
CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES
TRIP REPORT

SUBJECT: 10th International Symposium on Water-Rock Interactions
20.01402.871

DATE/PLACE: June 10–16, 2001
Villasimius, Sardinia, Italy

AUTHOR: Roberto T. Pabalan

EXECUTIVE SUMMARY:

The 10th International Symposium on Water-Rock Interactions (WRI–10) comprised four days of technical sessions on a variety of topics relevant to the issue of water-rock interactions. About 500 participants from 45 countries attended the symposium and presented 380 papers in thirty oral and two poster sessions. Of particular interest are papers relevant to nuclear waste storage and disposal. Two U.S. Nuclear Regulatory Commission (NRC) funded papers were presented, one on “Local structure of uranium(VI) sorbed on clinoptilolite and montmorillonite,” co-authored by R. Reeder (State University of New York at Stony Brook), M. Nugent, and R. Pabalan, and another on “Molecular dynamics simulation of the uranyl ion near quartz surfaces,” co-authored by J. Greathouse (St. Lawrence University), G. Bemis (St. Lawrence University), and R. Pabalan. The symposium was very well organized and attendance at the oral and poster presentations was high. Participation by U.S. scientists was low, with only about 10 percent of registered participants from the U.S. Nevertheless, the meeting provided an opportunity to interact with many international scientists who are also involved in nuclear waste programs. The conference provided an opportunity to get feedback on NRC-funded work and to obtain information from other international scientists on geochemical issues relevant to nuclear waste management that may be useful in NRC reviews and analyses of U.S. Department of Energy (DOE) work. The meeting provided an opportunity to present some of the technical bases used in NRC reviews of DOE information and model abstractions.

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SUBJECT: 10th International Symposium on Water-Rock Interactions
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PERSONS PRESENT:

The symposium was attended by about 500 participants from 45 countries.

BACKGROUND AND PURPOSE OF TRIP:

The purpose of the trip was to participate in the 10th International Symposium on Water-Rock Interactions (WRI-10). The Water-Rock Interaction meetings, held every three years, are an international forum for discussion of geochemistry issues, including nuclear waste storage and disposal. The author of this trip report presented one of two papers resulting from U.S. Nuclear Regulatory Commission (NRC)-sponsored work to study radionuclide adsorption onto mineral surfaces and to test U.S. Department of Energy (DOE) hypotheses regarding radionuclide migration. The other paper was presented by J. Greathouse (St. Lawrence University, Canton, NY). The conference provided an opportunity to get feedback on NRC-funded work and to obtain information from other international scientists on geochemical issues relevant to nuclear waste management that may be useful in NRC reviews and analyses of DOE work. The meeting provided an opportunity to present some of the technical bases used in NRC reviews of DOE information and model abstractions.

SUMMARY OF PERTINENT POINTS:

The conference comprised four days of technical sessions on a variety of topics relevant to the issue of water-rock interactions. About 380 papers were presented in thirty oral and two poster sessions. The session topics included:

- Experimental geochemistry
- Geochemical cycles and natural hazards
- Geothermal studies
- Groundwater environments

- Kinetics
- Mineral surfaces
- Minerogenetic processes
- Modeling water-rock interactions
- Pollution and remediation
- Stable and radiogenic isotopes in water-rock interaction studies
- Thermodynamics
- Volcanic environments
- Waste storage and disposal
- Weathering processes

In addition to the technical sessions, a mid-week field trip was conducted to various sites on the island of Sardinia that are of geologic and environmental interest.

Two NRC-funded papers were presented. The paper titled "Local structure of uranium(VI) sorbed on clinoptilolite and montmorillonite," co-authored by R. Reeder (State University of New York at Stony Brook), M. Nugent, and R. Pabalan was presented by the author of this trip report. The second paper titled "Molecular dynamics simulation of the uranyl ion near quartz surfaces," co-authored by J. Greathouse (St. Lawrence University), G. Bemis (St. Lawrence University), and R. Pabalan, was presented by J. Greathouse.

Radionuclide sorption behavior is typically studied through batch sorption experiments. The NRC-funded experiments provide important information on the dependence of radionuclide sorption behavior on the chemistry of the radionuclide-bearing water (e.g., pH, ionic strength, and complexing ligands) and on the mineral sorbent properties (surface charge, site density). However, sorption experiments provide only macroscopic information, and one has to infer indirectly the type and relative stability of the species sorbed on the surface of the mineral. The NRC-funded studies were designed to provide mechanistic information on uranium sorption on mineral surfaces, which would enhance the technical bases of NRC reviews of DOE abstractions of radionuclide transport. Based on feedback received on these two papers during the conference, there is recognition of the inherent limitation of surface-complexation models that are typically used to predict radionuclide sorption under varying geochemical conditions. The identity of sorbed species used in these models are based on best fits to sorption data, which frequently lead to inconsistent species being identified by different investigators for similar experimental conditions. Thus, x-ray-based spectroscopic methods, which can provide *in-situ* structural information on sorbed radionuclide species, are considered to be important in helping constrain these species. Several conference participants expressed interest in the use of molecular simulation methods to study sorption processes. However, because the technique is relatively new, it is not clear to some participants how successful this method will be to the study of radionuclide sorption behavior. I pointed out that for the NRC program we are employing a robust

approach using all three methods—sorption experiments, molecular simulations, and x-ray spectroscopy—to provide complementary information that will be abstracted for higher level surface complexation models and for performance assessment calculations. Several requests were received for reprints of CNWRA papers on radionuclide sorption.

A complete list of the conference papers is in the attached appendix, and the full papers were published as a two-volume conference proceeding by A.A. Balkema Publishers. A brief summary of some of the more pertinent papers follows.

J. Cline described a paragenetic study of secondary mineralization at the potential Yucca Mountain (YM) nuclear waste repository designed to provide the geologic context for subsequent fluid inclusion and geochronology studies. “Early” secondary mineralization precipitated in open space in lithophysal cavities, fractures, and breccias, and consists of calcite and lesser opal, chalcedony, quartz, and fluorite that occur in varying abundances across YM. “Later” secondary mineralization consists of bladed calcite that was overgrown by Mg-rich calcite and locally intergrown opal. The latter are the paragenetically youngest minerals and can be correlated between different sample locations across the YM site.

As a follow up on J. Cline’s presentation, N. Wilson presented the results of a study designed to temporally constrain the passage of fluids with elevated temperature through the potential YM nuclear waste repository. Two-phase fluid inclusions in secondary minerals from lithophysal cavities, fractures, and breccias within the host tuffs trapped fluids at between ~35 to 81 °C across the site. These fluids were not trapped in the youngest, chemically distinct Mg-enriched calcite, which contains only rare liquid-only inclusions, but were trapped in paragenetically early to early-intermediate calcite. U-Pb dating of coexisting opal inclusions constrains precipitation of this youngest Mg-enriched calcite to between 2.9 to 1.9 Ma to the present day. Trapping of elevated temperature fluids was older than these minimum ages and in some samples was clearly older than 4.0 to 5.3 Ma. These results show that elevated temperature fluids were not present in the recent past (i.e., = 1.9 Ma) and indicate that a future invasion of the proposed repository site by upwelling hydrothermal fluids is not likely.

C. Beaucaire presented the results of a study on the effects of irradiation and heating on Boom clay to simulate the near field of a nuclear repository in clay rock. The experiments showed that after a short oxidizing stage, the chemical parameters are stabilized with neutral pH and reestablishment of the initial reducing conditions. The resulting fluids are saturated with respect to carbonates, chalcedony, goethite and pyrite. Indications of thermal and/or radiation-induced degradation of organic matter were observed: production of CO₂, organic ligands and thiosulfates. The buffering capacity of the Boom clay with respect to Eh and pH is favorable to performance assessment (PA) of a HLW repository, although the production of thiosulfates and organic ligands may enhance the corrosion of steel containers and enhance the mobilization of metallic elements.

H. Visnawathan described a reactive transport model that was developed to simulate heavy metal and radionuclide transport from flooded underground mines. The numerical model simulates laminar and turbulent flow in the adjacent fractured rock area with a continuum approach. The model results show that the depth to which recharge penetrates in a mine can be strongly dependent on the shaft and drift system. The geochemical capability of the model allows simulation of mixing of water from different sources, although enhancement of the model is needed to implement sorption capability for contaminant transport studies.

M. Adler described a core infiltration experiment at 30 °C to investigate the alteration of low-permeability argillaceous rock by high-pH solutions resulting from cement degradation. The experiment involved reacting a core sample of Opalinus Clay with K-Na-Ca-OH solution (pH 13.2) for 400 days at 30 °C, a confining pressure of 60 bar, and a hydraulic head of 30 bar. The chemical composition of effluent solutions and the evolution of hydraulic conductivity were monitored, and mineral reactions were identified after termination of the experiment. The results show that the high-pH plume infiltrating the rock is effectively buffered for the entire duration of the experiment by ion exchange of K^+ , Na^+ , and Ca^{2+} with Mg^{2+} in the clay and by precipitation of Mg-hydroxide phases. Substantial precipitation of secondary phases (calcite, clay minerals) continuously reduce the hydraulic conductivity of the rock to the extent that is suggestive of self-sealing.

D.L. de Windt presented a reactive transport simulation aimed at providing information on the important chemical processes resulting from interactions between claystone and cement. The porewater chemistry of cement is characterized by high amounts of alkaline and hydroxyl ions, which could result in substantial destruction of claystone minerals and modification of porewater chemistry. The simulation results indicate that three interdependent mechanisms control the pH profile in the system: (i) diffusion of the highly alkaline pore fluid, (ii) strong buffering related to important mineral transformations both in cement and host rock at the interface, and (iii) beyond the zone of intense mineral transformations, cation exchange processes. The results also show that porosity in the altered zone would drop to a value close to the unaltered host rock, but without total sealing.

A. Milodowski studied the alteration of Maastrichtian clay biomicrites by natural hyperalkaline Ca-OH-SO₄ groundwater at Maqarin, northern Jordan, as a natural analog for the interaction of cement porewaters with the host rock of a cementitious repository for radioactive wastes. Calcium silicate hydrate minerals and hydrogels, ettringite, and thaumasite dominate the alteration mineralogy. The observed mineralogy is similar to that found in laboratory experiments and as predicted from geochemical models used in repository PA. The paragenetic sequence can be interpreted by the waxing and waning evolution of the rock-hyperalkaline interaction system.

D. Savage presented results of a study to assess cement-bentonite interactions. Analcite is a likely product of bentonite-cement interaction and its behavior was investigated at 25–90 °C and pH 9–13 in laboratory experiments. The results showed that analcite dissolution is highly nonstoichiometric, with Na removed from the analcite structure by ion exchange to form leucite. The rate of dissolution was pH-dependent and data are consistent with a dissolution mechanism controlled by detachment of Si at negatively charged surface sites. Application of these data in reactive transport modeling suggests that up to 60 percent of a 1-m thick bentonite layer could be converted to a mixture of zeolites and sheet silicates over 1,000 yr by reaction with cement.

B. van der Grift described laboratory experiments that were performed to characterize the possibility of geochemical isolation of a gypsum landfill. The landfill of interest contained about 2.2 million m³ of waste gypsum that was dumped in a former gravel quarry over a period of 20 yr. Dissolution of large amounts of gypsum is a concern because it may cause environmental and/or civil technical problems by leaching of sulfate and sagging of the gypsum landfill. The experiments showed that conversion of the very soluble gypsum into stable barite by addition of BaCl₂ to the groundwater is an effective way to prevent further dissolution of gypsum. A thin layer of barite forms on the surface of the gypsum and isolates the gypsum from the groundwater.

IMPRESSIONS/CONCLUSIONS

The symposium was very well organized and attendance at the oral and poster presentations was high. Participation by U.S. scientists was low, with only about 10 percent of registered participants from the United States. Nevertheless, the meeting provided an opportunity to interact with many international scientists that are also involved in nuclear waste programs and to solicit feedback on work funded by the United States. U.S. Nuclear Regulatory Commission (NRC). The two papers presenting the results of NRC-funded work were well-received.

PROBLEMS ENCOUNTERED:

None

PENDING ACTIONS:

None

RECOMMENDATIONS:

Continued participation in future Water-Rock Interactions symposia is highly recommended.

AUTHOR:



Roberto T. Pabalan
Principal Scientist

Date: 6/27/01

CONCURRENCE:



English C. Percy, Manager
Geohydrology and Geochemistry Element

Date: 6/28/2001



Budhi Sagar
Technical Director

Date: 6/28/2001

ATTACHMENTS
KEYNOTE LECTURES

KEYNOTE LECTURES

| | | |
|----------------------------|--|---|
| Monday 11 9.00–9.40 | G. Ottonello | The inverse modeling of water-rock interaction |
| Monday 11 11:20–12 | S.L. Brantley, M. Bau, S. Yau, B. Alexander, J. Chesley: | Interpreting kinetics of groundwater-mineral interaction using major element, trace element, and isotopic tracers |
| Tuesday 12 8.30–9.10 | T.D. Bullen, A.F. White, C.W. Childs, J. Horita | Reducing ambiguity in isotopic studies using a multi-tracer approach |
| Tuesday 12 14.00–14.40 | A.H. Bath, F.J. Pearson, A. Gautschi and H.N. Waber | Water-rock interactions in mudrocks and similar low permeability material |
| Thursday 14 8.30–9.10 | A. Vengosh, E. Farber, U. Shavit, R. Holtzman, M. Segal, I. Gavrieli ECO–Research Team, T. Bullen | Exploring the sources of the salinity in the Middle East: an integrative hydrologic, geochemical and isotopic study of the Jordan River |
| Thursday 14 14.00–14.40 | H. Kristmannsdóttir | Interactive processes due to subglacial volcanic activity—Local phenomena with global consequences |
| Friday 15 8.30–9.10 | E.L. Shock | Hydrothermal water/rock/organic/microbe interactions |
| Friday 15 14.00–14.40 | W.M. Edmunds | Significance of geochemical signatures in sedimentary basin aquifer systems |

ORAL PRESENTATIONS

Monday 11
9:40–11:00

Modelling water-rock interaction 1 (Room A)

1. P. Aagaard, J.S. Jahren, S.N. Ehrenberg: H₂S-controlling reactions in elastic hydrocarbon reservoirs from the Norwegian Shelf and US Gulf Coast
2. G.A. Harrington, A.J. Love, A.L. Herczeg: Relative importance of physical and geochemical processes affecting solute distributions in a clay aquitard
3. G.P. Shand, I.N. Gale, J. Eastwood: Geochemical modelling of groundwater quality changes during aquifer storage and recovery (ASR) in the dual porosity Chalk aquifer, England
4. C.H. Moore: Examination of the effect of uncertainty in thermodynamic and kinetic data on computer simulations of complex systems

Thermodynamics (Room C+D)

5. N.N. Akinfiev: Equation of state for aqueous non electrolytes
6. G.R. Kolonin, G.P. Shironosova: Thermodynamic elucidation of Eu anomalies in REE pattern in hydrothermal fluorite
7. L. Richard, H.C. Helgeson: Thermodynamic calculation of the distribution of organic sulfur compounds in crude oil as a function of temperature, pressure, and H₂S fugacity
8. M. Azaroual, V. Plagnes, I. Matsunaga: Soultz granite-saline water interactions at 175–200 °C and 10–50 bar: experimental and thermo-kinetic modeling approaches

Stable and radiogenic isotopes in WRI studies 1 (Room B)

9. R. Hesse, P.K. Egeberg, S.K. Frapre: Modelling of chlorine stable isotope ratios of a submarine gas-hydrate field
10. I.M. Villa, G. Ruggieri, M. Puxeddu: Geochronology of magmatic and hydrothermal micas from the Larderello geothermal field, Italy
11. H.W. Yeh, Y.S. Wang, L.P. Tan, M. Kusakabe, B.S. Yu: Fluid-inclusion, O-and S-isotope study of selected barite and enargite samples from Chinkuashih Cu-Au deposit
12. U. Fehn, G.T. Snyder, Y. Muramatsu: Tracing volatiles in subduction zones: I–129 results from three volcanic arcs

Monday 11

12:00–13:10

Kinetics (Room A)

13. P. Bénézech, D.A. Palmer, D.J. Wesolowski, C. Xiao, S.A. Wood: Solubility and reaction rates of oxides and hydroxides to high temperatures with *in situ* pH measurement
14. S. Gin, C. Jégou: Limiting mechanisms of borosilicate glass alteration kinetics: Effect of glass composition
15. J. Ganor, V. Metz: To stir or not to stir—implications for silicate dissolution experiments

Weathering processes (Room C+D)

16. W.I.S. Fernando, R. Kitagawa, B. P. Roser, Y. Hayasaka, Y. Takahashi: Composition of charnockite weathering products in three climatic zones
17. C.A. Johnson, I. Baur, F. Ziegler: Heavy-metal binding mechanisms in cement minerals
18. A.F. White, M.S. Schulz, D.V. Vivit, T.D. Bullen: Disseminated calcite in a global suite of granitic rocks: Correlations with experimental solutes

Minerogenetic processes (Room B)

19. N. Shikazono, N. Yonekawa, T. Karakizawa: Mass transfer, oxygen isotopic variation and gold precipitation in epithermal systems: A case study of the Hishikari Deposit, Southern Kyushu, Japan
20. P. Lattanzi, M. Benvenuti, P. Costagliola, C. Maineri, I. Mascaro, G. Tanelli, A. Dini, G. Ruggieri: Magmatic vs hydrothermal processes in the formation of raw ceramic material deposits in southern Tuscany

21. M. Boni, A. Iannace, I.M. Villa, L. Fedele, R. Bodnar: Multiple fluid-flow events and mineralizations in SW Sardinia: an European perspective
-

Tuesday 12

9:10–10:30

Stable and radiogenic isotopes in WRI studies 2 (Room A)

22. I. Cartwright, T. Weaver, S. Tweed, D. Ahearne, M. Cooper, C. Czapnik, J. Tranter: Sources of gas and water in carbonated mineral springs, Victoria, Australia
23. R. Purtschert, B.E. Lehmann, H.H. Loosli: Groundwater dating and subsurface processes investigated by noble gas isotopes (^{37}Ar , ^{39}Ar , ^{85}Kr , ^{222}Rn , ^4He)
24. J.M. Thomas, B.S. Morse, G.S. Burr, D.L. Reines: Age dating groundwater using dissolved organic carbon—an example from southern Nevada, USA
25. C. Cai, H. He, T. Xiang: Isotope evidence for the origin and mixing of brines from Kuga Basin, China
26. M. Boomeri, D. Ishiyama, O. Matsubaya: Water-rock interaction in the Sangam deposit, northeastern Iran.

Pollution and remediation: mining environments 1 (Room C+D)

27. P. Lattanzi, L. Fanfani, R. Caboi, R. Cidu, P. Zuddas: Environmental ore deposit models: insights from Sardinia
28. B.A. Azzie, M.V. Fey: A classification of mine water, reflecting both quality and geochemistry
29. B.L. Sherriff, K. Salzsauler, C. Lambert, D. Bray, K. Londry: Orphaned mine tailings in Nopiming Provincial Park, Manitoba, Canada
30. J.W. Ball, R.L. Runkel, D.K. Nordstrom: Reactive transport modeling at high-flow—Wightman Fork/Alamosa River, USA

Trace element mobility 1 (Room B)

31. S. Arnórsson, R. Lindvall: The distribution of arsenic, molybdenum and tungsten in natural waters in basaltic terrain, N-Iceland
32. J.V.S. Smith, J. Jankowski, J. Sammut: Vertical distribution of As(III) and As(V) in a coastal sandy aquifer: Marine clays, a potential reservoir for arsenic in coastal groundwater systems
33. S. Stadler, S. Jann, R. Höhn, M. Isenbeck-Schröter, V.W. Niedan, C. Scholz, A. Tretner, J.A. Davis, D.B. Kent: Tracer tests with As(III) in the oxic and suboxic groundwater zones at the USGS Cape Cod site, Mass., USA
34. M. Tretner, C. Kofod, M. Scholz, Isenbeck-Schröter: Influence of the geochemical conditions and the input species on the species distribution of As in groundwater
-

Tuesday 12

14:40–16:00

Waste storage and disposal 1 (Room A)

35. F.J. Pearson, H.N. Waber: Origin and evolution of pore-water solutes in the very-low permeability Opalinus Clay, Switzerland
36. H.N. Waber, S.K. Frape, A. Gautschi: Cl-isotopes as indicator for a complex paleohydrogeology in Jurassic argillaceous rocks, Switzerland
37. P. Sardini, A. Meunier, M. Siitari-Kauppi: Porosity distribution of minerals forming crystalline rocks
38. B. Orberger, M. Pagel, J. L. Michelot: Fluid-rock interaction in siltstones: origin of exceptional mechanical properties

Stable and radiogenic isotopes in WRI studies 3 (Room C+D)

39. P. Shand, D.P.F. Darbyshire, D.C. Gooddy, W.G. Darling, C. Neal, A.H. Haria, A.J. Dixon: The application of Sr isotopes to catchment studies: The Plynlimon upland catchment of Central Wales
40. M. Novak, D. Fottova: Geogenic and atmogenic sulfur in forested catchments: The isotope mass balance approach
41. T. Pichler: The use of $^{87}\text{Sr}/^{86}\text{Sr}$ ratios to document physico-chemical changes in shallow-water hydrothermal systems
42. K. Faure, R.L. Brathwaite, Y. Matsuhisa: Do hydrogen isotope values of fluid inclusion water in vein quartz accurately reflect water of deposition?

Trace element mobility 2 (Room B)

43. T. Paces, E. Pacesova: Weathering of rocks in soil budgets of trace metals
44. J.K. Aggarwal, M.R. Palmer: Mobility of rubidium, strontium, cesium and barium in hydrothermal fluids: evidence from Iceland
45. P. Möller: The behaviour of REE and Y in water-rock interactions
46. W.M. Shannon, S.A. Wood, K. Brown, G. Arehart: REE contents and speciation in geothermal fluids from New Zealand

Tuesday 12

16:30–18:10

Pollution and remediation: general issues 1 (Room A)

47. A.D. Gault, D.A. Polya, P.R. Lythgoe: Arsenic speciation in contaminated urban waters, Accrington (UK) using IC-ICP-MS
48. R. Höhn, M. Isenbeck-Schröter, V. Niedan, C. Scholz, A. Tretner, S. Jann, S. Stadler, D. Kent, J. Davis, R. Jakobsen: Tracer test with Arsenic (V) in an iron reducing environment at the USGS Cape Cod Site (Mass., USA)
49. D. Chandrasekharam, J. Karmakar, Z. Berner, D. Stüben: Arsenic contamination in groundwater, Murshidabad district, West Bengal
50. S.J. Sahu, S. Roy, J. Jana, B. Nath, R. Bhattacharya, D. Chatterjee, S. S. Dey Dalal: Water chemistry and sediment-water interaction responsible for mobilization of arsenic in groundwater in Bengal delta plain
51. R. Bhattacharyya, J. Jana, D. Chatterjee, S.S. De Dalal, P. Bhattacharya, G. Jacks: Arsenic in groundwater- Laterite treatment as the possible remedial option

Pollution and remediation: mining environments 2 (Room C+D)

- 52. S.B. Bortnikova, B.S.Smolyakov, E.P.Bessonova, N.V.Androsova: Ecosystem under acid mine drainage stress: ways of metal removal and biota response
- 53. T. Buckby, S.Black, M.L.Coleman: M.E.Hodson: Mineral precipitation experiments from an acid mine river: Río Tinto, South West Spain
- 54. F. Frau, C. Arda, M. Lorrai, L. Fanfani: Geochemistry of waters in the dismantled mine area of Baccu Locci (Sardinia, Italy): the arsenic contamination
- 55. S.A. Wood, L.L. Baker, W.M. Shannon: Heavy metals in mine drainage from the Pine Creek area, Coeur d'Alene River Valley, Idaho, USA
- 56. H. Pauwels, A. Lassin, J-C. Foucher, Y. Deschamps, M-L. Tercier, F. Graziottin, R. Castroviejo, J. Samper, A. López: Metal concentrations in groundwater around disturbed and undisturbed massive sulfide deposits

Geothermal systems (Room B)

- 57. N. Tsuchiya, N. Hirano, G.Bignall, K. Nawatsuka: Supercritical water-rock interaction for development of deep-seated geothermal waters
- 58. T. Kavouridis, G. La Ruffa, C. Panichi: Isotope and chemical studies for a geothermal assessment of Kios island, Greece
- 59. M.I.R.D. Balangue: Water-rock interaction in the Tongonan geothermal field, Leyte, Philippines
- 60. I.S. Torres-Alvarado, P.L. Maldonado: Geochemical modeling of the hydrothermal alteration in Los Humeros geothermal field, Mexico
- 61. P. Zhao, M. Kennedy, D. Shuster, J. Dor, E. Xie, S. Du: Implications of noble gas geochemistry in the Yangbajing geothermal field, Tibet

Thursday 14
9:10–10:30

Groundwater environments 1 (Room A)

- 62. P. De Caritat, N. Lavitt, D. Kirste: Groundwater geochemistry in the Broken Hill region, Australia
- 63. R. Favara, F. Grassa, M. Valenza: Geochemical characterization of groundwaters from the Hyblean aquifers, South-Eastern Sicily.
- 64. P.L. Smedley, M. Zhang, G. Zhang, Z. Luo: Arsenic and other redox-sensitive elements in groundwater from the Huhhot basin, Inner Mongolia
- 65. R. Wang, Y. Wang, H. Guo: Hydrogeochemistry of shallow groundwaters from the northern part of the Datong basin, China

Modelling water-rock interaction 2 (Room C+D)

- 66. S.L. Shvartsev: Evolution and self-organization of the water-rock system
- 67. R.C. Fletcher, E. Merino: Mineral growth in rocks: interacting stress and kinetics in vein growth, replacement, and water-rock interaction
- 68. B.R., T.J.P.: New insight on the chemical control of aqueous aluminum. Application for modelling water-rock interaction.

69. R.B. Wanty, B.R. Berger, M.L. Tuttle: Scale versus detail in water-rock investigations 1: a process-oriented framework for studies of natural systems. 2: Field-scale models of fracture networks in mineral deposits

Magmatic and metamorphic environments (Room B)

70. A. Dini, S. Tonarini, W.P. Leeman, I.E. Ertan, F. Pezzotta: Geochemical behavior of boron at the magmatic-hydrothermal transition: insights from $\delta^{11}\text{B}$ of tourmaline in peraluminous granites (Elba Island, Italy)
 71. G. Gianelli, M. Puxeddu, G. Ruggieri: Contents of F, Cl, Li and B in the granite intrusions of Larderello, Italy
 72. C. Corteel, N.J. Fortey: Trace element mobility in tourmalinite veins and surrounding metapelites from the Crummock Water aureole (Lake District, England)
 73. R. Abart: Metasomatic reaction bands—a key to component mobility at metamorphic conditions
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Thursday 14
14:40–16:30

Volcanic environments (Room A)

74. H. Ármannsson: Reaction of groundwater with rock from the Krafla area, N-E Iceland and volcanic gas
75. A. Paonita, P.M. Nuccio: Thermodynamic modeling of magma outgassing for multicomponent gas mixtures and its application in evaluation of volcanic activity
76. I.K. Pitcairn, D.A. Banks, L. Benning, H. Shinohara, F. Goff: $\delta^{37}\text{Cl}$ and Cl/Br systematics of volcanic gases
77. W.C. Evans, M.L. Sorey, R.L. Michel, A.C. Cook, B.M. Kennedy, E. Busenberg: Tracing magmatic carbon in groundwater at Big Springs, Long Valley caldera, USA
78. B. Takano, T. Maekawa, Q. Zheng: Kinetic study on aqueous polythionates and its application to active crater lake systems

Experimental geochemistry (Room C+D)

79. Y. Suto, L. Liu, T. Hashida, N. Tsuchiya, N. Yamasaki: Experimental study of Rock/water/ CO_2 interaction at temperatures of 100–350 °C
80. P. Zuddas, F. Seimbille: Rate of mineral dissolution during granite-hydrothermal alteration
81. D.K. Nordstrom: A test of aqueous speciation: Measured versus calculated free fluoride ion activity
82. L. Mercury, P. Freyssinet, Y. Tardy: Negative pressure and water-mineral interaction in the unsaturated zone of soils
83. B.O. Mysen, K. Wheeler: Solubility of Na, Al, and Si in aqueous fluid at 0.8–2.0 GPa and 1,000–1,300 °C

Sedimentary basins (Room B)

84. M.B. Buatier, M. Steinmann, C. Bertrand, A.M. Karpoff, G.L. Früh-Green: Fluid-sediment interaction and clay authigenesis along the flank of the Juan de Fuca Ridge

85. C. Monnin, C.G. Wheat, M.M. Mottil, S. Balleur: The influence of basement fluid upwelling and diagenesis on CaCO_3 stability in sediments from the eastern flank of the Juan de Fuca ridge
 86. H.G. Machel, B.E. Buschkuehle, K. Michael: Squeegee flow in Devonian carbonate aquifers in Alberta, Canada
 87. E. Mazor: Flat lowland paleogeography of sediment-collecting basins: Evidence from formation waters
 88. R.H. Worden, P.C. Smalley: H_2S in North Sea oil fields: importance of thermochemical sulphate reduction in clastic reservoirs
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Friday 15

9:10–10:30

Geochemical cycles and natural hazards (Room A)

89. V.P. Zverev: Massflows of the subsurface hydrosphere: Global and regional cycles
90. G.B. Arehart, S.R. Poulson: Hydrothermal systems as indicators of paleoclimate: an example from the Great Basin, Western North America
91. M. Gasparon: Anthropogenic lead in Antarctic fresh waters
92. F. Quattrocchi, G. Galli, L. Pizzino, G. Capelli, D. De Rita, C. Faccenna, R. Funicello, G. Giordano, D. Goletto, R. Mazza, C. Mancini: The Ardea Basin fluid geochemistry, hydrogeology and structural patterns: new insights about the geothermal unrest activity of the Alban Hills quiescent volcano (Rome, Italy) and its geochemical hazard surveillance

Groundwater environments 2 (Room C+D)

93. O.V. Chudaev, V.A. Chudaeva, K. Sugimori, K. Nagao, B. Takano, M. Matsuo, A. Kuno, M. Kusakabe: New geochemical data of the high PCO_2 waters of Primorye (Far East Russia)
94. J. Griffioen, T. Keijzer: Biogeochemical cycles of chloride, nitrogen, sulphate and iron in a phreatic aquifer system in The Netherlands
95. G. Massmann, A. Pekdeger, C. Merz, M.-Th. Schafmeister: Redox chemistry of a river-recharged aquifer in the "Oderbruch" region in eastern Germany
96. C. Plain, L. Dever, C. Marlin, E. Gibert: Chemical and isotopic signatures of interstitial water in the French Chalk aquifer and water-rock interactions

Pollution and remediation: general issues 2 (Room B)

97. T. Hofmann: Origin and relevance of mobile aqueous nanophases due to redox driven water-rock interactions
 98. Y.K. Kharaka, E.G. Kakouros, J.B. Miller: Natural and anthropogenic loading of dissolved selenium in Colorado River Basin
 99. C. Le Guern, P. Baranger, C. Crouzet, F. Bodéan, P. Conil, P. Négrel, M. Brach: Trace-element trapping by hydrous iron oxides and carbonates
 100. P. Arbizzani, G. Cortecchi, E. Dinelli, L. Pompilio, A. Bencini, O. Vaselli: Geochemistry of waters and sediments from the Serchio river catchment (Northern Italy)
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Friday 15
14:40–16:00

Groundwater environments 3 (Room A)

- 101. T.R. Weaver, S.K. Frappe, J.A. Cherry: Decoupling solute distributions from groundwater flow in low permeability media
- 102. P. Birkle: Chemical and isotopic evolution of formation water at the Activo Luna oilfield, Mexico
- 103. K. Bucher, Ingrid Stober: Does plagioclase control the composition of groundwater in the crystalline basement?
- 104. A.L. Herczeg: Can major ion chemistry be used to estimate groundwater residence time in basaltic aquifers?

Pollution and remediation: general issues 3 (Room C+D)

- 105. P.J. Stuyfzand: Pyrite oxidation and side-reactions upon deep well injection
- 106. P.J. Swedlund, J.G. Webster, G.M. Miskelly: Modeling ferrihydrite adsorption of Pb, Cd, and Co in SO₄-rich systems
- 107. Ch. Merz, P. Schuhmacher, A. Winkler: Anthropogenic-influenced hydrochemical processes in a Quaternary aquifer of the poldered floodplains of the Oder River
- 108. M. Dall'Aglia, G. Giuliano, et al.: (i) Assessing drinking water quality in Northern Latium by trace elements analysis. (ii) Drinking water quality in the Grosseto province (Tuscany, Italy).

Mineral surfaces (Room B)

- 109. B.T. Ngwenya, I.W. Sutherland: The surface chemistry of a gram-negative bacteria and its role in metal uptake
 - 110. G.De Giudici, P. Zuddas: Microscopic processes at the interface between metal sulphides and water
 - 111. N.C. Sturchio, P. Fenter, L. Cheng, H. Teng: Orthoclase surface structure and dissolution measured *in situ* by x-ray reflectivity and atomic force microscopy
 - 112. R.J. Reeder, M. Nugent, R.T. Pabalan: Local structure of uranium(VI) sorbed on clinoptilolite and montmorillonite
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Friday 15
16:30–18:10

Biogeochemical processes and organic complexation (Room A)

- 113. J.S. Herman, A.L. Mills, I.M. Cozzarelli: Microbially mediated alteration of iron mineral phases in contaminated sedimentary aquifers
- 114. J.P. Amend: Hyperthermophiles and geochemical energy in the thermal springs of Panarea
- 115. J.R. Rogers, P.C. Bennett, W.J. Choi: Enhanced weathering of silicates by subsurface microorganisms: a strategy to release limiting inorganic nutrients?
- 116. Y. Takahashi, Y. Minai: Role of complex formation with humic substances in the redistribution of trivalent rare earth elements and actinides

117. J.R. Kramer, H. Manolopoulos, R.A. Bell: Sulfide clusters in oxic waters, metal speciation and toxicity

Pollution and remediation: mining environments 3 (Room C+D)

118. M.C. Pirlo: Geochemical modeling of wastewater disposal at the Honeymoon *in-situ* leach uranium mine, South Australia
119. R.R. Seal, II, J.M. Hammarstrom, A.L. Meier: Geochemical controls on drainage from massive sulfide mines in the eastern USA
120. H.S. Viswanathan, M. Sauter: Contaminant migration from underground mines using a coupled continuum pipe-flow model
121. E. Dinelli, F. Tateo: Experimental formation of fine-grained precipitates from acid mine waters
122. I. Ko, J.S. Ahn, K.-W. Kim: Arsenic contamination of soils and stream sediments from the tailings in the vicinity of Myungbong Au mine in Korea

Waste storage and disposal 2 (Room B)

123. J.S. Jahren, P. Aagaard, W.M. Olsen, T. Løken, T. Sverreson: Geochemical characterization of the Langoya gypsum landfill and its suitability to store inorganic hazardous waste
124. Bas van der Grift, Jasper Griffioen, Fred Stadler, Rob van Midden: Geochemical isolation of a gypsum landfill
125. R. Metcalfe, T. Kunimaru, K. Hama, K. Amano, T. Iwatsuki, A.E. Milodowski, M.R. Gillespie: Water-rock interactions around a fault: implications for waste disposal
126. U.J. Suksi, P. Juntunen, P. Pitkänen, K. Rasilainen, T. Ruskeeniemi, J. Casanova: Application of uranium-series disequilibrium data to interpretation of oxygen intrusion in rocks
127. N.S.F. Wilson, J.S. Cline, Y. Amelin: Temporal constraints for elevated temperature fluids at the potential Yucca Mountain nuclear waste repository, USA

Poster presentations

Tuesday 12

11:00–12:40

Geochemical cycles, global change and natural hazards

128. A.P. Bonfanti, W.D'Alessandro: The chemistry of rainwater in the Mt. Etna area (Italy): sources of major species
129. W.D'Alessandro, F. Parello, B. Parisi, P. Ailard, P. Jean-Baptiste: Temporal variations of $^3\text{He}/^4\text{He}$ ratios of dissolved helium in groundwaters of Mt Etna, Southern Italy.
130. W.G. Darling: Magadi and Suguta: the contrasting hydrogeochemistry of two soda lake areas in the Kenya Rift Valley
131. G.M. Gavrilenko, M.G. Gavrilenko: Geochemical precursors of the 2000 eruption of Mutnovsky Volcano, Kamchatka
132. F. Italiano, M. Martelli, P.M. Nuccio: Helium geochemistry applied to crust-mantle interaction in the Apennines (Italy)

133. H. Woith, R. Wang, C. Milkereit, J. Zschau, U. Maiwald, A. Pekdeger: Response of an artesian well in southern Armenia to the 1400 km distant Izmit earthquake of August 17, 1999
134. A.R. Zanzari, A. Martinelli, R. Cioni, M. Guidi, B. Raco, A. Scozzari, F. Quattrocchi, G. Galli, C. Mancini: Discrete and continuous monitoring of groundwaters in the seismic area of the Umbria region (Italy).
135. *F. Quattrocchi, G.Di. Stefano, G. Galli, L. Pizzino, P. Scarlato, P. Allard, D. Andronico, D. Condarelli, T. Sgroi: Water-rock interactions during seismic and volcanic activity recorded at Mount Etna by continuous groundwater monitoring.

Modelling WRI

136. Nizar S. Abu-Jaber: Quantifying recharge of the Ghussein wells using chemical tracers
137. J. Bruni, M. Canepa, F. Cipolli, L. Marini, G. Ottonello, M. Vetusch Zuccolini, G. Chiodini, R. Cioni, A. Longinelli: Reactions governing the chemistry of waters interacting with serpentinites
138. O.V. Chudaev, V.B. Kurnosov, O.V. Avchenko, N.A. Chepkaya: Seawater-basalt interaction: field observations and modeling result
139. J.S. Cleverley, L.G. Benning, B.W. Mountain, M.C. Gorringe: Arsenic sulphide precipitation in an active geothermal system: reaction path modelling
140. M. Gasparrini, T. Bechstädt, M. Boni: Large-scale hydrothermal dolomitization in the Southern Cantabrian Zone (NW Spain)
141. J.A. Greathouse, G. Bemis, R.T. Pabalan: Molecular dynamics simulation of the uranyl ion near quartz surfaces
142. W. Kloppmann, D. Thiéry, C. Kervéan, A. Bourguignon, P. Négrel, J. Casanova: Chemistry-transport coupled modelling of the Äspö groundwater system (Sweden) since the last glaciation
143. U.K. Mäder, M. Adler, V. Langer, P. Degnan, A.E. Milodowski, J.A.T. Smellie, E. Salameh, H.N. Khoury, L.Y. Griffault, L. Trotignon: The Maqarin natural analogue study of a cement-buffered hyperalkaline groundwater plume: structural model and flow systems
144. J. Mirecki, M.D. Petkewich, K.J. Conlon, B.G. Campbell: Water quality changes during aquifer storage recovery in limestone-silicate aquifer material
145. A.F. Moench, Y.K. Kharaka: Analytical model for deep well injection of cold brine into a hot aquifer
146. M.J. Turrero, J. Peña, A.M. Fernández, P. Gómez, A. Garralón: Porewater geochemistry and modeling within Oligocene-Miocene clays of North Central Spain
147. R.B. Wanty, B.R. Berger, M.L. Tuttle: Scale versus detail in water-rock investigations 1: a process-oriented framework for studies of natural systems. 2: Field-scale models of fracture networks in mineral deposits.
148. *O. Bildstein, C.I. Steefel: The role of pressure solution in fracture healing: a multi-scale reaction-flow modeling approach
149. *Á.E. Sveinbjornsdottir, S. Arnorsson, J. Heinmeier: Isotopic and chemical characteristics of old ice "age" groundwater, North Iceland
150. *M.P. Verma, A.H. Truesdell: pH calculation through the use of alkalinity in geochemical modeling of hydrothermal systems

Thermodynamics, kinetics and experimental geochemistry

151. Ph. Blanc, E. Gaucher, B. Sanjuan, C. Crouzet, A. Seron, L. Griffault: Testing a clay/porewater interaction model through a laboratory experiment
152. J. Cama, X. Querol, C. Ayora, E. Sanz, J. Ganor: Dissolution of synthetic zeolites at low temperature—preliminary results
153. L.C. Cavé, M.V. Fey, D.K. Nordstrom: Dissolution rate of apophyllite. The effects of pH and implications for underground water storage
154. M. Descostes, C. Beaucaire, H. Pitsch, F. Mercier, P. Zuddas: Reactivity of pyrite surfaces: Combining XPS and speciation in solution
155. P. Fenter, L. Cheng, S. Rihs, M. Mackesky, M.J. Bedzyk, N.C. Sturchio: Probing the electrical double-layer structure at the rutile-water interface with X-ray standing waves
156. T. Gavriloaiei: The bentonite-water interface and its role in the adsorption processes of metals
157. Latrille, M. Jullien, C. Pozo: Elements transfers in compacted clayey materials under thermal gradient
158. William F. McKenzie, Laurent Richard, Sonia Salah: Gibbs free energies of formation of uranyl silicates at 298.15 K
159. E. Oila, S. Pinnioja, M. Siitari-Kauppi, V. Aaltonen, A. Lindberg: Fading of luminescence in feldspars – autoradiographic method
160. H. Pitsch, C. Beaucaire, P. Meier, S. Grappin: Sampling techniques and pH measurement methods for geochemical analysis of deep groundwaters
161. H. Sugita, I. Matsunaga, T. Yamaguchi, H. Tao: Measurement of quartz dissolution rates with a flow-through type autoclave reactor
162. Varsányi, L. Ó. Kovács: The source of sodium in groundwater, Pannonian Basin, Hungary
163. T. Wells, P. Binning, G. Willgoose, A. Mews: Leaching kinetics of a quartz-chlorite schist and consequent changes in the rock structure.
164. *Honghan Chen, Shengzhang Zou, Erping Bi: Experimental study on mixture corrosion effects in littoral karst area, coastal Liaodong Peninsula, China
165. *H.E. Gäbler, A. Bahr: Enriched stable isotopes for determining the sorbed element fraction in soils in order to calculate sorption isotherms
166. *M.F. Manna, D. E. Grandstaff, G. C. Ulmer, E. P. Vicenzi: The chemical durability of yttria-stabilized ZrO_2 pH and O_2 geothermal sensors
167. *W. Preis, H. Gamsjäger: Revised thermodynamic properties of malachite and azurite
168. *M.P. Verma: Silica solubility geothermometers for hydrothermal systems

Mineral surfaces and weathering processes

169. Cassagnabère, J.C. Parneix, S. Sammartino, L.Y. Griffault, U. Maeder: T. Milodowski: Mineralogical evolution of bituminous marl adjacent to an alkaline water conducting feature at the Maqarin analogue site
170. P.A. Díaz, V. Alvarado, M.I. Rodríguez: Dissolution of calcite in $CaCO_3$ - CO_2 - H_2O systems in porous media
171. C.A.M. Figueiredo, A. A. Mauricio, L. Aires-Barros: Basílica da Estrela stone decay: the role of rain-water
172. H.B. Ji, S.J. Wang, Z.Y. Ouyang, C.Q. Liu, C.X. Sun, X.M. Liu: Geochemistry of a profile at the weathering front in dolomite

173. J.R. Jiménez-Rueda, D.M. Bonotto: The use of U-isotopes on the study of a weathered cover in Paraná basin, Brazil
174. Dana Sue Kimbal, Ross W. Smith: Water-rock interaction and the water chemistry of a small Sierra Nevada lake
175. G. Macciotta, G. Bertorino, A. Caredda, S. Columbu, M. Franceschelli, M. Marchi, S. Rescic, R. Coroneo: The S. Antioco of Bisarcio Basilica (NE Sardinia, Italy): water-rock interaction in ignimbrite monument decay
176. F. Mercier, M. Descostes, C. Beaucaire, P. Trocellier, P. Zuddas: Characterization of oxidation products onto pyrite: coupling of XPS and NMA
177. Rossi, D. Atzei, B. Elsener, S. Da Pelo, F. Frau, P. Lattanzi, P.L. Wincott, D.J. Vaughan: Surface composition of enargite (Cu_3AsS_4)
178. Y. Zhang, G.R. Lumpkin, B.S. Thomas, Z. Aly, R.A. Day, K.P. Hart, M. Carter: Aqueous dissolution studies of synthetic and natural brannerites
179. *D. Charpentier, M. Cathelineau, R. Mosser-Ruck, G. Bruno: Oxidation of an argillaceous formation: mineralogical and geochemical evolution
180. *L. François, A. Probst, Y. Goddérès, J. Schott, D. Rasse, D. Viville, O. Pokrovsky, B. Dupré: A new model of rock weathering: design and validation on a small granitic catchment
181. *A. Gaudin, Y. Noack, A. Decarreau, S. Petit: Characteristics of smectites from nickeliferous laterite in Australia
182. *M.E. Hodson: Surface area vs mass - which is most important during mineral weathering in soils?
183. *Jill Betts, D.E. Grandstaff: Glauconite dissolution rates and the chemical evolution of vadose waters in the Hornerstown Formation, Hornerstown, New Jersey

Groundwater environments

184. T. Bahaj, M. El Wartiti, M. Zaharaoui, R. Caboi, R. Cidu: Shallow groundwater in the Sebou basin (Northern Morocco)
185. A.H. Bath: Pore waters in Mesozoic mudrocks in southern England
186. M. Battaglia, P. Bonfanti: Groundwater in the urban area of Catania (Sicily, Italy). Geochemical features and human-induced alterations
187. E. Bedbur, M. Petersen, H. Biallas, U. Wollschlager, S. Schmidt: Chemical evolution of ground waters in W-Iceland (Snaefellsnes)
188. R. Caboi, A. Cristini, M. Collu, F. Podda, L. Rundeddu: Hydrogeochemistry in the Flumendosa river basin (Sardinia, Italy)
189. Hyo-Taek Chon, Sung Young Oh: Hydrogeochemical characteristics of surface water and groundwater in areas underlain by black shales and slates of the Okchon zone, Korea
190. J.V. Cruz, Z.M. França: Groundwater composition of perched-water bodies at Azores volcanic islands
191. W. D'Alessandro, C. Federico, A. Aiuppa, M. Longo, F. Parello, P. Allard, P. Jean-Baptiste: Groundwater circulation at Mt. Etna: evidences from ^{18}O , ^2H and ^3H contents
192. G. Desiderio, S. Rusi, T. Nanni, P. Vivalda: The mineralised springs of the Marche and Abruzzi foredeep, central Italy: hydrochemical and tectonics features
193. A.A. El-Fiky, M.N. Shaaban, M.A. Rashed: Water/rock interaction in a karstified limestone sequence, south Galala, Gulf of Suez, Egypt
194. F. Frondini, G. Marchetti, A. Martinelli, L. Peruzzi, R. Crea: Monitoring of groundwater quality in Umbria (Central Italy)
195. F. Frondini, A. Zanzari, S. Giaquinto: Salt water intrusion in the Pisa coastal plain (central Italy)

196. E. Giménez Forcada, A. Bencini, G. Pranzini: Salinization in coastal plain of Grosseto: hydrochemical study
197. Gunnarson, S. Arnórsson, S. Jakobsson: Magnesium concentration control in groundwaters in Iceland
198. A.R. Hoch, M.M. Reddy: Water chemistry at Snowshoe Mountain, Colorado: mixed processes in a common bedrock
199. J. Jankowski, W. McLean: Origin of sodium-bicarbonate waters in the south-eastern part of the Great Artesian Basin: Influx of magmatic CO₂
200. Thomas G. Kretzschmar, Dirk Schulze-Makuch, Ignacio S. Torres-Alvarado: Chemical evolution of groundwater in the Tularosa Basin in Southern New Mexico, USA
201. Yilian Li, Yanxin Wang: Hydrogeochemical evolution of karst water system: A case study at Niangziguan Springs, northern China
202. Andrew J. Love, Andrew L. Herczeg: Exchange of solutes between primary and secondary porosity in a fractured rock aquifer induced by a change in land-use
203. W. McLean, J. Jankowski, N. Lavitt: The origin of Na-HCO₃ type groundwater in an eastern section of the Lower Namoi River catchment, New South Wales, Australia
204. J.P. Novel, G.M. Zuppi, M. Dray, S. Fudral, G. Nicoud, P. Lacombe: Mineralised waters and deep circulations in the French-Italian Alps
205. Monica Proto, Costanzo Panichi, Paola Zuddas, Francesca Podda: Water-rock interaction processes in the main thermal springs of Sardinia (Italy)
206. I.P. Swane, T.R. Weaver, C.R. Lawrence, I. Cartwright: Hydrologic controls on groundwater salinisation, Murray Basin, Australia
207. L. Toscani, G. Venturelli: Sulfide-free and sulfide-bearing waters in the Northern Apennines, Italy
208. S. Tweed, T.R. Weaver, G.P. Masur, I. Cartwright: Elevation, landuse and water-rock interaction effects on groundwater quality
209. E. Vilanova, J. Mas-Pla: Hydrochemical patterns of the Gavarres hydrological system and its surrounding aquifers (NE Spain).
210. *K. Becker, W. Ali, H. Hoetzi: Study on water quality in the area of Wadi Shueib, Jordan Valley, Jordan
211. *H. Çoban, *. Caran, M. Görmü: Origin of fluorine within the Afyon-Isparta volcanic district, SW Turkey: Is fluormica the key ?
212. *A.R. EL-Naqa, K.M. Ibrahim: Hydrogeochemical characteristics of Hummar aquifer in Amman-Zarqa basin, Jordan
213. *Ingrid Stober, Yinian Zhu, Kurt Bucher: Water-rock reactions in a deep barite – fluorite underground mine, Black Forest, Germany
214. *N.M. Howes, C. Le Gal La Salle, A.L. Herczeg: Evidence for brine circulation in a groundwater discharge zone
215. *Le Gal La Salle, J. Vanderzalm, J. Hutson, P. Dillon, P. Pavelic, R. Martin: Investigation of the carbonate system in Aquifer Storage and Recovery: an isotopic approach

Thursday 14
11.00–12.40

Trace element mobility

1. A. Aiuppa, F. Grassa, R. Favara, S. Inguaggiato: Geochemical survey of the occurrence of trace metals in thermal groundwaters from Sicily (Southern Italy)
2. A. Aiuppa, M. Valenza, W. D'Alessandro, C. Federico: The abundance and speciation of arsenic in groundwaters from volcanic areas: data from Etna, Vesuvius and Vulcano Island (Italy)
3. Riccardo Biddau, Rosa Cidu, Franco Frau: Rare earth elements geochemistry in waters from granodiorites of Central Sardinia, Italy
4. V.A. Chudaeva, O.V. Chudaev, K. Sugimory, B. Tokano, M. Matsuo, A. Kuno, M.W. Edmunds, P. Shand, W.C. Ispfording: Distribution of the trace elements in the surface waters of Primorye, Russia
5. A.S. Lapukhov, V.A. Simonov, R.D. Melnikova, L.K. Pavlova: The influence of volatile components on the distribution of noble metals in rocks from the Mid-Atlantic Ridge
6. G.G. Likhoidov, L.P. Plyusnina: Effect of Mn-oxide transformations on gold and platinum solubility at 200-300°C
7. B. Madé, E. Ledoux, I. Gurban: Reactive transport modelling of uranium around a natural nuclear reactor at Bangombé (Oklo, Gabon)
8. H.B. Nicolli, A. Tineo, J.W. García, C.M. Falcón, M.H. Merino: Trace-element quality problems in groundwater from Tucumán, Argentina
9. A.M. Shiller, Z. Chen, R. Hannigan: A time series of dissolved rare earth elements in the lower Mississippi River
10. M. Svetina, S. Pirc: A field study of cadmium mobility in three different soil types
11. G.M. Valentino, D. Stanzione: Lead distribution in the thermal waters of the Campi Flegrei (Naples, Italy)
12. *A. Lima, L. Daniele, B. DeVivo, A. Sava: Minor and trace elements investigation on thermal groundwaters of Ischia Island (Southern Italy)

Pollution and remediation: general issues

13. L. Aquilina, O. Bour, K. Plaines, G. Gruau, A. Dia, J.C. Clément, G. Pinay: Evaluation of the role of a wetland (Pleine-Fougères, Brittany-France) in the control of the nitrate fluxes through a coupled hydrogeologic and hydrochemical approach
14. M. Barbaferri: Heavy metal chemical species in soil in relation to plant uptake for phytoremediation strategies
15. C. Dadea, L. Fanfani, T. J. Keegan, M. Farago, I. Thornton: Sequential extraction in stream sediments from the Loa basin (Northern Chile)
16. M. Dall'Aglia, G. Giuliano, et al.: I) Assessing drinking water quality in Northern Latium by trace elements analysis. II) Drinking water quality in the Grosseto province (Tuscany, Italy).
17. D. Fabian, Z. Zheng, B. Wehrli, G. Friedl: Establishing a mass balance for fluxes of arsenic and antimony in Baldeggersee, a eutrophic lake in central Switzerland
18. Anna Gann: Vertical distribution of C, Pb, Zn, Cu, Ni, Mn, Fe and P in roadside soils, Caracas, Venezuela
19. S. Grassi, R. Netti: Mercury pollution of coastal aquifers in southern Tuscany (Central-Italy)
20. S.M. Grillo, A. Marcello, D. Pinna, S. Pretti, M. Fiori: Heavy metal pollution of natural origin in the Rio Norizzi basin (Southwestern Sardinia, Italy). The As aspect
21. A. Knappe, B. Fritz, A. Pekdeger, P. Möller, P. Dulski, H.-W. Hubberten: Using the REE gadolinium as a new tracer for sewage influence in aqueous urban systems
22. A. Mazzella: Windows manager for Sardinian geochemical data

23. Elisa Sacchi, Cristina Riva Roveda, Aurelio Facchinelli, Albino Defilippi, Mauro Magnoni, Enrico Allais: Geochemical and mineralogical evidence of the recent trophic evolution of a small peri-alpine lake (Lake Sirio, Ivrea, Northern Italy)
24. N. Saddiki, M. El Wartiti, M. Zaharaoui, R. Caboi, R.Cidu: Anthropogenic impact on the quality of surface waters in the Fès-Meknès plateau (Morocco)
25. D.S. Sheppard: The effects of hydrocarbon spills on the chemical environment in Antarctic soils
26. B. Spiro, D.P.F. Darbyshire, B. Smith, A.J. Ferguson, N. Antich, R. Nuñez: Isotope study of the origin and distribution of sulphate in waters from the Worcester Basin, UK
27. P. Tuccimei, M.C. Delitala, A. Taddeucci, R. Salzano, M. Soligo: Lead contamination in soils and sediments from Villa Pamphili (Rome, Italy)
28. Yanxin Wang: A continuous flow-through system using marble to remove cadmium(II) from waters
29. *C. Bini, L. Zilocchi: Fate of trace elements in the pedosphere: Venetian Territory, Italy
30. *B. De Vivo, M. Boni, A. Lima, A. Marcello, S. Pretti: Environmental geochemical atlas of southern Sardinia
31. *A.M. Jacobs: The significance of cyclic vinyl chloride fluctuations in a ground-water cleanup strategy, Maryland, USA
32. *Leonardo Romero, Hugo Alonso, Sergio Espinoza, Patricio Campano, Luca Fanfani, Rosa Cidu, Mario Lorrai, Luis Lopez, Raul E. Ferreyra: Arsenic and boron contamination in the Loa basin (northern Chile)

Pollution and remediation: mining environments

33. C. Arda, F. Frau, C. Dadea, P. Lattanzi, J. Mattusch, R. Wennrich, K. Titze: Solid-state speciation of arsenic in waste materials and stream sediments from the abandoned mine area of Baccu Locci (Sardinia, Italy)
34. Riccardo Biddau, Luca Fanfani, Pierfranco Lattanzi, Paola Zuddas: Acid mine drainage prediction by acid-base accounting tests in abandoned mine tailings from Sardinia
35. I.G. Carvalho, H.M.Perin, H.Pitsch, C.Beaucaire, L. Fanfani, R. Cidu, M. Lorrai, R.E.Ferreyra, L.E.Lopez, P. Zuddas: Hydrogeochemistry in the U-District of Lagoa Real, Brazil
36. G. Cortecchi, E. Dinelli, F. Lucchini, O. Vaselli: Hydrogeochemical and isotopic investigations in the abandoned Fe-Cu mine of Libiola (northern Italy)
37. S. Da Pelo, F. Frau, C. Arda, L. Rundeddu, P. Lattanzi: Water chemistry at the Montevecchio Levante mine tailings impoundment (Sardinia-Italy)
38. I. Denut, I.Bud, I. Pop: Cyanide groundwater pollution after the "AURUL" tailing pond accident
39. A. Di Gregorio, G. Lecca, P. Madau, G. Piras, W. Cuccu: Heavy metal pollution in Genna Luas mine site (South-Western Sardinia)
40. J.P. Duyanen, M. Wiesner: Historical geochemical profiles of Sonne 140 cores from Lingayen Gulf, The Philippines: Some imprints of mine wastes from the past
41. A.A. Fedotova, D.J. Bessonov, S.B. Bortnikova, V.G.Tsimbalist: Transformation of sulfide minerals and metal speciation in sulfide tailings
42. R.E. Ferreyra, L.E. López, G.C. Tomellini, J.G. Marrero, A.F. Benítez, H.O. Nievas, R. Bianchi, L. Fanfani, R. Cidu, M. Lorrai, H. Pitsch, C. Beaucaire, P. Zuddas: Hydrogeochemistry in the U-district of Cerro Solo (Chubut, Argentina)
43. O.L. Gaskova, E.P. Bortnikova: Experimental modeling of trace element leaching from As-bearing tailings impoundments
44. P. Gómez, A. Garralón, M.J. Turrero: Redox modelling of the waters in a restored uranium mine in Spain

45. Jin-Soo Lee, Hyo-Taek Chon, Ben Klinck, Yvette Moore: Hydrogeochemical characteristics of acid mine drainage along the Daduk creek in the vicinity of the abandoned metal mine, Korea
46. W. Ian Ridley, Byron R. Berger, Philip J. Aruscavage, Frederick E. Lichte: Environmental consequences of the distribution of trace metals in primary and secondary phases from skarn and vein deposits in the Patagonia Mountains, Arizona
47. N.V. Sidenko, E.V. Lazareva, Y.P. Kolmogorov: Noprecipitation of As, Zn, Cu and Pb into secondary iron minerals from sulfide wastes of Berikul mine (Russia)
48. Zhang Jianli, Pan Mao, Yu Yunbo, Liu Fei, Shen Zhaoli, Tang Minggao, Zhong Zuoshen: Water-rock interaction of mine drainage along channel of Zibo coal mine, China
49. *I.M.H.R. Antunes, A.M.R. Neiva, M.M.V.G. Silva: The mining impact on the environment at Segura, Central Portugal
50. *I. Mascaro, M. Benvenuti, F. Corsini, P. Costagliola, S. Lascialfari, O. Vaselli, G. Tanelli, C. Bini, C. Gonnelli, R. Gabbrielli, P. Lattanzi: Heavy metal pollution of soils and plants at the Bottino Pb (Ag)-Zn mine, Tuscany (Italy)
51. *M.M.S.C. Pinto, M.M.V.G. Silva, A.M.R. Neiva: Uranium mineralization and water contamination in Central Portugal

Waste storage and disposal

52. M. Adler, U.K. Mäder, H.N. Waber: Core infiltration experiment investigating high-pH alteration of low-permeability argillaceous rock at 30°C
53. David Arcos, Jordi Bruno, Javier Peña, M^a Jesús Turrero, Ana María Fernández: 1D reactive transport model for the Opalinus Clay at Mont Terri underground laboratory
54. C. Beaucaire, H. Pitsch, P. De Cannière, L. Noynaert: Effects of irradiation and heating on Boom clay: geochemical implications
55. L. De Windt, J. Van der Lee, D. Pellegrini: Reactive transport modeling of pH controlling processes in cement/clay systems
56. A.M. Fernández, M. J. Turrero, P. Rivas: Analysis of squeezed pore water as a function of the applied pressure in Opalinus Clay material (Switzerland)
57. H. Gaboriau, A. Seron, A. Saada, F. Villiéras, L. Griffault: Characterization and distribution of porewater in low permeable clayey formations: contribution of physical methods
58. R. Klein, T. Baumann, R. Niessner: Temperature Development in a modern MSWI bottom ash landfill
59. A.E. Milodowski, E.K. Hyslop, H.N. Khoury, C.R. Hughes, U. Mäder, L.Y. Griffault, L. Trotignon: Mineralogical alteration by hyperalkaline groundwater in northern Jordan
60. Javier Peña, M^a Jesús Turrero, Ana M^a Fernández, David Arcos: Geochemical modelling of processes inside a packed-off interval in the Opalinus Clay formation (Switzerland, Mont Terri Project): a kinetic approach
61. F. Rassineux, L.Y. Griffault, J.A.T. Smellie, L. Trotignon, J. Raynal, H. Khoury, F. Mercier: Mineralogical evolution of clay-bearing rock during alkaline alteration (Khushaym Matruk, Central Jordan)
62. André Rübel, Christian Sonntag: Profiles of noble gases and stable isotopes across the Opalinus Clay formation at Mont Terri, Switzerland
63. S. Sammartino, A. Bouchet, P. Sardini, A. Meunier, E. Tevissen, M. Siitari-Kauppi: An image processing and physical study of the porosity distribution heterogeneity in a fine grained argillite rock.: Application to long term radionuclide migration

64. D. Savage, C. Rochelle, Y. Moore, D. Noy, A. Milodowski, K. Bateman, D. Bailey, M. Mihara: Experimental and modelling studies to assess cement-bentonite interaction
65. S. Savoye, L. De Windt, C. Beaucaire, G. Bruno, N. Guitard: Are artificial tracers conservative in argillaceous media? The Tournemire claystone case
66. M. Siitari-Kauppi, J. Autio: Study of rock damage caused by drill and blast excavation at the Research Tunnel at Olkiluoto
67. J.A.T. Smellie, W.R. Alexander, P. Degnan, L. Griffault, U.K. Mäder, L. Trotignon: The role of the Jordan natural analogue studies in the performance assessment of cementitious repositories for radioactive wastes
68. *J.S. Cline, N.S.F. Wilson: Paragenesis of secondary mineralization at Yucca Mountain, Nevada, USA
69. *V. Ettler, P. Piantone, J.C. Touray: Metallurgical slag/water interaction: experimental approach, thermodynamic modeling and long-term assessment
70. *E.C. Gaucher, A.Cailleau, L. Griffault: Specific determination of ion exchange constants: the Opalinus Clay example
71. *Wenbin Zhou, Zhanshi Zhang: Geochemical behavior of Beishan granite in a negative temperature gradient

Biogeochemical processes and organic complexation

72. V.S. Arzhanova, T.N. Lutsenko: Dissolved organic carbon and metals in soils of Sikhote-Aline (Russia)
73. M.M.A. Cedeno, D.T.S. Tosiani: Adsorption of natural humic acid and analog compounds onto goethite
74. V.P. Elpatyevskaya: Biogeochemistry of Ca in temperate mixed hardwoods in the Russian Far East
75. A.R. Geptner, H. Kristmannsdottir: Biogeochemical precipitation of layer silicates in hydrothermal environments
76. Kurt O. Konhauser, Vernon R. Phoenix, Liane G. Benning: How do microorganisms silicify?
77. Katherine Malatt, Gabriella Zonnedda: Pyrite biooxidation-trial heaps at Sardinia Gold Mining, Furtei, Italy
78. *Motoharu Kawano, Katsutoshi Tomita: Bacterial formation of silicate minerals in the weathering environments

Friday 15
11.00–12.40

Sedimentary basins

1. J. De Waele, P. Forti, G. Perna: Hyperkarstic phenomena in the Iglesias mining district (SW-Sardinia)
2. J. Schneider, T. Bechstädt, S. Zeeh, M. Joachimski: Fluid flow in the Cantabrian Zone (NW-Spain)-contributions to the diagenetic evolution
3. C.J. Schubert, T.G. Ferdelman, B.B. Jørgensen, G. Klockgether: Sulfate reduction rates and organic matter composition in sediments of Namibia
4. *A.M. Karpoff, S.M. Bernasconi, C. Destigneville, P. Stille: Diagenetic zeolite and clay minerals in Miocene Great Bahama Bank carbonate sediments (ODP Leg 166, Site 1007)

5. *G. Lecca, R. Deidda, G. Gambolati: Numerical study of the coupling effect between fluid diffusion and medium deformation for subsidence calculation over deep reservoirs
6. *J. Shah, R. Hesse, S. Islam: Origin of Ordovician organogenic dolomite concretions: Significance for the $\delta^{18}\text{O}$ of Lower Paleozoic SMOW
7. *S. Shata, R. Hesse: Illite crystallinity and expandability: XRD and HRTEM studies of Gaspé Peninsula mudstones and slates

Magmatic, metamorphic and minerogenetic processes

8. A.V. Artamonov, V.B. Kurnosov, B.P. Zolotarev: Petrology and alteration of basalts from the intraplate rises, Indian Ocean
9. I.S. Buick, D. Close, I. Scrimgeour, C. Edgoose, J. Miller, C. Harris, I. Cartwright: High-pressure melting and fluid flow during the Petermann Orogeny, central Australia.
10. P. Cappelletti, G. Cerri, M. de'Gennaro, A. Langella, S. Naitza, G. Padalino, R. Rizzo, M. Palomba: Natural zeolites from Cenozoic pyroclastic flows of Sardinia (Italy): evidence of different minerogenetic processes
11. A.M. Caredda, G. Cruciani, M. Franceschelli, G. Carcangiu: Amphibole evolution in ultramafic amphibolites from NE Sardinia, Italy
12. R. Cioni, G. Macciotta, M. Marchi, G. Padalino, R. Simeone, M. Palomba: Water-rock interaction in genesis of perlite at Monte Arci volcanic complex (West Sardinia, Italy)
13. Yu. Fomin, He. Lasarenko, Yu. Demikhov, Vl. Blazhko: Gold ore-system in Arhcean greenstone structures of Middle-Dniper Area (Ukrainian Shield).
14. Regina Freiburger, Marie-Christine Boiron, Michel Cathelineau, Michel Cuney: Late Hercynian fluid circulation in the Charroux-Civray plutonic complex, NW Massif Central, France
15. M.R.Ghiara, C. Petti, R. Lonis: Experimental study on clinoptilolite and mordenite crystallization
16. D. Ishiyama, K. Hirose, T. Mizuta, O. Matsubaya, Y. Ishikawa: The characteristics and genesis of the kaolinite-bearing gold-rich Nurukawa Kuroko deposit, Aomori Prefecture, Japan
17. V.B. Kurnosov, B.P. Zolotarev, A.V. Artamonov: Sea water-basalt interaction in the Kerguelen Plateau, Indian Ocean
18. P. Mameli: Occurrence of halite in kaolin of NW Sardinia: genetic implications
19. V.S. Melnikov: Interaction of twinning structure of the feldspars with water fluid – the most significant geological process in the Earth's crust
20. Nevzat Özgür: Fossil geothermal systems in the continental rift zone of the Küçük Menderes within the Menderes Massif, Western Anatolia, Turkey
21. J. Rayner, D. Manis: Gold in Sardinia: recent development in exploration and exploitation
22. S. Salvi, B. Tagirov, B. Moine: Hydrothermal mineralization of Zr and other "immobile elements": field evidence and experimental constraints
23. N.A. Tchepkaia, Z.A. Kotelnikova: Interaction of fluid inclusions with dislocations in quartz
24. *Y.J. Chen, Y.H. Sui, X.L. Gao: Fluid geochemistry of Tieluping Ag ore and its implications for the CPMF model
25. *Renmin Hua, Xiaofeng Li, Jianjun Lu, Peirong Chen, Xiadong Liu: Ore fluid of late Mesozoic porphyry-epithermal gold-copper system in East China
26. *Hiroshi Shigeno: Time-depth-temperature relations for igneous, metamorphic and hydrothermal processes: Visualized through simplified-model numerical simulations
27. *Shimizu T., A. Aoki: Overprinted Cenozoic hydrothermal activities at the Toyoha Ag-Pb-Zn deposit, Japan

28. *Sun Zhanxue, Liu Jinhui, Li Xueli, Shi Weijun: Natural decay series studies of the Kujiertai uranium deposit, NW-China
29. *N. Takeno, H. Muraoka, T. Sawaki, M. Sasaki: Thermodynamic framework of the contact metamorphism around the Kakkonda granite in a active geothermal field, northeast Japan

Volcanic and geothermal processes

30. E.P. Bortnikova, O.L. Gaskova: Physical-chemical modeling of recent gas-hydrothermal andesite transformation
31. M.L. Carapezza, S. Inguaggiato: Interaction between thermal waters and CO₂-rich fluids at Stromboli volcano (Italy)
32. G. Cortecchi, T. Boschetti: Geochemical model of the phreatic system of Vulcano (Aeolian Islands, Italy)
33. C.E.J. De Ronde, B.W. Davy, R.T. Smith, D.K.H. Immenga, J.A. Baxter: Detailed swath mapping survey of a submarine geothermal system, Lake Taupo, New Zealand
34. R. Favara, S. Giammanco, S. Inguaggiato, G. Pecoraino, M. Ottaviani, L. Minelli, E. Veschetti: Preliminary geochemical study on the concentration of major and trace elements in the geothermal aquifer of Pantelleria Island, Italy
35. R. Favara, F. Grassa, P. Madonia, M. Valenza: Geochemical processes governing changes in the chemistry of some thermal and cold springs in Central Sicily, Italy.
36. R. Favara, S. Inguaggiato: Chemical and isotopic characterization of volcanic gas manifestations at Java Island and comparison with Mediterranean volcanic areas
37. Favara R., S. Inguaggiato, G. Pecoraino: Major, minor and trace elements in thermal groundwaters of Ischia Island
38. J.V. Frolova, V.M. Ladygin, S.N. Rychagov: The peculiarities of effusives leaching under the action of acid thermal water
39. U. Gemici, G. Tarcan: Hydrogeochemistry of the Saraycik geothermal area (Manisa) western Turkey
40. F. Gherardi, C. Panichi: Chemical and isotope composition of light hydrocarbons gases in hydrothermal systems: preliminary results from three Italian thermal areas
41. S. Gurrieri, C. Federico A. Aiuppa, M. Valenza: Thermodynamic constraints on WRI processes at Mt Vesuvius, Southern Italy
42. V. Harðardóttir, H. Kristmannsdóttir, H. Ármannsson: Scale formation in wells RN-9 and RN-8 in the Reykjanes geothermal field Iceland
43. Salvatore Inguaggiato, Giorgio Capasso, Rocco Favara, Ana Lillian Martin-Del Pozzo, Alexandra Aguayo: Water-rock interaction processes at Popocatepetl volcano, Mexico
44. F. Italiano, R. Favara, G. Etiope, P. Favali: Submarine emissions of greenhouse gases from hydrothermal and sedimentary areas
45. H. Kristmannsdóttir, V.T. Marteinsson, V. Hardardóttir: Aluminium silicate scales – Experience from geothermal development in Iceland
46. M. Lustrino: Volcanic activity in the western Mediterranean during the last 30 Ma
47. Nuccio, A. Paonita: Isotope mixing between magmatic and hydrothermal gases for assessment of H₂O origin at Vulcano Island (Italy)
48. M. Pennisi, G. Magro, A. Adorni-Braccesi, G. Scandiffio: Boron and helium isotopes in geothermal fluids from Larderello (Italy)
49. B. Sanjuan, M. Brach, E. Lasne: Bouillante geothermal fluid: mixing and water/rock interaction processes at 250°C

50. Mike Sorey, William Evans, Robert G. McGimsey, Cindy Werner: Magmatic carbon and helium discharge from Shrub mud volcano, Copper River basin, southeastern Alaska, USA
51. I.B. Slonovskiy: Rock alteration at the Mutnovsky hydrothermal system, Kamchatka, Russia
52. Sturz, S.C. Gray, K. Dykes: Hydrothermal discharge to coastal ocean waters at Deception Island, Antarctica
53. G. Tarcan, U. Gemici: Hydrogeochemistry of the Gumuskoy and Sazlikoy Geothermal Fields, Aydin, Turkey
54. M.L.G. Tejada, J.J. Mahoney, Y. Tatsumi, W.W. Sager: Water-rock interaction in dredged lavas from Shatsky Rise, Pacific Ocean
55. Jens Tómasson: The secondary mineralogy of the Reykir geothermal system in Iceland
56. *G.O. Fridleifsson, W. A. Elders, S. Saito: Drilling into supercritical fluid in Iceland (IDDP project)
57. *J. Hara, A. Inoue, N. Tsuchiya: Mineralogical alteration zoning in active geothermal systems of the Hachimantai volcanic region, northeast Japan
58. *J.-L. Hoareau, L. Bret, B. Robineau, E. Nicolini: Is neogenic chlorite responsible for the conductive basement in shield volcanoes of Reunion Island? A chemical modelling approach.
59. *O. Matsubaya, K. Kobayashi, H. Kawaraya: Water-rock interaction of SO_4 and HCO_3 -type geothermal waters in the same area
60. *F. May: CO_2 flux in a dormant intraplate volcanic field: the Westeifel, Germany
61. *T. Ohba: Hydrothermal system of Kusatsu-Shirane Volcano, Japan
62. *E. Portugal, G. Izquierdo, R.M. Barragan, P. Birkle: Isotopy of fluids from Los Humeros system (Mexico)

Stable and radiogenic isotopes in WRI studies

63. R.A. Ayuso, E. Callender, P.C. Van Metre: Pb isotopes of lake sediments and effects of human activities on water quality
64. Baciú, C. Cosma, D. Ristoiu: Radon content in groundwaters in Transylvania and surrounding areas (Romania)
65. D.M. Bonotto: Dissolved radioelements in (oil) water wells in Paraná basin, Brazil
66. G. Capasso, W. D'Alessandro, R. Favara, S. Inguaggiato, F. Parello: Kinetic isotope fractionation of CO_2 carbon due to diffusion processes through the soil
67. J. Casanova, Ph. Négrel, J. Bruhlet: Tracing oxic intrusions in Jurassic deposits from the Bure site, Meuse (France)
68. G. Cortecci, E. Dinelli, M. Mussi: Environmental isotope geochemistry of precipitation at Bologna, Italy
69. Mariusz O. Jedrysek, Anita Weber-Weller, Anna Szykiewicz, Sonja Lojen: Oceanic and continental alteration in two ophiolites: stable isotope record
70. B.E. Lehmann, H.H. Loosli, R. Purtschert, I. Tolstikhin, A. Gautschi, R. Kipfer, W. Aeschbach-Hertig: Helium in a 1000 m-borehole: Isotope analyses on sedimentary rocks and related pore- and groundwaters
71. Li Xueli, Sun Zhanxue, Shi Weijun, Liu Jinhui: Isotope geochemistry of natural waters in the northern part of the Zhungeer Basin, NW-China
72. S.P. Loheide II, D.L. Cannon, N.C. Krothe: Delineating groundwater flow paths using stable isotopes
73. V.B. Maglambayan, D. Ishiyama, T. Mizuta, Y. Ishikawa, O. Matsubaya: Oxygen and carbon isotope study of calcite and dolomite in the disseminated gold-silver telluride Bulawan deposit, Negros island, Philippines

74. J.M. Marques, L. Aires-Barros, R.C. Graça, M.J. Matias, M.J. Basto: Mineral/fluid reactions associated with a low-temperature geothermal system (N-Portugal)
75. Ph. Négrel, J. Casanova, W. Kloppmann, J.F. Aranyosy: Investigating water-rock interaction in the Vienne crystalline basement (France)
76. V.P. Samodurov: Tritium water – rock interactions
77. Philip L. Verplanck, D.Kirk Nordstrom, G.Lang Farmer, Daniel M. Unruh, David L. Fey: Sr isotopic investigation to determine ground water flow paths, Silverton, Colorado
78. W. Ye, S. Yabuki, S. Kanayama, M. Honda, Q. Chang: Geochemical characteristics of loess and paleosols in Yili Basin, NW China
79. *H. Kwaraya, O. Matsubaya Stable isotopic study on infiltration and evaporation at soil water zone