Martin A. Becker, Ph.D.

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Education:

Rutgers College, New Brunswick, NJ Montclair State University, Upper Montclair, NJ CUNY, New York, NY

B.S. Geology, 1988 M.S. Geosciences, 1992 Ph.D. Earth and Environmental Sciences, 1997

Teaching Experience:

• Professor; 2006-present; William Paterson University, Wayne, NJ. (Chairperson 2009-2014)

• Assistant and Associate Professor; 1997-2006; The College of New Jersey, Ewing, NJ

• Earth Science Teacher; 1994-1997; Randolph High School, Randolph, NJ

• Geology Instructor; Fall 1995; New Jersey Institute of Technology, Newark, NJ

• Chemistry Teacher; 1992-1994; DePaul High School, Wayne, NJ

• Lab Instructor-Introductory Geology and Earth History; 1990-1991; Rutgers Newark, Newark, NJ

• General Science and Biology Teacher; 1988-1989; Immaculate Conception High School, Montclair, NJ

#### Advanced Professional Certification:

• Secondary Education Earth Science in the State of New Jersey, 1993

United States Coast Guard Certification

• Licensed Boat Captain-Operator of Uninspected Passenger Vessel, 2012-present

Field Experience:

• Field trip sponsor, organizer and leader to collect fossils and study geologic processes in Atlantic, Gulf Coastal Plain and Western

Interior Seaway states. (1988-2017)

• Extensive vertebrate fossil collecting in New Jersey, North Carolina, Georgia, Alabama, Florida, Arkansas, Texas, New Mexico, South Dakota and

Utah. (1985-2017)

• Geology Field Camp Instructor-Great Smoky Mountains, Maryville, Tennessee. (1999-2001)

Publications Related to Stratigraphy, Sedimentology and Paleontology. (*All featured fossils in publications are self-collected*.)

1) Becker, M., Slattery, W., and Chamberlain, J., 1996, Reworked Campanian and Maastrichtian Macrofossils in a Sequence Bounding Transgressive Lag Deposit, Monmouth County, New Jersey, *Northeast Geology and Environmental Science*, Vol. 18, pp. 234-252.

2) Becker, M., Slattery, W., and Chamberlain, J., 1998, Mixing of Santonian and Campanian Chondrichthyan and Ammonite Macrofossils along a Transgressive Lag Deposit, Greene County, Western Alabama, *Southeastern Geology*, Vol. 7, No. 1, pp. 1-12.

3) Becker, M., Meier, J., and Slattery, W., 1999, Spiral Coprolites from the Upper Cretaceous Wenonah-Mt. Laurel and Navesink Formations in the Northern Coastal Plain of New Jersey, *Northeastern Geology and Environmental Science*, Vol. 21, No. 3, pp. 181-187.

4) Becker, M., Chamberlain, J., and Stoffer, P., 2000, Pathological Tooth Deformities in Modern and Late Cretaceous Chondrichthyans: A Consequence of Feeding Related Injury, *Lethaia*, Vol. 36, No. 2, pp. 1-16.

5) Becker, M., and Chamberlain, J., 2001, Fossil Turtles from the Lowermost Navesink Formation (Maastrichtian) in Monmouth County New Jersey, *Northeastern Geology and Environmental Science*, Vol. 23, No. 4, pp. 332-339.

6) Chamberlain, J., Terry, D., Stoffer, P., and Becker, M., 2001, Paleontology of the K/T Boundary: Badlands National Park, South Dakota; in Santucci, V. L. and McClelland, L., eds., Proceedings of the 6th Fossil Resource Conference: *National Park Service Geological Resource Division Technical Report*, pp. 11-22.

7) Becker, M., Earley R., and Chamberlain, J., 2002, A Survey of Non-Tooth Chondrichthyan Hard-Parts from the Lower Navesink Formation (Maastrichtian) in Monmouth County, New Jersey, *Northeastern Geology and Environmental Science*, Vol. 24, No. 4, pp. 282-292.

8) Becker, M., Chamberlain J., and Terry, D., 2004, Chondrichthyans from the Fairpoint Member of the Fox Hills Formation (Maastrichtian), Meade County South Dakota, *Journal of Vertebrate Paleontology*, Vol. 24, pp. 780-793.

9) Becker, M., Brady, D., and Chamberlain, J., 2005, Rostral Morphology of the Sawfish, *Ischyrhiza mira*, from the Lower Navesink Formation (Maastrichtian) Monmouth County, New Jersey, *Northeastern Geology and Environmental Science*, Vol. 23, No. 4, pp. 332-339.

10) Becker, M., Chamberlain, J., and Wolf, G. 2006, Chondrichthyans from the Arkadelphia Formation (Upper Cretaceous: late Maastrichtian) of Hot Spring County, Arkansas, *Journal of Paleontology*, Vol. 80, No. 4, pp. 700-716.

11) Becker, M., and Chamberlain, J., 2006, Evidence for a Shark-Bitten Turtle Costal From The Lowermost Navesink Formation (Campanian-Maastrichtian) Monmouth County, New Jersey, *Northeastern Geology and Environmental Science*, Vol. 28, No. 2, pp. 174-181.

12) Becker, M., and Chamberlain, J., 2006, Anomuran Microcoprolites from the Lowermost Navesink Formation (Maastrichtian), Monmouth County, New Jersey, *Ichnos*, Vol. 13, pp. 1-9.

13) Becker, M., Chamberlain, R., and Chamberlain, J., 2007, The Paradox of Large Carcharhinoid-Type Shark Vertebrae in the Upper Cretaceous of New Jersey, *Proceeding of the Geological Association of New Jersey*, Vol. 24, pp. 69-84.

14) Becker, M., Chamberlain, R., and Chamberlain, J., 2007, Large Carcharhinoid-Type Shark Vertebrae in the Upper Cretaceous of New Jersey: Evidence for an Anacoracid Origin, *Northeastern Geology and Environmental Science*, Vol. 30, pp. 118-129.

15) Becker, M., Chamberlain, J., Seidemann, D., Buhl, D., and Slattery, W., 2008, Strontium Isotopic Signatures in the Enameloid and Dentine of Upper Cretaceous Shark Teeth from Western Alabama: Paleocologic and geochronologic implications, *Palaeogeography, Palaeoclimatology and Palaeoecology*, Vol. 264, pp. 188-194.

16) Becker, M., Chamberlain, J., Lundberg, J., L’Amoreaux, W., Chamberlain, R., and Holden,T., 2009, Acanthomorph Fish Fossils with Probable Berciform Relationships (Osteichthyans:Teleostei: Beryciformes) From the Late Cretaceous-Early Tertiary of New Jersey, *Proceeding of the Philadelphia Academy of Sciences*, Vol. 158, pp. 159-181.

17) Becker, M., Chamberlain, J., Robb, A. Terry, D. and Garb, M., 2009, Osteichthyans from the Fairpoint Member of the Fox Hills Formation (Maastrichtian), Meade County, South Dakota, USA, *Cretaceous Research*, Vol. 30, pp. 1031-1040.

18) Becker, M., Wellner, R., Mallery, C., Chamberlain, J., 2010, Chondrichthyans from the Lower Ferron Sandstone Member of the Mancos Shale (Upper Cretaceous: Middle Turonian) of Emery and Carbon Counties Utah, USA. *Journal of Paleontology*, Vol. 84, pp. 248-266.

19) Becker, M., Chamberlain, R. and Chamberlain, J., 2010, Probable Elk-Moose Cervical Vertebra Dredged from the Inner Continental Shelf off Central New Jersey. *Atlantic Geology*, Vol. 46, pp. 7-18.

20) Becker, M., Mallery, C., and Chamberlain, J., 2010, Osteichthyans from the Arkadelphia Formation (Late Maastrichtian) of Hot Spring County, Arkansas, USA, *Journal of Vertebrate Paleontology*, Vol. 30, pp. 1019-1036.

21) Becker, M., Smith, L., and Chamberlain, J., 2011, Chondrichthyans from the Clayton Limestone Unit of the Midway Group (Paleogene: Paleocene) of Hot Spring County, Arkansas. *Cainozoic Research*, Vol. 4, pp. 194-207.

22) Becker, M., and Chamberlain, J., 2012, Osteichthyans from the Paleocene Clayton Limestone of the Midway Group, Hot Spring County, Arkansas, USA: Bony Fish Evolution Across the Cretaceous-Paleogene Boundary, *Paludicola*, Vol. 4, pp. 194-207.

23) Becker, M., and Chamberlain, J., 2012, *Squalicorax* Chips a Tooth: A Consequence of Feeding-Related Behavior from the

Lowermost Navesink Formation (Late Cretaceous: Campanian-Maastrichtian) of Monmouth County, New Jersey, USA.

*Geosciences,* Vol. 2, pp. 109-129.

25) John, J., Seidemann D., Chamberlain, J., Cheng, Z. and Becker, M., 2012, Trace and Minor Element Chemistry of Modern Shark Teeth and Implications for Shark Tooth Geochronometry , pp. 1-31. *In* Strontium: Chemical Properties, Applications and Health Effects, Editors: Wai, M. and Guan Gong, X., Nova Science Publishers, Hauppauge, New York, ISBN: 978-1-62257-632-6.

25) Becker, M., Maisch, H. .Hand Chamberlain, J., 2012, Pycnodonts from the Lower Ferron Sandstone Member of the Upper Cretaceous Mancos Shale (Middle Turonian), Emery and Carbon Counties, Utah. *The Mountain Geologist*, Vol. 4, p. 101-114.

26) Becker, M., Maisch, H., .Hand Chamberlain, J., 2013, Plesiosaurian Remains from the Arkadelphia Formation-Midway Group Contact (Maastrichtian-Paleocene) Hot Spring County, Near Malvern, Arkansas, USA. *Paludicola*, Vol. 9, p. 131-143.

27) Becker, M., and Bartholomew, A., 2013, Lower Devonian Glacial Erratics from High Mountain, northern New Jersey,

USA: Discovery, Provenance, and Significance. *Atlantic Geology*, Vol. 49, p. 194-203.

28) Maisch, H., Becker, M., Raines, B., and Chamberlain, J., 2014, Chondrichthyans from the Tallahatta-Lisbon Formation

Contact (Middle Eocene) Silas, Choctaw County, Alabama. *Paludicola*, Vol. 9, p. 183-209.

29) Maisch, H., Becker, M., and Chamberlain, 2015, Chondrichthyans from a Lag Deposit between the Shark River

Formation (Middle Eocene) and Kirkwood Formation (Early Miocene), Monmouth County, New Jersey. *Paludicola*, Vol.

10, p. 149-213.

30) Becker, M., Maisch, H., and Bartholomew, A., 2016, Pleistocene Ice Flow Direction indicated by *Terataspis grandis* (trilobite) bearing

erratics from the Rickard Hill Facies of the Saugerties Member of the Schoharie Formation (Lower Devonian), *Northeastern*

*Geosciences*, Vol. 34, p. 7-11.

31) Maisch, H., Becker, M., Raines, B., and Chamberlain, J., 2016, Osteichthyans from the Tallahatta–Lisbon Formation Contact (middle Eocene–Lutetian) Pigeon Creek, Conecuh-Covington Counties, Alabama with Comments on Transatlantic Occurrences in the Northern Atlantic Ocean Basin. *PalArch’s Journal of Vertebrate Palaeontology*, Vol. 13, p. 1-22.

32) Becker, M., Maisch, H., and Chamberlain, J., 2016, Turtles from an Arkadelphia Formation-Midway Group Lag Deposit, (Maastrichtian

Paleocene) Hot Springs, County, Arkansas, USA, *Geosciences*, Vol. 6, p. 1-14.

33) Becker, M., Chamberlain, R. Maisch, H., Bartholomew, A. and Chamberlain, J., 2017, Trilobites from the Rickard Hill facies of the

Saugerties Member of the Schoharie Formation, eastern New York (upper Emsian and Lower Devonian): a case study in taphonomy and

sequence stratigraphy from glacial erratics. *Atlantic Geology*, Vol. 53, p. 117-132.

34) Maisch, H., Becker, M., and Chamberlain, J., 2018, Lamniform and Carcharhiniform Sharks from the Pungo River and Yorktown

Formations (Miocene-Pliocene) of Submerged Continental Shelf, Onslow Bay, North Carolina, USA. Copeia 106: 353-374.

35) Becker, M., H. Maisch IV, R. Chamberlain, J. Chamberlain Jr., C. Kline, and C. Mautz. 2018. Nautiloid cephalopods from the Rickard Hill facies of the Saugerties Member of the Schoharie Formation, eastern New York (late Emsian, Devonian): a case study in taphonomy from glacial erratics. *Palaeontologia Electronica*, 21.3.42A 1-22.

36) Maisch, H., IV, M. Becker, and M. Griffiths. 2019. Chondrichthyans from the Lower Clayton Limestone Unit of the Midway Group (Paleocene) near Malvern, Arkansas, USA with Comments on the K/Pg boundary. *PalZ* (Paläontologische Zeitschrift), 94:561-593.

37) Maisch, H., IV, M. Becker, and J. Chamberlain Jr. 2019. Macroborings in *Otodus megalodon* and *Otodus chubutensis* Shark Teeth from the Submerged Shelf of Onslow Bay, North Carolina, USA: Implications for Processes of Lag Deposit Formation. *Ichnos*, 27:122-141.

38) Akhtar, Alliya A., Lauren M. Santi, Michael L. Griffiths, Martin Becker, Robert A. Eagle, Sora Kim, László Kocsis, Yair Rosenthal, and John A. Higgins. "A record of the δ44/40Ca and [Sr] of seawater over the last 100 million years from fossil elasmobranch tooth enamel." *Earth and Planetary Science Letters* 543 (2020): 116354.

39) Shimada, Kenshu, Martin A. Becker, and Michael L. Griffiths. 2020. Body, jaw, and dentition lengths of macrophagous lamniform sharks, and body size evolution in Lamniformes with special reference to ‘off-the-scale’gigantism of the megatooth shark, Otodus megalodon. *Historical Biology* (2020): 1-17.

40) Shimada, Kenshu, Matthew F. Bonnan, Martin A. Becker, and Michael L. Griffiths. 2020. Ontogenetic growth pattern of the extinct megatooth shark Otodus megalodon—implications for its reproductive biology, development, and life expectancy." *Historical Biology* (2020): 1-6.

41) Maisch, H., IV, M. Becker, and K. Shimada. 2021. Chondrichthyans and Osteichthyans from a Turonian–Coniacian lag deposit between the Tocito Sandstone and Mulatto Tongue (Mancos Shale), Sandoval County, New Mexico, USA with comments on correlative Turonian–Coniacian vertebrate lags in the Western Interior Seaway. *Cretaceous Research*, 126:

42) Maisch, H., IV and M. Becker. 2021. The Northernmost Cenozoic Atlantic Coastal Plain Occurrence and First Report of the Whale Shark, *Rhincodon typus* Smith, 1829 from Monmouth County, New Jersey, USA. *Bulletin of the New Jersey Academy of Science*, 61:3-9.

43) Maisch, H., IV and M. Becker. 2021. Osteichthyans from the Shark River Formation (middle Eocene) and Kirkwood Formation (early Miocene) contact, Monmouth County, New Jersey, USA with comments on habitat shifts along the Western Atlantic Coastal Plain. *Paludicola*, 13:106-127.

PUBLICATIONS UNDER REVIEW AND IN PREPARATION:

1)  Shimada, K., H. Maisch IV, V. Perez, M. Becker, and M. Griffiths. 2021. Revisiting body size trends and nursery areas of the Neogene megatooth shark, *Otodus megalodon* (Lamniformes: Otodontidae) reveals Bergmann's rule possibly enhanced its gigantism in cooler waters (Under review- *Historical Biology*, Nov. 2021)

2)  Kast, E., M. Griffiths, Z. Rao, K. Shimada, M. Becker, S. Kim, H. Maisch IV, R. Eagle, C. Clark, A. Neumann, T. Lüdecke, J. Leichliter, A. Martínez-García, A. Akhtar, X. Wang, G. Haug, D. Sigman. Trophic position of extinct Cenozoic megatooth sharks (Under Review- *Science Advances* Nov. 2021)

3)  McCormack, J., M. Griffiths, K. Shimada, S. Kim, M. Karnes, H. Maisch IV, S. Pederzania, N. Bourgona, K. Jaouen, M. Becker, N. Jönsi, G. Sisma-Venturaj, N. Straube, J. Pollerspöck, J. Hublina, R. Eagle, and T. Tütken. 2021. Competition between Neogene *Otodus megalodon* and great white sharks revealed by zinc isotopes. (Being revised-*Nature Communications*, Nov. 2021).

4)  Maisch, H., IV, M. Becker, and J. Chamberlain Jr. *Teredolites*-bored driftwood from the Arkadelphia Formation–Midway Group Contact (K–Pg), Malvern, Arkansas, USA. For submission to *Ichnos* (In prep. Expected Submission: Spring 2022)

5)  Maisch, H., IV, M. Becker, and J. Chamberlain Jr. Bathymetric Controls on Taphonomic Reworking and Bioerosion of Fossil Teeth from Megatoothed Sharks: A Comparative Study from the Miocene Pungo River and Pliocene Yorktown Formations, Onslow Bay, North Carolina, USA. For submission to *PALAIOS* (In Prep. Expected Submission: Spring 2022)

6) M. Griffiths, R. Flores, M. Becker, K. Shimada, S. Kim, H. Maisch IV, A. Tripati, and R. Eagle. Isotopic (13C-18O) ordering in bioapatite reveals thermoregulation in ancestral shark species (In prep. Expected Submission: Spring 2022)

RECENT ABSTRACTS

1)  Maisch, H., IV, M. Becker, V. Perez, and K. Shimada. 2021. Elasmobranchs from the Peace River and Tamiami formations (Miocene–Pliocene) on the submerged continental shelf near Venice, Florida, USA. Society of Vertebrate Paleontology, Fall 2021 Virtual Conference

2)  Griffiths, M., R. Flores, S. Kim, E. Kast, J. McCormack, A. Akhtar, K. Shimada, M. Becker, H. Maisch IV, Z. Rao, D. Sigman, J. Higgins, A. Neumann, C. Clarke, A. Tripati, R. Chan, M. Karnes, and R. Eagle. 2022. Cenozoic evolution and extinction of megatoothed sharks through the lens of stable isotope ratios. Submitted to the American Geophysical Union, Climate and Ocean Change Session, Spring 2022 Conference.

3)  Karnes, M., R. Chan, M. Griffiths, K. Shimada, M. Becker, R. Eagle, G. Cliff, H. Maisch IV, S. Kim. 2021. Investigating enigmatic carbonate carbon isotopic values in shark teeth: evidence for temperature dependent partitioning. Geological Society of America Annual Meeting, Portland, O.R., Fall 2021.

4)  Maisch, H., IV, M. Becker, and K. Shimada. 2020. Chondrichthyans and Osteichthyans from a Turonian–Coniacian lag deposit between the Tocito Sandstone and Mulatto Tongue (Mancos Shale), Sandoval County, New Mexico, USA with comments on correlative lags in the Western Interior Seaway. Society of Vertebrate Paleontology, Fall 2020 Virtual Conference.

5)  Maisch, H., IV, S. Foster, M. Gardiner, and M. Becker. 2020. Osteichthyans from the Shark River Formation (middle Eocene) and Kirkwood Formation (early Miocene) contact, Monmouth County, New Jersey, USA. Geological Society of America, Northeastern Section Meeting, Reston, V.A.

6)  Maisch, H., IV, M. Gardiner, S. Foster, M. Becker, K. Shimada, and M. Griffiths. 2020. Chondrichthyans and Osteichthyans from a Turonian–Coniacian lag deposit between the Gallup Sandstone–Mulatto Tongue (Mancos Shale), Sandoval County, New Mexico, USA with comments on coeval lags in the Western Interior Seaway. Geological Society of America, Northeastern Section Meeting, Reston, V.A.

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RECENT NEWS ARTICLES AND PRESS RELEASES:

1) *An unlikely path to a historic discovery*: The Star-Ledger Newspaper • January 19, 2020 (print release) By: Rob Jennings

2)  *How an unlikely N.J. duo made a 60-million-year-old discovery*: The Star-Ledger online

-January 18, 2020, (online release) By: Rob Jennings

3)  News 12 New Jersey interview and video on discovering a new species of fossil stingray

-Aired: January 17, 2020

5) *WPU Professor Discovers New Fossil, Names It After Colleague*-Wayne, NJ Patch: January 15, 2020, By: Kimberly Redmond

6)  *WP Professor Harry Maisch IV Discovers Teeth Belonging to New Species of Fossil Stingray, Names It After Fellow Professor on Campus* ---

-December 2019, By: Maria Daniels, WPU

7)  *Ancient fossils found on campus give glimpse of Earth’s changing climate*: WP Magazine

-April 2019, By: Mary Beth Zeman, WPU

8)News 12 New Jersey interview and video on fossils from the WPU campus region March 20, 2019

9)  *SCUBA diving scientists find shark teeth and guns on the Sepulga River*

-November 5, 2015, By: Ben Raines, AL.com

10)  *Alabama’s hidden role in Darwin’s theory of evolution*

-October 29, 2015, By: Ben Raines, AL.com

11) *Was giant shark ancestor in Alabama? Yes, say paleontologists hunting ancient teeth in Choctaw County*

-November 15, 2013, By: Ben Raines, AL.com

Recent External Grant Funding:

1) Collaborative Research: Biogeochemical fingerprinting of the megatoothed (‘megalodon’) shark: a dual study in thermophysiological evolution and seawater chemistry” [PI: M.L. Griffiths; co-PIs: M. Becker (WPU), Sora Kim (UC Merced), R. Eagle (UCLA), K. Shimada (DePaul University)] National Science Foundation, Sedimentary Geology and Paleobiology (SGP) EAR-7858820, $571,014. 09/01/18 – 08/31/21.

2) Late Phanerozoic Evolution of Seawater Temperature and Sr/Ca: New Insights from “Clumped Isotope” Thermometry in Biogenic Apatite” [PI: M.L. Griffiths; co-PI: M. Becker (WPU)]. American Chemical Society Petroleum Research Fund Undergraduate New Investigator Grant, PRF–#54852-UNI2, $55,000. 01/01/15 – 01/01/17.

Organizations and Special Interests:

Geological Society of America, Geological Association of New Jersey, Pines Lake Fishing Club, Zeolite and Quartz mineral collector, Upper

Cretaceous chondrichthyan and osteichthyan teeth collector, Saltwater fishing and Boating, Hiking, Backpacking and Camping

REFERENCES:

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