONES**

**G.T. NIXON, A.D. JOHNSTON
AND R.F. MARTIN
EDITORS**

VOLUME 35, part 2 APRIL 1997

THE CANADIAN MINERALOGIST

**Journal of the
Mineralogical Association
of Canada**



R.F. Martin, Editor

Volume 34, 1996

BULLETIN DE L'ASSOCIATION MINERALOGIQUE DU CANADA

THE CANADIAN MINERALOGIST

JOURNAL OF THE MINERALOGICAL ASSOCIATION OF CANADA

Hydrothermal synthesis of gold grains with apparent five-fold symmetry	C.H. GAMMONS	1
Conditions of chlorite growth in the Hill End Goldfield, New South Wales, Australia: some predictions and evaluations	JIANCHUN LU, P.K. SECCOMBE & J.L. WALSHE	9
The first report of cobalt pentlandite from a Mid-Atlantic Ridge hydrothermal deposit	N.N. MOZGOVA, S.G. KRASNOV, B.N. BATUYEV, YU.S. BORODAEV, A.V. EFIMOV, V.F. MARKOV & T.V. STEPANOVA	23
Mn-rich ilmenite from the Sullivan Pb-Zn-Ag deposit, British Columbia	SHAO-YONG JIANG, M.R. PALMER & J.F. SLACK	29
Micro-PIXE analysis of silicate reference standards for trace Ni, Cu, Zn, Ga, Ge, As, Rb, Sr, Y, Zr, Nb, Mo and Pb, with emphasis on Ni for application of the Ni-in-garnet geothermometer	J.L. CAMPBELL, W.J. TEESDALE, B.A. KJARSGAARD & L.J. CABRI	37
Jensenite, $\text{Cu}_3\text{Te}^{6+}\text{O}_6 \cdot 2\text{H}_2\text{O}$, a new mineral species from the Centennial Eureka mine, Tintic District, Juab County, Utah	A.C. ROBERTS, J.D. GRICE, L.A. GROAT, A.J. CRIDDLE, R.A. GAULT, R.C. ERD & E.A. MOFFATT	49
Jensenite, a cupric tellurate framework structure with two coordinations of copper	J.D. GRICE, L.A. GROAT & A.C. ROBERTS	55
Clinoatacamite, a new polymorph of $\text{Cu}_2(\text{OH})_3\text{Cl}$, and its relationship to paratacamite and "anarakite"	J.L. JAMBOR, J.E. DUTRIZAC, A.C. ROBERTS, J.D. GRICE & J.T. SZYMAŃSKI	61
The crystal structure of clinoatacamite, a new polymorph of $\text{Cu}_2(\text{OH})_3\text{Cl}$	J.D. GRICE, J.T. SZYMAŃSKI & J.L. JAMBOR	73
The crystal structure of ludlockite, $\text{PbFe}_{10}^{3+}\text{As}_{10}^{3+}\text{O}_{22}$, the mineral with pentameric arsenite groups and orange hair	M.A. COOPER & F.C. HAWTHORNE	79
The crystal structure of shigaite, $[\text{AlMn}_2^{2+}(\text{OH})_6]_3(\text{SO}_4)_2\text{Na}(\text{H}_2\text{O})_6\{\text{H}_2\text{O}\}_6$, a hydrotalcite-group mineral	M.A. COOPER & F.C. HAWTHORNE	91
The crystal structure of rapidcreekite, $\text{Ca}_2(\text{SO}_4)(\text{CO}_3)(\text{H}_2\text{O})_4$, and its relation to the structure of gypsum	M.A. COOPER & F.C. HAWTHORNE	99
Phosinaite-(Ce) from Mont Saint-Hilaire, Quebec: new data and structure refinement	A.M. McDONALD, G.Y. CHAO & J.D. GRICE	107
Rietveld refinement of micaceous materials: muscovite $2M_1$, a comparison with single-crystal structure refinement	JIAN-JIE LIANG & F.C. HAWTHORNE	115
Structural mechanisms for light-element variations in tourmaline	F.C. HAWTHORNE	123
Interpretation of plagioclase zonation in calcic pelitic schists, South Strafford, Vermont, and the effects on thermobarometry	T. MENARD & F.S. SPEAR	133
Intrinsic and extrinsic controls on the incorporation of rare-earth elements in calc-silicate minerals	YUANMING PAN & M.E. FLEET	147
Location of ray paths for a known wave normal in biaxial crystals	J. NICHOLLS	161

ALKALINE ROCKS: PETROLOGY AND MINERALOGY

Preface	R.H. MITCHELL & G.N. EBY	173
Classification of lamprophyres, lamproites, kimberlites, and the kalsilitic, melilitic, and leucitic rocks	A.R. WOOLLEY, S.C. BERGMAN, A.D. EDGAR, M.J. LE BAS, R.H. MITCHELL, N.M.S. ROCK & B.H. SCOTT SMITH	175
Origin of glass in Quaternary mantle xenoliths from Meerfeldermaar, West Eifel, Germany: implications for enrichment in the lithospheric mantle	T.K. O'CONNOR, A.D. EDGAR & F.E. LLOYD	187
Mineralogy and geochemistry of fenitized alkaline ultrabasic sills of the Gifford Creek Complex, Gascoyne Province, Western Australia	J.M. PEARSON & W.R. TAYLOR	201
The association basanitic nephelinite - feldspar ijolite - nepheline monzosyenite at House Mountain volcano, north-central Arizona	J.H. WITTKE & R.F. HOLM	221
Chemical variation along strike in feldspathoidal rocks of the Eastern Alkalic Belt, Trans-Pecos Magmatic Province, Texas and New Mexico	L.S. POTTER	241
Alkaline rocks of the Turiy Peninsula, Russia, including type-locality turjaite and turjite: a review	K. BELL, E.A. DUNWORTH, A.G. BULAKH & V.V. IVANIKOV	265
The Los Archipelago nepheline syenite ring-structure: a magmatic marker of the evolution of the central and equatorial Atlantic C. MOREAU, D. OHNENSTETTER, D. DEMAFFE & B. ROBINEAU		281
The formation of quartz syenite by crustal contamination at Mont Shefford and other Montregian complexes, Quebec	J.D. LANDOLL & K.A. FOLAND	301
Constraints on the mantle plume model for Mesozoic alkaline intrusions in northeastern North America	J.G. McHONE	325
Petrology and mineral resources of the Wind River laccolith, Cornudas Mountains, New Mexico and Texas	V.T. MCLEMORE, V.W. LUETH, T.C. PEASE & J.R. GUILINGER	335
Structural and textural evolution of the Strange Lake peralkaline rare-element (NYF) granitic pegmatite, Quebec-Labrador	R.R. MILLER	349
Consequences of recycled carbon in carbonatites	D.S. BARKER	373
Extrusive carbonatite from the Quaternary Rockeskyll Complex, West Eifel, Germany	T.R. RILEY, D.K. BAILEY & F.E. LLOYD	389
Carbonatites of the Turi Peninsula, Kola: role of magmatism and of metasomatism	A.G. BULAKH & V.V. IVANIKOV	403
Diopside phenocrysts from nephelinite lavas, Napak volcano, eastern Uganda: evidence for magma mixing	A. SIMONETTI, M. SHORE & K. BELL	411
Relatively aluminous alkali pyroxene in nepheline syenites from Malawi: mineralogical response to metamorphism in alkaline rocks	A.R. WOOLLEY, R.G. PLATT & G.N. EBY	423
The origin of rare minerals in the Kipawa syenite complex, western Quebec	K.L. CURRIE & O. VAN BREEMEN	435
Rhombohedral carbonates from carbonatites of the Khibina Massif, Kola Peninsula, Russia	A.N. ZAITSEV	453

Phlogopite crystallization in carbonatitic magmas from Uganda	G.R. McCORMICK & M.J. LE BAS	469
On the development of niobium and rare-earth minerals in monticellite–calcite carbonatite of the Oka Complex, Quebec	A.R. CHAKHMOURADIAN	479
<hr/>		
Immiscibility between arsenide and sulfide melts: a mechanism for concentration of noble metals	F. GERVILLA, M. LEBLANC, J. TORRES-RUIZ & P. FENOLL HACH-ALÍ	485
Cobaltite–gersdorffite solid solution as a primary magmatic phase in spessartite, Lacauane area, Montagne Noire, France	D. BÉZIAT, P. MONCHOUX & F. TOLLON	503
Habit and composition of gold grains in quartz veins from greenstone belts: implications for mechanisms of precipitation of gold	D. MICHEL & G. GIULIANI	513
The distribution and mineral hosts of silver in eastern Australian volcanogenic massive sulfide deposits	D.L. HUSTON, W. JABLONSKI & S.H. SIE	529
Thermodynamic and textural evidence for at least two stages of Au–Pd mineralization at the Cauê iron mine, Itabira District, Brazil	G.R.. OLIVO & C.H. GAMMONS	547
Cryptic trace-element alteration of anorthosite, Stillwater Complex, Montana	G.K. CZAMANSKE & P.J. LOFERSKI	559
Sodium at the A site in clinoamphiboles: the effects of composition on patterns of order	F.C. HAWTHORNE, R. OBERTI & N. SARDONE	577
Optical properties of C2/c pyroxenes: a point-dipole explanation	R.N. ABBOTT, JR.	595
Mineral intergrowths replaced by “elbow-twinned” rutile in altered rocks	E.R. FORCE, R.P. RICHARDS, K.M. SCOTT, P.C. VALENTINE & N.S. FISHMAN	605
Twinned hambergite from the Gilgit district, northern Pakistan	R.P. RICHARDS	615
The crystal structure of keyite, $\text{Cu}_3^{2+}(\text{Zn},\text{Cu}^{2+})_4\text{Cd}_2(\text{AsO}_4)_6(\text{H}_2\text{O})_2$, an oxysalt mineral with essential cadmium	M.A. COOPER & F.C. HAWTHORNE	623
The crystal chemistry of the tapiolite series	M.A. WISE & P. ČERNÝ	631
The crystal structure of shomiokite-(Y)	J.D. GRICE	649
Penobsquisite: a new borate mineral with a complex framework structure	J.D. GRICE, R.A. GAULT & J. VAN VELTHUIZEN	657
Bioavailability of riverine, sewage plant, and sediment phosphorus in the Bay of Quinte, Lake Ontario	P.G. MANNING	667
BOOK REVIEWS		677
New minerals recently approved by the Commission on New Minerals and Mineral Names, International Mineralogical Association		685
Referees for 1995		693
Silver in sulfide chimneys and mounds from 13°N and 21°N, East Pacific Rise	R. MOSS & S.D. SCOTT	697

Unusually high concentrations of magnetite at Caraiba and other Cu-sulfide deposits in the Curaçá Valley, Bahia, Brazil	W.D. MAIER & S.-J. BARNES	717
Feruvite from the Sullivan Pb-Zn-Ag deposit, British Columbia	SHAO-YONG JIANG, M.R. PALMER, A.M. McDONALD, J.F. SLACK & C.H.B. LEITCH	733
Fibrous foitite from San Piero in Campo, Elba, Italy	F. PEZZOTTA, F.C. HAWTHORNE, M.A. COOPER & D.K. TEERTSTRA	741
Geochemistry of cassiterite and its inclusions and exsolution products from tin and tungsten deposits in Portugal	A.M.R. NEIVA	745
Extreme differentiation of peralkaline rhyolite, Terceira, Azores: a modern analogue of Strange Lake, Labrador?	J.E. MUNGALL & R.F. MARTIN	769
Occurrence and composition of some Ti-bearing minerals in the Strange Lake intrusive complex, Quebec-Labrador boundary	T.C. BIRKETT, W.E. TRZCIENSKI, JR. & J.A.R. STIRLING	779
A single-crystal infrared spectroscopic and X-ray-diffraction study of untwinned San Benito perovskite containing OH groups	A. BERAN, E. LIBOWITZKY & T. ARMBRUSTER	803
The crystal structure of sabinaite, $\text{Na}_4\text{Zr}_2\text{TiO}_4(\text{CO}_3)_4$	A.M. McDONALD	811
The atomic arrangement of iimoriite-(Y), $\text{Y}_2(\text{SiO}_4)(\text{CO}_3)$	J.M. HUGHES, E.E. FOORD, J. JAI-NHUKNAN & J.M. BELL	817
The crystal structure of spiroffite	M.A. COOPER & F.C. HAWTHORNE	821
Sigismundite, $(\text{Ba}, \text{K}, \text{Pb})\text{Na}_3(\text{Ca}, \text{Sr})(\text{Fe}, \text{Mg}, \text{Mn})_{14}\text{Al}(\text{OH})_2(\text{PO}_4)_{12}$, a new Ba-rich member of the arrojadite group from Spluga Valley, Italy	F. DEMARTIN, C.M. GRAMACCIOLI, T. PILATI & E. SCIESA	827
Magnesian hornblende from a metamorphosed ultramafic body in southwest Finland: crystal chemistry and petrological implications	F. MANCINI, R. SILLANPÄÄ, B. MARSHALL & H. PAPUNEN	835
U^{6+} minerals and inorganic phases: a comparison and hierarchy of crystal structures	P.C. BURNS, M.L. MILLER & R.C. EWING	845
Phase transitions in the series boracite – trembachite – congoite: phase relations	P.C. BURNS & M.A. CARPENTER	881
The thermal behavior of cancrinite	I. HASSAN	893
Book Reviews		901
Occurrence and significance of stalactites within the epithermal deposits at Creede, Colorado	W.R. CAMPBELL & P.B. BARTON, JR.	905
Hydrothermal silica – gold stalactites formed by colloidal deposition in the Cirotan epithermal deposit, Indonesia	M. JÉBRAK, E. MARCOUX & D. FONTAINE	931
Hydrothermal argentopentlandite at El Charcón, southeastern Spain: mineral chemistry and conditions of formation	S. MORALES-RUANO & P. FENOLL HACH-ALÍ	939
Inversion between sphalerite- and wurtzite-type structures in the system Zn–Fe–Ga–S	T. UENO, S.D. SCOTT & S. KOJIMA	949

Contrasting corona structures in mafic granulite from the Blansky Les complex, Bohemian Massif, Czech Republic	J.V. OWEN & J. DOSTAL	959
Barium- and titanium-rich biotite and phlogopite from the Western and Eastern Gabbro, Coldwell alkaline complex, northwestern Ontario	C.S.J. SHAW & R.S. PENCZAK	967
Compositional variation of loparite from the Lovozero alkaline complex, Russia	R.H. MITCHELL & A.R. CHAKHMOURADIAN	977
"Nioboloparite": a re-investigation and discreditation	R.H. MITCHELL, A.R. CHAKHMOURADIAN & V.N. YAKOVENCHUK	991
Hafnian zircon from the apical part of the Suzhou granite, China	RU CHENG WANG, F. FONTAN, SHI JIN XU, XIAO MING CHEN & P. MONCHOUX	1001
Li- and F-bearing alkali amphibole from granitic pegmatite at Hurricane Mountain, Carroll County, New Hampshire	E.E. FOORD, R.C. ERD, S.B. ROBIE, F.E. LICHTE & V.T. KING	1011
Lithium-bearing fluor-arfvedsonite from Hurricane Mountain, New Hampshire: a crystal-chemical study	F.C. HAWTHORNE, R. OBERTI, L. OTTOLINI & E.E. FOORD	1015
The crystal structure of liottite, a six-layer member of the cancrinite group	P. BALLIRANO, S. MERLINO, E. BONACCORSI & A. MARAS	1021
Two-dimensional periodic antiphase boundaries in a synthetic aluminate sodalite, $\text{Ca}_8[\text{Al}_{12}\text{O}_{24}](\text{CrO}_4)_2$	I. HASSAN	1031
Marialite: Rietveld structure-refinement and ^{29}Si MAS and ^{27}Al satellite transition NMR spectroscopy	E.V. SOKOLOVA, Y.K. KABALOV, B.L. SHERRIFF, D.K. TEERTSTRA, D.M. JENKINS, G. KUNATH-FANDREI, S. GOETZ & C. JÄGER	1039
Crystal-structure refinement of a highly ordered staurolite	R. OBERTI, F.C. HAWTHORNE, A. ZANETTI, L. OTTOLINI & J.I. SOTO	1051
X-ray and neutron crystal-structure refinements of a boron-bearing vesuvianite	L.A. GROAT, F.C. HAWTHORNE, G.A. LAGER, A.J. SCHULTZ & T.S. ERCIT	1059
The crystal structure of schoepite, $[(\text{UO}_2)_8\text{O}_2(\text{OH})_{12}](\text{H}_2\text{O})_{12}$	R.J. FINCH, M.A. COOPER, F.C. HAWTHORNE & R.C. EWING	1071
Static and dynamic Jahn-Teller effects in Cu^{2+} oxysalt minerals	P.C. BURNS & F.C. HAWTHORNE	1089

ORIGIN AND SIGNIFICANCE OF ZONING IN MINERALS

Preface	R.A. MASON & R.F. MARTIN	1109
Oscillatory zoning in minerals: a common phenomenon	M. SHORE & A.D. FOWLER	1111
Determination of Lyapounov exponents to characterize the oscillatory distribution of trace elements in minerals	N.M. HALDEN	1127
Isothermal constitutive undercooling as a model for oscillatory zoning in plagioclase	I. L'HEUREUX & A.D. FOWLER	1137
Influence of magmatic assimilation on mineral growth and zoning	B.R. EDWARDS & J.K. RUSSELL	1149

Patterns of zonation in rare-earth-bearing minerals in nepheline syenites of the North Qôroq Center, South Greenland	I.M. COULSON & A.D. CHAMBERS	1163
Trace-element zoning in mantle minerals: metasomatism and thermal events in the upper mantle	W.L.. GRIFFIN, D. SMITH, C.G. RYAN, S.Y. O'REILLY & T.T. WIN	1179
Ca-metasomatism and chemical zonation of garnet in contact-metamorphic aureoles, Juneau Gold Belt, southeastern Alaska	H.H. STOWELL, T. MENARD & C.K. RIDGWAY	1195
Self-organized banded sphalerite and branching galena in the Pine Point ore deposit, Northwest Territories	A.D. FOWLER & I. L'HEUREUX	1211
Cathodoluminescence investigations and trace-element analyses of quartz by micro-PIXE: implications for diagenetic and provenance studies in sandstone	F. BRUHN, P. BRUCKSCHEN, J. MEIJER, A. STEPHAN, D.K. RICHTER & J. VEIZER	1223
Raman and infrared spectra of hydrous β -Mg ₂ SiO ₄	T.P. MERNAGH & LIN-GUN LIU	1233
Ba- and Ti-rich primary biotite from the Brome alkaline igneous complex, Monteregian Hills, Quebec: mechanisms of substitution	C.M.B. HENDERSON & K.A. FOLAND	1241
Emerald mineralization and metasomatism of amphibolite, Khaltaro granitic pegmatite – hydrothermal vein system, Haramosh Mountains, northern Pakistan	B.M. LAURS, J.H. DILLES & L.W. SNEE	1253
Nežilovite, a new member of the magnetoplumbite group, and the crystal chemistry of magnetoplumbite and hibonite	V. BERMANEC, D. HOLSTHAM, D. STURMAN, A.J. CRIDDLE, M.E. BACK & S. ŠČAVNIČAR	1287
Zajacite-(Ce), a new rare-earth fluoride from the Strange Lake deposit, Quebec–Labrador	J.L. JAMBOR, A.C. ROBERTS, D.R.. OWENS & J.D. GRICE	1299
Gallobeudantite, PbGa ₃ [AsO ₄] ₂ (SO ₄) ₂ (OH) ₆ , a new mineral species from Tsumeb, Namibia, and associated new gallium analogues of the alunite – jarosite family	J.L. JAMBOR, D.R. OWENS, J.D. GRICE & M.N. FEINGLOS	1305
Piretite, Ca(UO ₂) ₃ (SeO ₃) ₂ (OH) ₄ ·4H ₂ O, a new calcium uranyl selenite from Shinkolobwe, Shaba, Zaire	R. VOCHTEN, N. BLATON, O. PEETERS & M. DELIENS	1317
Pavonite from the Ikuno mine, Hyogo Prefecture, Japan	M. SHIMIZU & A. KATO	1323
Metasomatism at a granitic pegmatite – dunite contact in Galicia: the Franqueira occurrence of chrysoberyl (alexandrite), emerald, and phenakite: discussion	G. FRANZ, H.A. GILG, G. GRUNDMANN & G. MORTEANI	1329
Metasomatism at a granitic pegmatite – dunite contact in Galicia: the Franqueira occurrence of chrysoberyl (alexandrite), emerald, and phenakite: reply	A. MARTIN-IZARD, A. PANIAGUA, D. MOREIRAS, R.D. ACEVEDO & C. MARCOS-PASCUAL	1332
BOOK REVIEWS		1337
Proceedings of the forty-first annual meeting of the Mineralogical Association of Canada	G.M. LECHEMINANT	1341
The Hawley Medal for 1996 to David S. O'Hanley and Fred J. Wicks		1343
The Berry Medal for 1996 to Sol Kaiman		1347
The Past Presidents' Medal for 1996 to Thomas E. Krogh		1349
Index, Volume 34	J.D. SCOTT	1353