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LARRY K. BENNINGER
DEPARTMENT OF GEOLOGICAL SCIENCES
UNIVERSITY OF NORTH CAROLINA
CHAPEL HILL, NC 27599-3315

Education

Michigan State University, East Lansing, MI; B.A. with High Honor (Chemistry), 1969.

Cambridge University, Cambridge, England; 1969-1970, no degree.

Yale University, New Haven, CT; M. Phil., Geology and Geophysics, 1973.

Yale University, New Haven, CT; Ph.D., Geology and Geophysics, 1976.

Professional Experience

1975-1976	Research Associate, Yale University
1976-1978	Research Associate (Postdoctoral), Yale University
1978-1985	Assistant Professor, Department of Geology, University of North Carolina, Chapel Hill
1985-1993	Associate Professor, Department of Geology, University of North Carolina, Chapel Hill
1993-	Professor, Department of Geology, University of North Carolina, Chapel Hill
2003-2008	Department Chair, Geological Sciences

Academic Honors

Elected to Phi Beta Kappa, 1968

Churchill Scholar, Churchill College, Cambridge University, 1969-1970

Professional Associations

The Geochemical Society

American Geophysical Union

American Association for the Advancement of Science

Registered Geologist, State of North Carolina

Fellow, Carolina Environmental Program

Association for the Sciences of Limnology and Oceanography

Publications---refereed journals

Benninger, L.K. 1978. Pb-210 balance in Long Island Sound. *Geochim. Cosmochim. Acta* 42, 1165-1174.

Benninger, L.K., Aller, R.C., Cochran, J.K. and K.K. Turekian. 1979. Effects of

biological sediment mixing on the lead-210 chronology and trace metal distribution in a Long Island Sound sediment core. *Earth Planet. Sci. Lett.* 43, 241-259.

Von Damm, K.L., Benninger, L.K. and K.K. Turekian. 1979. The lead-210 chronology of a core from Mirror Lake, New Hampshire. *Limnol. Oceanogr.* 24, 434-439.

Benoit, G.J., Turekian, K.K. and L.K. Benninger. 1979. Radiocarbon dating of a core from Long Island Sound. *Estuar. Coastal Mar. Sci.* 9, 171-180.

Aller, R.C., Benninger, L.K. and J.K. Cochran. 1980. Tracking particle-associated processes in nearshore environments by use of $^{234}\text{Th}/^{238}\text{U}$ disequilibrium. *Earth Planet. Sci. Lett.* 47, 161-175.

Krishnaswami, S., Benninger, L.K., Aller, R.C. and K.L. Von Damm. 1980. Atmospherically-derived radionuclides as tracers of sediment mixing and accumulation in nearshore marine and lake sediments: evidence from ^7Be , ^{210}Pb and $^{239,240}\text{Pu}$. *Earth Planet. Sci. Lett.* 47, 307-318.

Benninger, L.K. and S. Krishnaswami. 1981. Sedimentary processes in the inner New York Bight: evidence from excess ^{210}Pb and $^{239,240}\text{Pu}$. *Earth Planet. Sci. Lett.* 53, 158-174.

Aller, R.C. and L.K. Benninger. 1981. Spatial and temporal patterns of dissolved ammonium, manganese, and silica fluxes from bottom sediments of Long Island Sound, U.S.A. *J. Mar. Res.* 39, 295-314.

Li, Y-H., Santschi, P.H., Kaufman, A., Benninger, L.K. and H.W. Feely. 1981. Natural radionuclides in waters of the New York Bight. *Earth Planet. Sci. Lett.* 55, 217-228.

Dodge, R.E., Fairbanks, R.G., Benninger, L.K. and F. Maurasse. 1983. Pleistocene sea levels from raised coral reefs of Haiti. *Science* 219, 1423-1425.

Turekian, K.K., Benninger, L.K. and E.P. Dion. 1983. ^7Be and ^{210}Pb total deposition fluxes at New Haven, Connecticut and at Bermuda. *J. Geophys. Res.* 88, 5411-5415.

Benninger, L.K. and R.E. Dodge. 1986. Fallout plutonium and natural radionuclides in annual bands of the coral *Montastrea annularis*, St. Croix, U.S. Virgin Islands. *Geochim. Cosmochim. Acta* 50, 2785-2797.

Canuel, E.A., Martens, C.S. and L.K. Benninger. 1990. Seasonal variations in beryllium-7 activity in the sediments of Cape Lookout Bight, NC. *Geochim. Cosmochim. Acta* 54, 237-45.

Meece, D.E. and L.K. Benninger. 1993. The coprecipitation of plutonium and other radionuclides with calcium carbonate. *Geochim. Cosmochim. Acta* 57, 1447-1458.

Benninger, L.K. and J.T. Wells. 1993. Sources of sediment to the Neuse River estuary, North Carolina. *Mar. Chem.* *43*, 137-156.

Benninger, L.K., Suayah, I.B. and D.J. Stanley. 1998. Manzala lagoon, Nile delta, Egypt: modern sediment accumulation based on radioactive tracers. *Environmental Geology* *34*, 183-193.

Alperin, M.J., Martens, C.S., Albert, D.B., Suayah, I.B., Benninger, L.K., Blair, N.E. and R.A. Jahnke. 1999. Benthic fluxes and porewater concentration profiles of dissolved organic carbon in sediments from the North Carolina continental slope. *Geochim. Cosmochim. Acta* *63*, 427-448.

Nie, Y., Suayah, I.B., Benninger, L.K. and M.J. Alperin. 2001. Detailed sediment chronology in Chesapeake Bay from high-resolution profiles of ^{210}Pb and fallout nuclides. *Limnology and Oceanography* *46*, 1425-1437.

Alperin, M.J., Suayah, I.B., Benninger, L.K. and C.S. Martens. 2002. Modern organic carbon burial fluxes, recent sedimentation rates, and particle mixing rates from the upper continental slope near Cape Hatteras, North Carolina (USA). *Deep -Sea Research II* *49*, 4645-4665.

Mayer, L., Benninger, L., Bock M., DeMaster, D., Roberts, Q. and C. Martens. 2002. Mineral associations and nutritional quality of organic matter in shelf and upper slope sediments off Cape Hatteras, U.S.A.: A case of unusually high loadings. *Deep-Sea Research II* *49*, 4587-4597.

Muñoz, P., Lange, C.B., Gutiérrez, D., Hebbeln, D., Salamanca, M.A., Dezileau, L., Reyss, J.L., and Benninger, L.K. 2004. Recent sedimentation and mass accumulation rates based on ^{210}Pb along the Peru-Chile continental margin. *Deep-Sea Research II* *51*, 2523-2541.

DelVecchia, Amanda G., Bruno, John F., Benninger, Larry, Alperin, Marc, Banerjee, Ovik and Juan de Dios Morales. 2014. Organic carbon inventories in natural and restored Ecuadorian mangrove forests. *PeerJ* *2*:e388, DOI 10.7717/peerj.388

Hasan, Mejs and Benninger, Larry. 2017. Resiliency of the western Chesapeake Bay to total suspended solid concentrations following storms and accounting for land-cover. *Estuarine, Coastal and Shelf Science* *191*, 136-149

Publications---books and symposium volumes

Benninger, L.K., Lewis, D.M. and K.K. Turekian. 1975. The use of natural ^{210}Pb as a

heavy metal tracer in the river-estuarine system. In *Marine Chemistry in the Coastal Environment* (ed. T.M. Church), Am. Chem. Soc. Symp. Ser. 18, Washington, D.C., pp. 202-210.

Turekian, K.K., Nozaki, Y. and L.K. Benninger. 1977. Geochemistry of atmospheric radon and radon products. *Ann. Rev. Earth Planet. Sci.* 5, 227-255.

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Publications---reports

Adams, D.A., Benninger, L.K., Hosier, P.E., Overton, M.F. and J.P. Reed. 1982. White Oak River Management Project Final Report. For Office of Water Resources, North Carolina Department of Natural Resources and Community Development, Raleigh, NC.

Benninger, L.K. and C.S. Martens. 1983. Sources and fates of sedimentary organic matter in the White Oak and Neuse River estuaries. Univ. North Carolina Water Resources Research Institute Report UNC-WRRI-83-194. 60 pp.

Brinson, M.M., W.L. Bryant, M.N. Jones, and L.K. Benninger. 1991. Composition, distribution and dynamics of organic sediments. In M.M. Brinson (ed.), *Ecology of a Nontidal Brackish Marsh in Coastal North Carolina*, National Wetlands Research Center, Fish and Wildlife Service, U.S. Department of the Interior, Open File Report 91-03, pp 23-46.

Benninger, L.K. 1994. Carbon cycling on the continental margin: evidence from sediment 14-C and nutrient elements. Progress Report to U.S. Department of Energy under grant DE FG05 92ER61413, November 1994, 44 pp, 26 figures.

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Benninger, L.K., Alperin, M.J., Wells, J.T., Muñoz, P., Nie, Y., Mislowski, B., and Lafond, S. 2008. Impact of Hurricane Floyd on sediment deposition, erosion, and benthic nutrient fluxes in Pamlico Sound, North Carolina. UNC Water Resources Research Institute Report NC-WRRI-364, 50 pp, (<http://repository.lib.ncsu.edu/dr/bitstream/1840.4/1997/1/NC-WRRI-364.pdf>)

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Benninger, L.K., Aller, R.C., Cochran, J.K. and K.K. Turekian. 1976. Lead-210 geochronology of contemporary nearshore sediments: status and problems. *Eos, Trans. Amer. Geophys. Union* 57, 931.

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- Krishnaswami, S., Benninger, L.K., Aller, R.C. and K.L. Von Damm. 1978. Application of 7-Be for estimating particle reworking rates in nearshore and lake sediments. *Eos, Trans. Amer. Geophys. Union* 58, 296.
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- DeVito, C.M., Benninger, L.K., Cutshall, N.H. and I.L. Larsen. 1982. Radionuclides as tracers of sediment transport processes in North Carolina continental slope sediments. *Eos, Trans. Amer. Geophys. Union* 63, 353.
- Benninger, L.K. and C.S. Martens. 1983. Carbon isotopes as tracers of sources and sinks of organic matter in sediments of the White Oak River estuary, North Carolina. *Eos, Trans. Amer. Geophys. Union* 64, 244.
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- Benninger, L.K. and J.P. Chanton. 1985. Fallout 239,240-Pu and natural 238-U and 210-Pb in sediments of the North River marsh, North Carolina. *Eos, Trans. Amer. Geophys. Union* 66, 276.
- Freeman, J.H., Benninger, L.K. and R.E. Dodge. 1985. Fallout plutonium and naturally-occurring radionuclides in annual bands from *Montastrea annularis*, Broward County, Florida. *Eos, Trans. Amer. Geophys. Union* 66, 1330.
- Madzsar, E.M., Benninger, L.K., Freeman, J.H. and R.E. Dodge. 1988. Combined fallout 90-Sr and 239,240-Pu in the annual bands of *Montastrea annularis*, Broward County, Florida. *Eos, Trans. Amer. Geophys. Union* 68, 1743.
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- Benninger, L. 1992. Particle-reactive elements in sands of the Atlantic continental shelf - upper slope. *The Geochemical Society, Program and Abstracts, V.M. Goldschmidt Conference, May 8-10, 1992, Reston, VA, A-8*.
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- van Ende, B.A., C.K. Paull, and L.K. Benninger. 1994. Integrated dating techniques to determine the age of a glauconite deposit on the modern seafloor. *Eos, Trans. Amer. Geophys. Union, Trans. AGU* 75, 198.
- Suayah, I.B. and L.K. Benninger. 1994. Sedimentary framework for carbon deposition on the continental margin near Cape Hatteras. *Eos, Trans. Amer. Geophys. Union*, 75, 202.
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- Alperin, M.J., C.S. Martens, I.B. Suayah, L.K. Benninger, N.E. Blair, and R.A. Jahnke. 1994. Dissolved organic carbon in sediments from the North Carolina continental slope. *Eos, Trans. Amer. Geophys. Union* 75, 323.
- Benninger, L.K., Suayah, I.B. and R.J. Walter. 1996. Storage of modern particles in sands of the shelf and upper slope: evidence from partial inventories of excess 210-Pb and fallout plutonium. *Eos, Trans. Amer. Geophys. Union* 76, OS115.
- Suayah, I.B., Benninger, L.K., Alperin, M.J. and S.L. Meyer. 1996. Particle mixing and short-term accumulation rates in sediments of the Hatteras margin. *Eos, Trans. Amer. Geophys. Union* 76, OS8.
- Meyer, S.L., Suayah, I.B., and L.K. Benninger. 1996. Seafloor morphology in relation to modern sediment accumulation and mixing on the Hatteras slope. *Limnology and Oceanography Program with Abstracts, ASLO 1996 Annual Meeting*, 70.
- Suayah, I.B., Alperin, M.J., Benninger, L.K. and C.S. Martens. 1996. Sediment accumulation and mixing rates on the upper continental slope east of Currituck Sound, North Carolina. *Eos, Trans. Amer. Geophys. Union* 77, F403.
- Benninger, L.K., I.B. Suayah, and S.L. Meyer. 1998. Intensity of sediment accumulation and mixing from 210Pb: SEEP-I, SEEP-II, and OMP compared. *Eos, Trans., Amer. Geophys. Union* 79, OS73-OS74.
- Suayah, I.B., C.S. Martens, M.J. Alperin and L.K. Benninger. 1998. Rates of sediment accumulation and mixing along the slope depocenter between Cape Hatteras and Chesapeake Bay. *Eos, Trans. Amer. Geophys. Union* 79, OS74.
- Alperin, M.J., C.S. Martens, D.B. Albert, I.B. Suayah and L.K. Benninger. 1998. Factors controlling organic carbon burial efficiency in sediments from the North Carolina continental slope. *Eos, Trans. Amer. Geophys. Union* 79, OS183.

- Nie, Y., I.B. Suayah, and L.K. Benninger. 1998. Multiple-tracer approach to sediment chronology in Chesapeake Bay. *Eos, Trans. Amer. Geophys. Union* 79, no. 17, S364.
- Alperin, M.J., I.B. Suayah, L.K. Benninger, C.M. DeVito and N.H. Cutshall. 1999. A comparison of fallout plutonium and cesium in sediments from the North Carolina continental slope. ASLO Aquatic Sciences Meeting, February 1-5, 1999, Santa Fe, New Mexico.
- Benninger, L.K. 1999. Authigenic U in sediments of the Neuse River estuary as a potential paleoredox indicator: *Eos, Trans. Amer. Geophys. Union* 80, no. 17, S175.
- Nie, Y., L.K. Benninger, M.J. Alperin and I.B. Suayah. 1999. Detailed sediment chronology in Chesapeake Bay from high-resolution profiles of ^{210}Pb and fallout nuclides. *Eos, Trans. Amer. Geophys. Union* 80, no. 49, OS16.
- Benninger, L.K., I.B. Suayah and S.L. Meyer. 2000. Selective feeding on modern organic carbon in North Carolina slope sediments. *Benthic Ecology 2000*, 29th Benthic Ecology Meeting, p 33.
- Benninger, L.K. and I.B. Suayah. 2001. Deposition of modern sediments on the North Carolina continental shelf and slope. Abstract Book, 2001 Aquatic Sciences Meeting, American Society of Limnology and Oceanography, p. 22.
- Mayer, L.M., L.K. Benninger, Q. Roberts, M. Bock, and D. DeMaster. 2001. Sedimentary organic matter on the shelf and upper slope off Cape Hatteras: grain size and nutritional quality considerations. Abstract Book, 2001 Aquatic Sciences Meeting, American Society of Limnology and Oceanography, p. 22.
- Suayah, I.B., M.J. Alperin, L.K. Benninger, and C.S. Martens. 2001. Sedimentation rates, particle mixing rates, and organic carbon burial fluxes from the North Carolina continental slope. Abstract Book, 2001 Aquatic Sciences Meeting, American Society of Limnology and Oceanography, p. 22.
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- Benninger, L.K., M.J. Alperin, J.T. Wells, P. Munoz, Y. Nie, B.J. Rea., and B.J. Mislowack. 2003. Before and after: impacts of hurricane-induced flooding on sediments of the Neuse River estuary and Pamlico Sound, North Carolina. 2003 Abstracts with Programs, Geological Society of America, South-Central/Southeastern Sections, vol. 35 (1), 14.
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- Benninger, Larry K., Yonghong Nie, Ismail Suayah, and Marc Alperin. 2007. Fallout ^{137}Cs and $^{239,240}\text{Pu}$: are they redundant tracers in modern sediment chronology? Program with Abstracts, 53rd Annual Radiobioassay and Radiochemical Measurements Conference, Jackson Hole, WY.
- Benninger, L.K., Y. Nie, J. Wells, M. Alperin, and P. Muñoz. 2010. Sediment redistribution following hurricane-induced flooding, Neuse River estuary and Pamlico Sound, North Carolina. *Eos Trans. AGU* 91 (26), Ocean Sci. Meet. Suppl., Abstract GO24A-06.
- Percy, M.S., K. Singha, L. Benninger, D. Riveros-Iregui, and B. Mirus. 2015. Trends in soil moisture reflect more than slope position: soils on San Cristobal, Galapagos as a case study. GSA National Meeting, Baltimore, MD, October 2015, Abstract 296-179.

- Percy, M.S., K. Singha, L. Benninger, D. Riveros-Iregui, and B. Mirus. 2015. Trends in soil moisture reflect more than slope position: soils on San Cristobal, Galapagos as a case study. AGU National Meeting, San Francisco, CA, December 2015, Abstract EP31A-0990.
- Allan, G.C., L. Benninger, K. Bullins, J. Bishop, and A. Haboush. 2016. Heavy minerals in North Carolina stream sediments and the potential implications for rare earth element deposits. GSA Southeastern Section Meeting, Columbia, SC, 31 March – 1 April 2016, Abstract 30-25.
- Percy, Madelyn S. and Benninger, Larry. 2016. A-O-clay: using mineralogy to distinguish soil zones on San Cristóbal Island, Galápagos. GSA Annual Meeting, Denver, CO, October 2016, Paper 199-10.
- Hasan, Mejs and Benninger, Larry. 2016. Resiliency of the Chesapeake Bay to total suspended solid concentrations following storms and based on land-use. GSA Annual Meeting, Denver, CO, October 2016, Paper 158-2.

External Funding

\$20,000	A proposal to improve a facility for environmental radiochemistry at the University of North Carolina at Chapel Hill. North Carolina Science and Technology Committee. 1 January 1979 - 31 December 1980.
\$6,197	Geological and Sea Level History Implications of the Raised Reefs of Haiti. National Science Foundation (subcontract). 1 March 1980 - 31 August 1981.
\$5,000	Records of modern sea-level change and of trace-element accumulation in North Carolina salt-marsh sediments. UNC Marine Science Council. 1 July 1981 - 30 June 1982.
\$20,000	Sources and degradation of sedimentary organic materials in North Carolina rivers and estuaries. UNC Water Resources Research Institute. November 1981 - December 1982.
\$7,170	White Oak River Management Project. UNC Water Resources Research Institute. December 1981 - May 1982.
\$86,271	A record of seawater fallout plutonium from annual growth bands in corals. National Science Foundation. 15 December 1983 - 14 December 1985.
\$231,201	Seasonal variations in isotopic signatures of methane produced in organic-rich environments (co-PI with C.S. Martens, J.P. Chanton, N.E. Blair). NASA. 1 October 1985 - 30 June 1989.
\$89,545	Plutonium oxidation states in corals and in synthetic calcium carbonates. National Science Foundation. 15 May 1987 - 31 October 1989.
\$58,806	The role of “marine snow” in vertical flux and accumulation of sediments in an estuary. Sea Grant College Program. 1 January 1988 - 31 December 1989.
\$82,830	Accumulation rates, heavy metal pollution, and processes of sedimentation of organic-rich muds. Sea Grant College Program. 1 January 1990 - 31 December 1991.
\$1,000	Particle-reactive elements of the Atlantic shelf and upper slope. Duke/UNC Oceanographic Consortium. 1991. Also included five days ship time on R/V

	<i>Cape Hatteras.</i>
\$423,255	Carbon cycling on the continental margin: evidence from sediment 14-C and nutrient elements. U.S. Department of Energy. 1 May 1992 - 30 April 1995.
\$136,431	Examination of the evolution of the Florida - Hatteras slope and its relationship to the aquifers of the southeastern United States (co-PI with C.K. Paull, P.D. Fullagar, W. Ussler III). National Science Foundation. 1 January 1992 - 31 December 1993.
\$95,974	Particulate organic matter on the continental slope north of Cape Hatteras: transport, transformation and burial (co-PI with Rick Jahnke and Cynthia PilskaIn). NOAA/NURC. (\$19,999 for three co-PI's, balance as ship and submersible time). 1 January - 31 December 1994.
\$49,994	Carbon cycling on the continental margin: evidence from sediment 14-C and nutrient elements (extension with additional funding). U.S. Department of Energy. 1 August 1995 - 31 July 1996.
\$49,994	Carbon cycling on the continental margin: evidence from sediment 14-C and nutrient elements (extension with additional funding). U.S. Department of Energy. 1 August 1996 - 31 July 1997.
\$74,794	Impact of Hurricane Floyd on sediment deposition, erosion, and benthic nutrient fluxes in Pamlico Sound, NC (M.J. Alperin and J.T. Wells, Co-P.I.'s.). NC Department of Environment and Natural Resources. 1 July 2000 - 30 June 2001.
\$83,782	Introducing nuclear geology: course modules and student research using gamma spectrometry. U.S. Nuclear Regulatory Commission, 22 August 2011 – 31 August 2012 (extended to 31 August 2013).

University Service (2002 - present)

Chair, Geological Sciences 2002-2008
 Administrative Board of the Library, 2004-2008
 Mason Farm Biological Reserve Advisory Board, 2004 – present
 Faculty Advisory Committee, Carolina Environmental Program and Institute for the Environment, 2004 – 2010
 Faculty Hearings Committee, 2008 – 2009
 Appointments, Promotions, and Tenure Committee, 2009 – 2013
 Financial Exigency and Program Change, 2014 - 2017