Scientific Leadership

The research highlights presented in this circular represent examples of the type of inter-disciplinary research conducted by NRP scientists to help the USGS and the U.S. Department of the Interior meet their goals in serving the public. In addition to conducting research, scientists in the NRP provide leadership and service such as (1) teaching of formal training courses, (2) participating in technology transfer, (3) consulting on USGS District (State) projects, (4) participating in reviews of USGS programs, (5) participating in the development of new programs, and (6) serving as scientific advisors for local, State, and other Federal agencies, and for the public. Scientific expertise is provided to the national and international scientific community as well, through service on technical panels and committees and participation in activities of professional societies. The focus of the NRP is to conduct research directed toward developing fundamental process knowledge, new models or methods, to resolve difficult hydrologic questions, and to provide service to the USGS and the at-large scientific community.





Concluding Remarks

Research in the hydrologic sciences will continue to be important to the Nation. There will always be floods, droughts, depletion of resources, new water-quality issues, and the need for better assessments. Water shortages can arise from climate change, distribution problems, depletion of resources and/or water-quality constraints. Increasing population, shifting centers of population, and new industrial and agricultural practices will stress the Nation's water-supply systems even more in the future. At the same time, demands are increasing to reserve or allocate more water for environmental protection and restoration. Water quality is a major concern. Specifically, contamination of water supplies is a continuing threat to the health and safety of the public and the environment. New chemical products are continually being introduced to the

environment, and their fate and transport through environmental pathways, as well as their health risks, are often unanticipated by manufacturers, users, and regulators. Pathogens are an increasing concern in drinking-water supplies. Optimal and safe use of the Nation's limited surface and subsurface freshwater resources will require continued monitoring, development of increased understanding of hydrologic processes, and improved predictive tools. NRP scientists, in cooperation with scientists in other parts of the USGS, other Federal and State Agencies, and Universities, will continue to strive to conduct the innovative research and development needed to help the Nation live successfully within the limits imposed by human and natural constraints on the hydrologic environment.

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Selected References

Sustained Progress in Estuarine Studies—San Francisco Bay

Brown, C.L., and Luoma, S.N., 1995, Use of the euryhaline bivalve *Potamocorbula amurensis* as a biosentinel species to assess trace metal contamination in San Francisco Bay: Marine Ecology Progress Series, v. 124, p. 129-142.

Cheng, R.T., Casulli, Vincenzo, and Gartner, J.W., 1993, Tidal residual, intertidal mudflat (TRIM) model and its applications to San Francisco Bay, California: Estuarine, Coastal and Shelf Science, v. 36, p. 235–280.

Cloern, J.E., 1996, Phytoplankton bloom dynamics in coastal ecosystems: A review with some general lessons from sustained investigation of San Francisco Bay, California: Reviews of Geophysics, v. 34, p. 127–168.

Hornberger, M.I., Luoma, S.N., Van Green, A., Fuller, C., and Anima, R., 1999, Historical trends of metals in the sediments of San Francisco Bay, California: Marine Chemistry, v. 64, p. 39–55.

Kuwabara, J.S., Nichols, F.H., Kuivila, K.M., DiLeo, J.S., 1999, Understanding the human influence on the San Francisco Bay-Delta Estuary Ecosystem—The Toxic Substances Hydrology Program and USGS Place-based Studies Program provide complementary approaches and results, *in* Morganwalp, D.W., and Buxton, H.T., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings: Contamination of Hydrologic Systems and Related Ecosystems: U.S. Geological Survey Water-Resources Investigations Report 99-41018B, v. 2, p. 109–113.

Use of Environmental Tracers to Track Nitrate Contamination

Bohlke, J.K., and Denver, J.M., 1995, Combined use of ground-water dating, chemical, and isotopic analyses to resolve the history and fate of ground-water nitrate contamination in two agricultural watersheds, Atlantic Coastal Plain, Maryland: Water Resources Research, v. 31, p. 2319–2339.

Dunkle, S.A., Plummer, L.N., Busenberg, E., Phillips, P.J., Denver, J.M., Hamilton, P.A., Michel, R.L. and Coplen, T.B., 1993, Chlorofluorocarbons (CC1₃ F and CC1₂F₂) as dating tools and hydrologic tracers in shallow groundwater of the Delmarva Peninsula, Atlantic Coastal Plain, United States: Water Resources Research, v. 29, p. 3837–3860.

Kendall, C., 1998, Tracing nitrogen sources and cycling in catchments, *in* Kendall, C., and Mc-Donnell, J.J., eds., Isotope Tracers in Catchment Hydrology: Amsterdam, Elsevier, p. 519–576.

McMahon, P.B., and Bohlke, J.K., 1996, Denitrification and mixing in a stream-aquifer system: effects on nitrate loading to surface water: Journal of Hydrology, v. 186, p. 105–128.

Plummer, L.N. and Busenberg E., 2000, Chlorofluorocarbons, *in* Cook, P. and Herczeg, A, eds., Environmental Tracers in Subsurface Hydrology: Kluwer Academic, Boston, Chap. 15, p. 441–478.

Smith, R.L., Garabedian, S.P., and Brooks, M.H., 1996, Comparison of denitrification activity measurements in groundwater using cores and natural-gradient tracer tests: Environmental Science and Technology, v. 30, no. 12, p. 3448–3456.

Ground-Water Movement in Fractured Rock

Hsieh, P.A. and Shapiro, A.M., 1994, Hydraulic characteristics of fractured bedrock underlying the FSE well field at the Mirror Lake Site, Grafton County, New Hampshire, *in* Morganwalp, D.W., and Aronson, D.A., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings: U.S. Geological Survey Water-Resources Investigations Report 94-4015, v. 1, p. 127–130.

Shapiro, A.M., 1996, Estimation of effective porosity in fractured crystalline rock by controlled tracer tests, in Stevens, P.R., and Nicholson, T.J., eds., Joint U.S. Geological Survey,

U.S. Nuclear Regulatory Commission Workshop on Research Related to Low-Level Radioactive Disposal—Proceedings: U.S. Geological Survey Water-Resources Investigations Report 95-4015, p. 185–190.

Tiedeman, C.R., Goode, D.J., and Hsieh, P.A., 1997, Numerical simulation of ground-water flow through glacial deposits and crystalline bedrock in the Mirror Lake area, Grafton County, New Hampshire: U.S. Geological Survey Professional Paper 1572, 50p.

Wright, D.L., Olhoeft, G.R., Hsieh, P.A., Majer, E.L., Paillet, F.P. and Lane, J.W., 1994, Electromagnetic and seismic tomography compared to borehole acoustic televiewer and flowmeter logs for subsurface fracture mapping at Mirror Lake site, New Hampshire, *in* Morganwalp, D.W., and Aronson, D.A., eds., U.S. Geological Survey Toxic Substances Hydrology Program—Proceedings: U.S. Geological Survey Water-Resources Investigations Report 94-4015, v. 1, p. 119–126.

Modeling and Experimental Flooding in the Grand Canyon

Webb, R.H., Schmidt, J.C., Marzolf, G.R., and Valdez, R.A., eds., 1999, The Controlled Flood in Grand Canyon Monograph: American Geophysical Union, 367p.

Schmidt, J. C., Webb, R.H., Valdez, R.A., Marzolf, G.R., and Stevens, L.E., 1998, Science and values in river restoration in the Grand Canyon: Bioscience, v. 48, no. 9, p. 735–747.

Collier, M., Webb, R.H., and Schmidt, J.C., 1996, Dams and rivers, A primer on the downstream effects of dams: U.S. Geological Survey Circular 1126, 94p.

Collier, M.P., Webb, R.H., and Andrews, E.D., 1997, Experimental flooding in Grand Canyon: Scientific American, v. 276, no. 1, p. 66–73.

Devils Hole—A Paleoclimate Treasure Chest

Coplen, T.B., Winograd, I.J., Landwehr, J.M., and Riggs, A.C., 1994, 500,000-year stable carbon isotopic record from Devils Hole, Nevada: Science, v. 263, p. 361–365.

Riggs, A.C., Carr, W.J., Kolesar, P.T. and Hoffman, R.J., 1994, Tectonic speleogenesis of Devils Hole, Nevada, and implications for hydrogeology and the development of long continuous paleoenvironmental records: Quaternary Research, v. 42, p. 241–254.

Szabo, B.J., Kolesar, P.T., Riggs, A. C., Winograd, I.J., and Ludwig, K.R., 1994, Paleoclimatic inferences from a 120,000-yr calcite record of water-table fluctuation in Browns Room of Devils Hole, Nevada: Quaternary Research, v. 41, p. 59–69.

Winograd, I.J., Coplen, T.B., Landwehr, J.M., Riggs., A. C., Ludwig, K.R., Szabo, B.J., Kolesar, P.T., and Revesz, K.M., 1992, Continuous 500,000-year climate record from vein calcite in Devils Hole, Nevada: Science, v. 258, p. 255–260.

Winograd, I.J., Landwehr, J.M., Ludwig, K.R., Coplen, T.B., and Riggs, A.C., 1997, Duration and structure of the past four interglaciations: Quaternary Research, v. 48, p. 141–154.

Microbial Activity and Transport in Ground Water

Bekins, B.A., Godsy, E.M., and Warren, E., 1999, Distribution of microbial physiologic types in an aquifer contaminated by crude oil: Microbial Ecology, v. 37, p. 263–275.

Harvey, R.W., 1997, In situ and laboratory methods to study subsurface microbial transport, *in* Hurst, C.J., Knudsen, G.R., McInerney, M.J., Stetzenback, L.D., and Walter, M.V., eds., Manual of Environmental Microbiology: Washington D.C., ASM Press, p. 586–599.

Kinner, N.E., Harvey, R. W., Blakeslee, K., Novarino, G., and Meeker, L.D., 1998, Size-selective predation of groundwater bacteria by nanoflagellates in a organically-contaminated aquifer: Applied and Environmental Microbiology, v. 64, p. 618–625.

Smith, R.L., and Garabedian, S.P., 1998, Using transport model interpretations of tracer tests to study microbial process in groundwater *in* Koch, A.L., Robinson, J.A., and Milliken, G.A., Mathematical modeling in microbial ecology: Chapman and Hall, p. 94–123.

Lake Ecosystem Studies

Anderson, D.E., Striegl, R.G., Stannard, D.I., Michmerhuizen, C.M., McConnaughey, T.A., and LaBaugh, J.W., 1999, Estimating lake-atmosphere CO₂ exchange: Limnology and Oceanography, v. 44, p. 988–1001.

Labaugh, J.W., Winter, T.C., Rosenberry, D.O., Schuster, R.F., Reddy, M.M., and Aiken, G.R., 1998, Hydrological and chemical estimates of the water balance of a closed-basin lake in north-central Minnesota: Water Resources Research, v. 33, no. 12, p. 2799–2812.

Striegl, R.G., and Michmerhuizen, C.M., 1998, Hydrologic influence on methane and carbon dioxide dynamics at two north-central Minnesota lakes: Limnology and Oceanography, v. 43, p. 1519–1529.

Winter, T.C., ed., 1997, Hydrological and biogeochemical research in the Shingobee River headwaters area, north-central Minnesota: U.S. Geological Survey Water Resources Investigations Report 96-4215, 210p.

Selenium: Rocks, Ducks, Microbes, and Membranes

Kharaka, Y.K., Ambats, G., Presser, T.S., and Davis, R.A., 1996, Removal of selenium from contaminated agriculture drainage water by nanofiltration membranes: Applied Geochemistry, v. 11, no. 6, p. 797–802.

Luoma, S.N., Johns, C., Fisher, N.S., Steinberg, N.A., Oremland, R.S. and Reinfelder, J.R., 1992, Determination of selenium bioavailability to a benthic bivalve from particulate and solute pathways: Environmental Science and Technology, v. 26, p. 485–491.

Dowdle, P.R., and Oremland, R.S., 1998, Microbial oxidation of elemental selenium in soil slurries and bacterial cultures: Environmental Science and Technology, v. 32, p. 3749–3755.

Presser, T.S., 1994, Geologic origin and pathways of selenium from the California coast ranges to the West-Central San Joaquin Valley, *in* Frankenberger, W.T., Jr., and Benson, S., eds., Selenium in the Environment: Marcel Dekker, New York, p. 139–155.

Presser, T.S., and Piper, D.Z., 1998, Mass balance approach to selenium cycling through the San Joaquin Valley: From source to river to bay, *in* Frankenburger, W.T., and Engberg, R.A., eds., Environmental Chemistry of Selenium: Marcel Dekker, Inc., New York, p. 153–182.

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