



Sonia Tikoo-Schantz

Assistant Professor of Geophysics and, by courtesy, of Earth and Planetary Sciences

Bio

BIO

I utilize paleomagnetism and fundamental rock magnetism as tools to investigate problems in the planetary sciences. By studying the remanent magnetism recorded within rocks from differentiated planetary bodies, I can learn about core processes that facilitate the generation of dynamo magnetic fields within the Earth, Moon, and planetesimals. Determining the longevities and paleointensities of dynamo fields that initially magnetized rocks also provides insight into the long-term thermal evolution (i.e., effects of secular cooling) of planetary bodies. I also use paleomagnetism to understand impact cratering events, which are the most ubiquitous modifiers of planetary surfaces across the solar system. Impact events produce heat, shock, and sometimes hydrothermal systems that are all capable of resetting magnetization within impactites and target rocks via thermal, shock, and chemical processes. Therefore, I am able to use a combination of paleomagnetic and rock magnetic characterization to investigate shock pressures, temperatures, structural changes, and post-impact chemical alteration experienced by cratered planetary surfaces.

ACADEMIC APPOINTMENTS

- Assistant Professor, Geophysics
- Assistant Professor (By courtesy), Earth & Planetary Sciences

LINKS

- Google Scholar Profile: https://scholar.google.com/citations?user=E4SNn_MAAAAJ&hl=en&oi=ao

Teaching

COURSES

2023-24

- Designing Science Fiction Planets: EPS 30N, GEOPHYS 30N (Aut)
- Evolution of Terrestrial Planets: EPS 238, GEOPHYS 237 (Spr)
- Frontiers of Geophysical Research at Stanford: GEOPHYS 101, GEOPHYS 201 (Aut)
- Planetary Magnetism: GEOPHYS 385T (Aut, Win, Spr)

2022-23

- Introduction to Planetary Science: ESS 125, GEOLSCI 124, GEOPHYS 124 (Spr)
- Planetary Magnetism: GEOPHYS 385T (Aut, Win, Spr, Sum)

2021-22

- Designing Science Fiction Planets: GEOLSCI 30N, GEOPHYS 30N (Spr)
- Frontiers of Geophysical Research at Stanford: GEOPHYS 101, GEOPHYS 201 (Aut)

- Paleomagnetism: GEOLSCI 129, GEOLSCI 229, GEOPHYS 139, GEOPHYS 239 (Aut)
- Planetary Magnetism: GEOPHYS 385T (Aut, Spr, Sum)

2020-21

- Diversity and Inclusion in the Geosciences: EARTH 203 (Win)
- Frontiers of Geophysical Research at Stanford: GEOPHYS 101, GEOPHYS 201 (Aut)
- INTRODUCTION TO PLANETARY SCIENCE: ESS 125, GEOLSCI 124, GEOPHYS 124 (Spr)
- Planetary Magnetism: GEOPHYS 385T (Aut, Win, Spr)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Ji In Jung, Margariete Malenda

Doctoral Dissertation Advisor (AC)

Thom Chaffee, Ethan Lopes

Publications

PUBLICATIONS

- **A South Pole-Aitken impact origin of the lunar compositional asymmetry.** *Science advances*
Jones, M. J., Evans, A. J., Johnson, B. C., Weller, M. B., Andrews-Hanna, J. C., Tikoo, S. M., Keane, J. T.
2022; 8 (14): eabm8475
- **An episodic high-intensity lunar core dynamo** *NATURE ASTRONOMY*
Evans, A. J., Tikoo, S. M.
2022
- **Dynamos in the Inner Solar System** *ANNUAL REVIEW OF EARTH AND PLANETARY SCIENCES*
Tikoo, S. M., Evans, A. J.
2022; 50: 99-122
- **Mars as a time machine to Precambrian Earth** *Journal of the Geological Society*
Lapotre, M., Bishop, J., Ielpi, A., Lowe, D., Siebach, K., Sleep, N., Tikoo, S.
2022
- **Probing the hydrothermal system of the Chicxulub impact crater.** *Science advances*
Kring, D. A., Tikoo, S. M., Schmieder, M., Riller, U., Rebolledo-Vieyra, M., Simpson, S. L., Osinski, G. R., Gattacceca, J., Wittmann, A., Verhagen, C. M., Cockell, C. S., Coolen, M. J., Longstaffe, et al
2020; 6 (22): eaaz3053
- **Explosive interaction of impact melt and seawater following the Chicxulub impact event** *GEOLOGY*
Osinski, G. R., Grieve, R. F., Hill, P. A., Simpson, S. L., Cockell, C., Christeson, G. L., Ebert, M., Gulick, S., Melosh, H., Riller, U., Tikoo, S. M., Wittmann, A.
2020; 48 (2): 108–12
- **Probing space to understand Earth** *Nature Reviews Earth & Environment*
Lapotre, M. G., O'Rourke, J. G., Schaefer, L. K., Siebach, K. L., Spalding, C., Tikoo, S. M., Wordsworth, R. D.
2020; 1: 170-181
- **The first day of the Cenozoic** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Gulick, S. S., Bralowe, T. J., Ormo, J., Hall, B., Grice, K., Schaefer, B., Lyons, S., Freeman, K. H., Morgan, J., Artemieva, N., Kaskes, P., de Graaff, S. J., Whalen, et al
2019; 116 (39): 19342–51
- **Drilling-induced and logging-related features illustrated from IODP-ICDP Expedition 364 downhole logs and borehole imaging tools** *SCIENTIFIC DRILLING*

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- Lofi, J., Smith, D., Delahunty, C., Le Ber, E., Brun, L., Henry, G., Paris, J., Tikoo, S., Zylberman, W., Pezard, P. A., Celerier, B., Schmitt, D. R., Nixon, et al
2018; 24: 1–13
- **Lunar Swirl Morphology Constrains the Geometry, Magnetization, and Origins of Lunar Magnetic Anomalies** *JOURNAL OF GEOPHYSICAL RESEARCH-PLANETS*
Hemingway, D. J., Tikoo, S. M.
2018; 123 (8): 2223–41
 - **Rapid recovery of life at ground zero of the end-Cretaceous mass extinction** *NATURE*
Lowery, C. M., Bralower, T. J., Owens, J. D., Rodriguez-Tovar, F. J., Jones, H., Smit, J., Whalen, M. T., Claeys, P., Farley, K., Gulick, S. S., Morgan, J. V., Green, S., Chenot, et al
2018; 558 (7709): 288–+
 - **The Case Against an Early Lunar Dynamo Powered by Core Convection** *GEOPHYSICAL RESEARCH LETTERS*
Evans, A. J., Tikoo, S. M., Andrews-Hanna, J. C.
2018; 45 (1): 98–107
 - **A two-billion-year history for the lunar dynamo** *SCIENCE ADVANCES*
Tikoo, S. M., Weiss, B. P., Shuster, D. L., Suavet, C., Wang, H., Grove, T. L.
2017; 3 (8): e1700207
 - **The fate of water within Earth and super-Earths and implications for plate tectonics** *PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY A-MATHEMATICAL PHYSICAL AND ENGINEERING SCIENCES*
Tikoo, S. M., Elkins-Tanton, L. T.
2017; 375 (2094)
 - **Further evidence for early lunar magnetism from troctolite 76535** *JOURNAL OF GEOPHYSICAL RESEARCH-PLANETS*
Garrick-Bethell, I., Weiss, B. P., Shuster, D. L., Tikoo, S. M., Tremblay, M. M.
2017; 122 (1): 76–93
 - **The formation of peak rings in large impact craters** *SCIENCE*
Morgan, J. V., Gulick, S. S., Bralower, T., Chenot, E., Christeson, G., Claeys, P., Cockell, C. S., Collins, G. S., Coolen, M. L., Ferriere, L., Gebhardt, C., Goto, K., Jones, et al
2016; 354 (6314): 878–82
 - **Reply to Comment on "Pervasive remagnetization of detrital zircon host rocks in the Jack Hills, Western Australia and implications for records of the early dynamo"** *EARTH AND PLANETARY SCIENCE LETTERS*
Weiss, B. P., Maloof, A. C., Harrison, T., Swanson-Hysell, N. L., Fu, R. R., Kirschvink, J. L., Watson, E., Coe, R. S., Tikoo, S. M., Ramezani, J.
2016; 450: 409–12
 - **A matter of minutes: Breccia dike paleomagnetism provides evidence for rapid crater modification** *GEOLOGY*
Fairchild, L. M., Swanson-Hysell, N. L., Tikoo, S. M.
2016; 44 (9): 723–26
 - **Magnetism of a very young lunar glass** *JOURNAL OF GEOPHYSICAL RESEARCH-PLANETS*
Buz, J., Weiss, B. P., Tikoo, S. M., Shuster, D. L., Gattacceca, J., Grove, T. L.
2015; 120 (10): 1720–35
 - **Preservation and detectability of shock-induced magnetization** *JOURNAL OF GEOPHYSICAL RESEARCH-PLANETS*
Tikoo, S. M., Gattacceca, J., Swanson-Hysell, N. L., Weiss, B. P., Suavet, C., Courmede, C.
2015; 120 (9): 1461–75
 - **The lunar dynamo** *SCIENCE*
Weiss, B. P., Tikoo, S. M.
2014; 346 (6214): 1198–+
 - **Decline of the lunar core dynamo** *EARTH AND PLANETARY SCIENCE LETTERS*
Tikoo, S. M., Weiss, B. R., Cassata, W. S., Shuster, D. L., Gattacceca, J., Lima, E. A., Suavet, C., Nimmo, F., Fuller, M. D.
2014; 404: 89–97
 - **A Long-Lived Lunar Core Dynamo** *SCIENCE*
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Shea, E. K., Weiss, B. P., Cassata, W. S., Shuster, D. L., Tikoo, S. M., Gattaccea, J., Grove, T. L., Fuller, M. D.
2012; 335 (6067): 453–56