Dr Tobias Stephan

Postdoctoral associate

Lakehead University
Department of Geology
Thunder Bay, ON, Canada

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Education

2019/03 **Doctor of Philosophy (PhD)** in "Geology"
Technische Universität Bergakademie Freiberg, Germany

- Thesis: "Paleogeographic and Structural Control on the Arcuate Variscan Belt"
- Supervisors: Dr Uwe Kroner (Technische Universität Bergakademie Freiberg) and Prof Dr Rolf L. Romer (Geoforschungszentrum Potsdam)

2013/09 **Master of Science (MSc)** in "Geosciences" (major: Tectonics and Geochronology)
Technische Universität Bergakademie Freiberg, Germany

- Thesis: "Variscan Tectonics of the Schwarzburg unit (Central European Variscides): From a transform plate boundary zone to an orogenic wedge"
- Supervisor: Dr Uwe Kroner (Technische Universität Bergakademie Freiberg)

2010/09 **Bachelor of Science (BSc)** in "Geology and Mineralogy"
Technische Universität Bergakademie Freiberg, Germany

- Thesis: "Structural geology and sedimentology of the Tanne Greywacke Zone, Harz Mts., Germany"
- Supervisor: Dr Uwe Kroner (Technische Universität Bergakademie Freiberg)

Professional Experience

since 2023/04 **Postdoctoral associate**
Lakehead University, Structure Group, Department of Geology, Thunder Bay, ON, Canada
Project: NSERC Alliance Grant — "Structure, petrology, geochemistry, and geochronology of the Moss Lake Au deposit, Northern Ontario, Canada"
Advisors: Dr Noah J. Phillips, Dr Peter Hollings

2020/12–2022/11 **Postdoctoral associate** (DFG Research Fellow)
University of Calgary, Geo- and Thermochronology Research Group, Department of Geoscience, Calgary, AB, Canada
Project: DFG Research Fellowship — "Developing a statistical approach to analyze large paired geo-thermochronological datasets with an application to the Canadian Cordilleras"
Advisor: Dr Eva Enkelmann

2020/03–2020/11 **Postdoctoral associate**
Friedrich-Alexander-Universität Erlangen-Nürnberg, Geozentrum Nordbayern, Erlangen, Germany
Project: LfU Bayern & ERDF — "Integrated geophysical–structural–kinematic analysis of the fault patterns in Northern Bavaria"
Advisors: Dr Daniel Koehn, Dr Harald Stollhofen

2019/09–2019/12 **Teaching assistant**
Technische Universität Bergakademie Freiberg, Institute for Computer Sciences, Freiberg, Germany

2014–2018 **Research assistant**
Technische Universität Bergakademie Freiberg, Institute for Geology
Project: BMBF ZIM — "Developing a method for three dimensional forecasting of covered mineral deposits on the example of the Erzgebirge", BMBF r4 — "Granite related mineralization

of strategic metals (GEM) – conditions of mineralization and search criteria for hidden ore bodies"

2014/01–2014/06 **Geologist**
Beak Consultants GmbH (Germany / Tanzania)
Field work in Tanzania, compilation for metallogenic database of Tanzania, GIS training to the staff of the Geological Survey of Tanzania, Dodoma, Tanzania

2009–2013 **Lab assistant**
Technische Universität Bergakademie Freiberg, Institute for Geology
Rock processing and mineral separation for geochronological analyses (Ar–Ar, fission track, U–Pb)

2011/07–2011/09 **Teaching and research assistant (IAESTE student exchange)**
Mongolian University of Science and Technology, Ulaanbaator, Mongolia
Field work in ophiolitic sequences of Western Mongolia

2007/05–2007/06 **Student internship**
GFZ German Research Center for Geosciences Potsdam, Department for Geomagnetism, Potsdam, Germany
Contribution to the IGRF Declination Calculator, an online software for estimating the magnetic field declination, inclination, and intensity for any location on Earth and times since 1990

Teaching Experience

2023/10 Short course: "Plate motion and deformation of the lithosphere" (1 week)
Department of Geology, Technische Universität Bergakademie Freiberg, Germany Course level: postgraduate-graduate | number of students: 20 | lecture hours per week: 20

2022/09 Short course "Programming with R — A Beginners' Guide for Geoscientists" (1 week)
University of Calgary, Department of Geoscience, Calgary, AB, Canada
Course level: graduate | number of students: 8 | lecture hours per week: 12

2022/01 Guest lecture: "Structural geology"
University of Calgary, Department of Geoscience, Calgary, AB, Canada
Course level: undergraduate | number of students: 23 | lecture hours per week: 1

2019/09–2019/12 3D Modeling in Earth Sciences
Institute for Computer Sciences, Technische Universität Bergakademie Freiberg, Germany
Course level: undergraduate | number of students: 20 | lecture hours per week: 4

2017/10–2018/03 "Specific Topics of Applied Geomodelling"
Department of Geophysics and Geoinformatics, Technische Universität Bergakademie Freiberg, Germany
Course level: undergraduate | number of students: 20 | lecture hours per week: 2

2015–2018 Teaching assistant for field course "Strucutral Geology"
Department of Geology, Technische Universität Bergakademie Freiberg, Germany

2014/01–2014/05 Digital maps and GIS courses
Geological Survey of Tanzania, Dodoma, Tanzania

2011/07–2011/09 Teaching and field work assistant during geological mapping courses in Khangai Mnts., Mongolia
Mongolian University of Science and Technology, Ulaanbaator, Mongolia
Course level: undergraduate | number of students: 40

Student Co-Supervision

Graduate Perez, A., "Petrology and Geochemistry of the western Shebandowan Greenstone Belt (Superior Province, Northern Ontario, Canada)"
Started: 2023/04, *Lakehead University, Thunder Bay*

Nwakanma, M., "Alteration and mineral paragenesis of the Moss Lake gold deposit (Shebandowan Greenstone Belt, Superior Province, Northern Ontario, Canada)"
Started: 2023/04, *Lakehead University, Thunder Bay*

Müller, F., "Tectonic 3D model of the Berga Antiform, Saxothuringian Zone, Germany"
Completed: 2018/04/30, *Technische Universität Bergakademie Freiberg*

Undergraduate

Tiitto, H. "Anatomy of an Archean terrane boundary: Structural analysis of the boundary between the Quetico and Wawa Subprovinces (Superior Province)"
Started: 2023/08, *Lakehead University, Thunder Bay*

Unger, A., "Tectonics of low-grade metasedimentary rocks of the Vogtland near Klingenthal"
Completed: 2016/11/21, *Technische Universität Bergakademie Freiberg*

Miebach, I., "Geology of the Ollo de Sapo formation of Iberia — A compilation of tectonic, geochronological, and geochemical data"
Completed: 2017/07/20, *Technische Universität Bergakademie Freiberg*

Hartmann, C., "Variscan tectonics of Devonian synorogenic sediments in Northwestern Cornwall / UK"
Completed: 2017/12/19, *Technische Universität Bergakademie Freiberg*

Lippke, H., "Geology of Cornwall"
Completed: 2018/03/12, *Technische Universität Bergakademie Freiberg*

Roethe, R., "Structural geology and petrography of the Eibenstock granite"
Completed: 2014/09/25, *Technische Universität Bergakademie Freiberg*

Additional Training

2021–2022 Organization of the weekly *Thermochronology Seminar* at the University of Calgary

2018 Organization and field trip co-leader, *Variscan tectonics of Cornwall, SE Britain*

2016 Organization of the international workshop *Late Paleozoic tectonic and magmatic evolution of the Erzgebirge Complex, Germany*, assistant and field trip co-leader

Publications

total times cited: 240* (336†)

h-index: 5* (7†)

13 Schaeben, H., Kroner, U., and Stephan, T. (2024): "Mathematical Fundamentals of Spherical Kinematics of Plate Tectonics in Terms of Quaternions". *Mathematical Models and Methods in Applied Sciences* 47(6). pp. 4469–4496. doi: 10.1002/mma.9823

12 Stephan, T., Enkelmann, E., and Kroner, U. (2023): "Analyzing the horizontal orientation of the crustal stress adjacent to plate boundaries". *Scientific Reports* 13:15590. doi: 10.1038/s41598-023-42433-2.

11 Járóka, T., Pfänder, J. A., Seifert, T., Hauff, F., Sperner, B., Staude, S., Stephan, T., and Schulz, B. (2023): "Age and petrogenesis of Ni-Cu-(PGE) sulfide-bearing gabbroic intrusions in the Lausitz Block, northern Bohemian Massif (Germany/Czech Republic)". *Lithos* 444–445:107090. doi: 10.1016/j.lithos.2023.107090

10 Kroner, U., Romer, R. L., and Stephan, T. (2023): "Die Rekonstruktion von relativen Plattenbewegungen aus dem paläozoischen Deformationsmuster der kontinentalen Kruste". *Zeitschrift der Deutschen Gesellschaft für Geowissenschaften (J. Appl. Reg. Geol.)*. doi: 10.1127/zdgg/2023/0365

9 Köhler, S., Duschl, F., Fazlikhani, H., Koehn, D., Stephan, T., and Stollhofen, H. (2022): "Reconstruction of cyclic Mesozoic-Cenozoic stress development in SE Germany using fault-slip

*Web of Science
†Google Scholar

and stylolite inversion". *Geological Magazine* 159 (11-12). pp. 2323–2345. doi: 10.1017/S0016756822000656

8 Kroner, U., Stephan, T., and Romer, R. L. (2022): "Paleozoic orogenies and relative plate motions at the sutures of the Iapetus-Rheic Ocean". In Y. D. Kuiper, J. B. Murphy, R. D. Nance, R. A. Strachan, and M. D. Thompson (Eds.), *New Developments in the Appalachian-Caledonian-Variscan Orogen*. Geological Society of America. doi: 10.1130/2021.2554(01)

7 Schaeben, H., Kroner, U., and Stephan, T. (2021): "Euler Poles of Tectonic Plates". In B. S. Daza Sagar, Q. Cheng, J. McKinley, and F. Agterberg (Eds.), *Encyclopedia of Mathematical Geosciences. Encyclopedia of Earth Sciences Series. Springer Nature* Switzerland AG 2021. doi: 10.1007/978-3-030-26050-7_435-1

6 Caracciolo, L., Ravidà, D. C. G., Chew, D., Janßen, M., Lünsdorf, N. K., Heins, W. A., Stephan, T., and Stollhofen, H. (2021): "Reconstructing environmental signals across the Permian-Triassic boundary in the SE Germanic Basin: A Quantitative Provenance Analysis (QPA) approach". *Global and Planetary Change*, 206:103631. doi: 10.1016/j.gloplacha.2021.103631

5 Kroner, U., Stephan, T., Romer, R. L., and Roscher, M. (2020): "Paleozoic plate kinematics during the Pannotia–Pangaea supercontinent cycle". *Geological Society, London, Special Publications* 503, SP503-2020-15. doi: 10.1144/SP503-2020-15

4 Stephan, T., Kroner, U., Romer, R. L., and Rösel, D. (2019): "From a bipartite Gondwana shelf to the arcuate Variscan belt: The Early Paleozoic evolution of northern Peri-Gondwana". *Earth-Science Reviews* 192, pp. 491–512. doi: 10.1016/j.earscirev.2019.03.012

3 Heinicke, J., Stephan, T., Alexandrakis, C., Buske, S., and Gaupp, R. (2019): "Alteration as possible cause for transition from brittle failure to aseismic slip: the case of the NW-Bohemia / Vogtland earthquake swarm region". *Journal of Geodynamics* 124, pp. 79–92. doi: 10.1016/j.jog.2019.01.010

2 Stephan, T., Kroner, U., and Romer, R. L. (2018): "The pre-orogenic detrital zircon record of the Peri-Gondwanan crust". *Geological Magazine* 156 (2), pp. 281–307. doi: 10.1017/s0016756818000031

1 Stephan, T., Kroner, U., Hahn, T., Hallas, P., and Heuse, T. (2016): "Fold / cleavage relationships as indicator for late Variscan sinistral transpression at the Rheno-Hercynian–Saxo-Thuringian boundary zone, Central European Variscides". *Tectonophysics* 681, pp. 250–262. doi: 10.1016/j.tecto.2016.03.005

Book Legler, C., Barth, A., Knobloch, A., Mruma, A. H., Myumbilwa Y., Magigita, M., Msechu, M., Ngole, T., Stanek, K. P., Boniface, N., Kagya, M., Manya, S., Berndt, T., Stahl, M., Gebremichael, M., Dickmayer, E., Repper, C., Falk, D., and Stephan, T. (2015): "Explanatory Notes for the Minerogenic Map of Tanzania 1:1,5 M.", *Geological Survey of Tanzania*. ISBN: 978-9987-477-94-4

Conference proceedings

36 Enkelmann, E. and Stephan, T. (2024): Unveiling the Northern Cordilleran Puzzle: From the St. Elias to the Mackenzie Mountains. *GSA 2024*, Anaheim, CA, USA

35 Kroner, U. and Stephan, T. (2024): Kossmat's zonation of the Central European basement in the light of the current knowledge. *GeoSaxonia 2024*, Dresden, Germany

34 Tiitto, H., Stephan, T., and Phillips, N. J. (2024): Anatomy of an Archean terrane boundary: Structural analysis of the boundary between the Quetico and Wawa Subprovinces (Superior Province). *GAC-MAC 2024*, Brandon, MN

33 Stephan, T., Perez, A., Nwakanma, M., Phillips, N. J., Hollings, P. N., and Flindell, P. (2024): Chemical and structural constraints of shear-zone hosted gold mineralization from the Archean Shebandowan Greenstone Belt (Superior Craton, NW Ontario). *GAC-MAC 2024*, Brandon, MN

32 Stephan, T. (2024): Structural control of Gold Mineralization in the Archean Shebandowan Greenstone Belt (Superior Craton, NW Ontario). *Ontario Prospectors Exploration Showcase "Exploration finds Mines!"*, Thunder Bay, ON

31 Kroner, U., and Stephan, T. (2024): The Rocky Mountain Trench — the surface expression of a Late Devonian lithospheric scale strike-slip zone? *48th Cordilleran Tectonics Workshop*, Calgary, AB

30 Stephan, T., and Enkelmann, E. (2024): All aligned on the western front of North America? — Present-day deformaton in the diffuse plate boundary zone of Alaska-Canadian Cordillera. *48th Cordilleran Tectonics Workshop*, Calgary, AB

29 Kroner, U., and Stephan, T. (2024): Initial Collision of Gondwana Promontories with Forming Laurasia — The Orogenic Record of Western Pangea in the Devonian. *Tectonics, Structural Geology and Crystalline Geology (TSK 20)*, Freiburg, GER

28 Kroner, U., Stephan, T., and Nagel, T. (2023): The Ellesmerian orogeny of Laurussia —- A far-field effect of the late Devonian collision of Gondwana with North America. *GeoBerlin 2023*, Berlin, GER

27 Stephan, T., Perez, A., Phillips, N. J., Hollings, P. N., and Flindell, P. (2023): Structural control on gold mineralization in the Archean Shebandowan Greenstone Belt (Superior Craton, NW Ontario, Canada). *AGU 2023*, San Francisco, CA

26 Stephan, T., Enkelmann, E. (2023): Identifying stress anomalies in Alaska and the Canadian Cordillera using the spherical and statistical analysis of horizontal stress. *AGU 2023*, San Francisco, CA

25 Kroner, U., Stephan, T., Nagel, T. (2023): The Ellesmerian orogeny of Laurussia —- A far-field effect of the late Devonian collision of Gondwana with North America. *GeoBerlin 2023*, Berlin, GER

24 Köhler, S., Duschl, F., Fazlikhani, H., Koehn, D., Stephan, T., and Stollhofen, H. (2023). Zooming into the transition between thrusting and strike-slip in an intra-continental compressional setting, *EGU General Assembly 2023*, Vienna, AT. doi: 10.5194/egusphere-egu23-13457

23 Stephan, T. and Enkelmann, E. (2022). What stresses the Canadian Cordillera? — Statistical analysis of the first-order intraplate stress field of western Canada, *2022 Canadian Tectonics Group Workshop*, 1 April 2022, virtual

22 Stephan, T. and Enkelmann, E. (2022). Statistical analysis of the first-order intraplate stress field of Alaska and the Canadian Cordillera, *EON-ROSE Scientific Workshop Series*, 25–28 April 2022, Nanaimo, BC, Canada

21 Schaeben, H., Kroner, U., and Stephan, T. (2022): Absolute and relative motion of three tectonic plates assuming two fixed Euler poles: I. Rotation of plates in terms of quaternions. *21st annual conference of the International Association for Mathematical Geosciences (IAMG2022)*, 29 August – 3 September 2022, Nancy, France

20 Schaeben, H., Kroner, U., and Stephan, T. (2022): Absolute and relative motion of three tectonic plates assuming two fixed Euler poles: II. Applications. *21st annual conference of the International Association for Mathematical Geosciences (IAMG2022)*, 29 August – 3 September 2022, Nancy, France

19 Kroner, U., Nagel, T., Stephan, T., and Romer, R. L. (2022): Late Devonian – Early Carboniferous Peri-Laurentian orogenies and the position of Mexican terranes. *2022 GAC-MAC-IAH-CNC-CSPG Joint Meeting*, Halifax, NS, Canada

18 Stephan, T., Kroner, U., Köhler, S., Koehn, D., Bauer, W., and Stollhofen, H. (2021). Lithospheric-scale anisotropies control first-order stress orientation during Cretaceous-Cenozoic plate kinematics in Western-Central Europe, *EGU General Assembly 2021*, online, 19–30 Apr 2021, EGU21-106. doi: 10.5194/egusphere-egu21-106

17 Duschl, F., Stephan, T., Köhler, S., Koehn , D., Stollhofen, H., and Drews, M. (2021). Compiling and correlating paleostress fields across Central Europe — A paleostress chart for northern Bavaria and adjacent areas. *EGU General Assembly 2021*, online, 19–30 Apr 2021, EGU21-106. doi: 10.5194/egusphere-egu21-10098

16 Kroner, U., Hallas, P., Stephan, T., and Romer, R. L. (2019): Superimposed structures during prolonged plate convergence — examples from the Central European Variscides. *GSA Annual Meeting*, Phoenix, Arizona, USA

15 Stephan, T., Kroner U., and Romer, R. L. (2018): The bipartite Early Paleozoic Gondwana shelf: paleogeographic control on the Sn-W mineralization along the Variscan-Appalachian orogenic belt. *GSA 2018*, Indianapolis, Indiana, USA

14 Stephan, T., Kroner U., and Romer, R. L. (2018): Multi-sample comparison of detrital zircon age spectra of Lower Paleozoic units from the Variscan-Appalachian orogenic belt. *GSA 2018*, Indianapolis, Indiana, USA

13 Stephan, T., Kroner U., and Romer, R. L. (2018): Sediment provenance control on the distribution of magmatic tin-tungsten mineralization — the Palaeozoic evolution of the northern Peri-Gondwana shelf. *Resources for Future Generations — RFG2018*, Vancouver, BC, Canada

12 Kroner, U., Stephan, T., and Romer, R. L. (2018): The architecture of the Variscan orogen – structural control of late and postorogenic Sn/W deposits. *Resources for Future Generations — RFG2018*, Vancouver, BC, Canada

11 Stephan, T., Kroner U., Romer, R. L., and Rösel, D., (2018): Early Palaeozoic evolution of the northern Peri-Gondwana shelf — reconsidering the sedimentary, magmatic and the tectono-metamorphic record. *17th TSK*, Jena, Germany

10 Stephan, T., Hallas, P., Kirsch, M., Kroner, U., and Buske, S. (2018): Crustal-scale 3D modeling of the Allochthonous Domain of the Erzgebirge-Vogtland-Fichtelgebirge area, Saxo-Thuringian Zone. *17th TSK*, Jena, Germany

9 Heinecke, J., Alexandrakis, C., Stephan, T., and Buske, S. (2018): Die Triggerung der NW-Böhmischen Schwarmbeben: eine Diskussion zu den möglichen Ursachen. *78. Jahrestagung der Deutschen Geophysikalischen Gesellschaftät*, Leoben, Austria

8 Stephan, T., Kroner, U., and Romer, R. L. (2017): Reconstruction of Early Palaeozoic Peri-Gondawna: insights from statistical analysis of the detrital zircon record. *GEOBremen2017*, Bremen, Germany

7 Stephan, T. and Kroner, U. (2017): The pre-orogenic detrital zircon record of the Variscan orogen: preliminary results. *EGU2017*, Vienna, Austria

6 Stephan, T., Kroner, U., and Hallas, P. (2016): Tectonic framework of Sn-W enriched magmatism: Examples from NW Iberia and SW England. *Erzgebirge Workshop*, Freiberg, Germany

5 Hallas, P., Stephan, T., Kirsch, M., and Kroner, U. (2016): The exhumation channel of the Erzgebirge: From heat advection to the emplacement of Sn-W enriched granites. *Erzgebirge Workshop*, Freiberg, Germany

4 Stephan, T., Hallas, P., Kroner, U., and Buske, S. (2015): Crustal-scale 3D modelling of the Allochthonous Domain of the Saxo-Thuringian Zone: constraints from the high-resolution 2D seismic profiles. *Variscan 2015*, Rennes, France

3 Stephan, T., Hallas, P., and Kroner, U. (2015): 3D modelling of the Variscan granites in the Erzgebirge-Vogtland-Fichtelgebirge area. *CETEG2015*, Kadaň, Czech Republic

2 Stephan, T., Kroner, U., Hahn, T., Hallas, P., and Heuse, T. (2014): Fold / Cleavage Relationships as Indicator for Sinistral Transpression in the Rheno-Hercynian–Saxo-Thuringian Boundary Zone, Central European Variscides. *15th TSK*, Potsdam, Germany

1 Stephan, T. and Kroner, U. (2013): Variscan Tectonics of the Schwarzburg Unit (Saxo-Thuringian Zone): from a Transform Plate Boundary Zone to an Orogenic Wedge. *GEOPilsen2013*, Plzeň, Czech Republic

Invited presentations

2022/10/18 Lakehead University, Geology Seminar Series

2022/05/11 Geological Survey Canada, McConnell Club Talks

Software developments

tectonicr Free and open-source R package for modeling and analyzing the direction of the maximum horizontal stress using relative plate motion (doi: 10.5281/zenodo.8372508).
Package website: `https://tobiste.github.io/tectonicr/`
Download: `https://CRAN.R-project.org/package=tectonicr`

structr Free and open-source R package for analyzing and visualizing orientation data for structural geology. `https://github.com/tobiste/structr`

ptrotR Free and open-source R package for plate motion reconstruction. `https://github.com/tobiste/ptrotR`

laftr Free and open-source R package to calculate the ages from LA-ICP-MS based fission track dating using the zeta approach. `https://github.com/tobiste/laftr`

euler Free and open-source R package for describing plate motion in terms of quaternions. `https://github.com/tobiste/euler`

euler.reco Free and open-source R package. Provides algorithms to find and evaluate the Euler pole solution describing the orientation of geological structures. `https://github.com/tobiste/euler.reco`

Funding, Grants, and Awards

Grants 2020–2022 DFG Research Fellowship (85 000€) — *German Research Foundation (DFG)*

2016 Travel grant (750€) — *Centre of Advanced Study and Research Freiberg*

2013 Travel grant (500€) — *TU Bergakademie Freiberg Association of Friends*

Awards Poster award at *CETEG2015*, Kadaň, Czech Republic, 2014

Professional Services and Fellowships

Memberships The Geological Association of Canada (GAC), Canadian Tectonics Group (CTG)

Reviewer for journals Geology, Gondwana Research, Terra Nova, Geological Society of America, Proceedings of the Geologists' Association, Basin Research, Lithosphere

Volunteer and Extracurricular Activities

Committee board of the Jack Henderson Best PhD Thesis Award from the Canadian Tectonics Group of the GAC (2023, 2024)

Talaria Summer Institute (TSI) — a free summer STEM research mentorship program for female and genderqueer students (July 2022)

"MINT-Camp Future Skills" — Outreach program to high school students: I taught and demonstrated 3D modelling, visualization and applications in geosciences.

International Association for the Exchange of Students for Technical Experience (IAESTE), local committee Freiberg: I mentored international student during their stay as an intern/exchange student (2010–2013)

June 4, 2024