



# GEODYNAMICS @ GRAZ

(Working Group Stüwe)

## Annual Report 2014



Department for Earth Sciences  
University of Graz  
Universitätsplatz 2  
A-8010 Graz, Austria  
phone: ++43-316-380-5682; fax: -9872  
<http://wegener.uni-graz.at>  
<http://www.alpengeologie.org>  
<http://www.africageology.org>

2014 was all in the theme of the Alfred Wegener Memorial Expedition, which took place all summer. The expedition was a full success, but we also had some set-backs in 2014: Several large grant proposals were rejected, and several students finished their thesis with fewer new students starting their projects. As a consequence, the research group saw quite a substantial reduction in 2014. Nevertheless, we managed to keep quite a strong publication record this year.....

## 1. GROUP MEMBERS

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### Postdoctoral Research Staff:

**Elena Sizova** (Postdoc 1.1.14 – 31.12.14)  
*Interest:* Numerical Modelling of Archaean processes  
*Funded by:* Lise-Meitner Grant FWF elena.sizova@uni-graz.at

### PhD students:

**Syed Ali Turab** (PhD student 1.1.2014 - 31.12.2014)  
*Interest:* Uplift history of passive margins  
*Funded by:* self supported by PAROWN Austria-Egypt; mahmoud.hassan@uni-graz.at

**Angela Oswald** (PhD student 1.1.14 – 31.12.14)  
*Interest:* Neotectonics, low-T geochron, Sinai (project currently dormant)  
*Funded by:* FWF project P22351-N22; angela.oswald@uni-graz.at

**Mahmoud Hassan** (PhD student 1.1.13 – PhD defense: 4.11.14)  
*Interest:* Metamorphic Geology of Sinai  
*Funded by:* self supported by PAROWN Austria-Egypt; mahmoud.hassan@uni-graz.at

### Masters Students:

**Gustav Hanke** (MSc student 1.1.14 – MSc defense: 16.6.2014)  
*Interest:* Neotectonics, low-T geochronology, Sinai  
*Funded by:* supported by FWF Forschungsbeihilfe Najd Fault System project

**Christian Aufreiter** (MSc student 1.1.14 – MSc defense: 25.9.2014)  
*Interest:* Landsat image interpretation Sudan digital artisanic mine detection  
*Funded by:* self supported

**Thomas Nigl** (MSc student 1.1.14 – 31.12.2014)  
*Interest:* Neotectonics Mur-Mürz valleys  
*Funded by:* self supported

- Florian Dertnig** (MSc student 1.1.14 – 31.12.2014)  
*Interest:* Augenstein landscape in Niedere Tauern  
*Funded by:* self supported
- Felix Rauschenb.** (MSc student 1.1.14 – 31.12.2014)  
*Interest:* Caledonian Geology, NE Greenland  
*Funded by:* self supported
- Simon Schorn** (MSc student 1.1.14 – 31.12.2014)  
*Interest:* Metamorphic Petrology Saualpe / Plankogel Abschiebung  
*Funded by:* self supported
- Sebastian Wiesmayr** (MSc student 1.10.14 – 31.12.2014)  
*Interest:* Geological studies of stoneage monuments in Styria  
*Funded by:* self supported
- Angela Brand** (MSc student 1.1.14 – 31.12.2014)  
*Interest:* 3D modelling of pull apart basins in Noric depression  
*Funded by:* self supported

**Bachelors Students:**

- |                              |   |                        |
|------------------------------|---|------------------------|
| <b>Erich Regelsberger</b>    | Fluvial terrace Drau Valley               | (finished in April)    |
| <b>Marlene Löberbauer</b>    | Channel Analysis Mürz valley              | (finished in February) |
| <b>Lammer-Stecher Jürgen</b> | Augensteine in Karst caves                | (finished in October)  |
| <b>Ploder Andreas</b>        | Augensteine in Karst caves                | (finished in February) |
| <b>Landler Andreas</b>       | Stone aged monuments near Vorau           | (finished in Mai)      |
| <b>Speil Andreas</b>         | Stone aged monuments in Vorau             | (finished in February) |
| <b>Thorsten Bartosch</b>     | Numerical modelling of Faults in the Alps |                        |
| <b>Ukowitz Andreas</b>       | Mapping pegmatites at Steinberg           |                        |
| <b>Baumann Christian</b>     | Petrography of pegmatites for He dating   |                        |

## 2. RESEARCH PROJECTS WITH FUNDING IN 2014

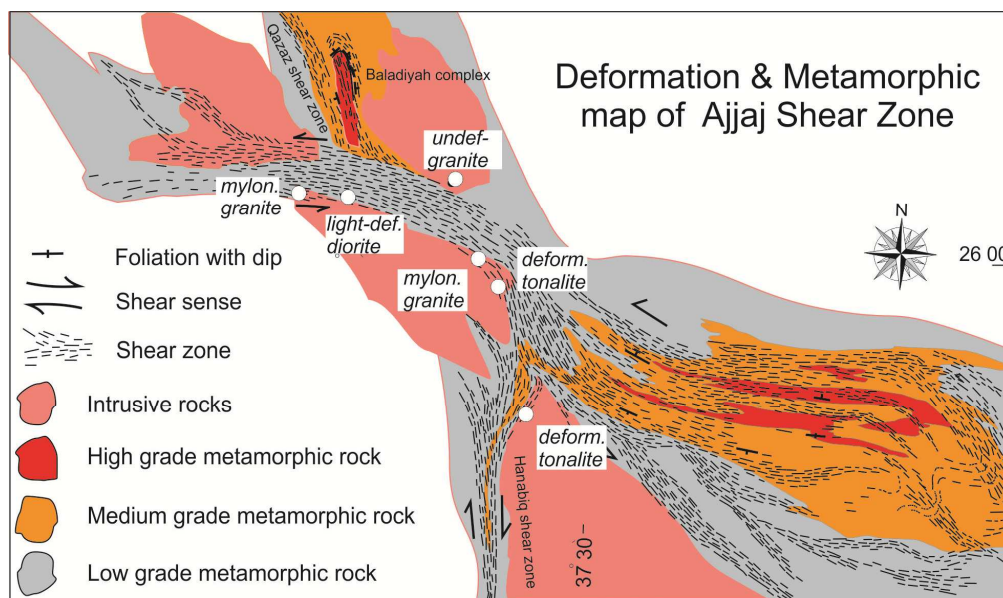
- Exhumation Mechanisms of the Najd Fault System

**Funding Institution:** FWF Project P22351 (PI Stüwe)

**Covered time:** 1.1.2014 - 30.9.2014 (project end)

**Total Funding:** spent in 2014: € 100.000,- (total funding: €333.500)

**Activity:** This project was in its 4th and final year. In 2014 papers were written and final analyses performed. Mahmoud Hassan graduated with his PhD within the project and Syed Turab started within the project a "lead over project" to new activities in Saudi Arabia.



**Figure 1:** Geological and strain map of the Ajjaj shear zone branch in Saudi Arabia (one of the major results of the Najd Fault System project).

- Alfred Wegener Memorial Expedition

**Funding Institution:** Austrian Academy of Sci., Eduard Suess (PI: Piller & Stüwe)

**Covered time:** 1.1.2014 - 31.12.2014

**Total Funding:** spent in 2014: € 47.000 (total funds: € 50000)

**Activity:** The Eduard Suess fund of the Austrian Academy of Science funded the conduct of a memorial expedition to Greenland in honor of the 100th anniversary of the discovery of continental drift theory by Wegener to Piller and Stüwe. The expedition was conducted in 2014 with full success.



**Figure 2:** Clockwise from top left: \* After 7 years in Graz we said farewell to Tamer Abu-Alam with Mahmoud Hassan, Tom Wagner, Flo Dertnig, Kurt Stüwe, Elena Sizova and Felix Rauschenbusch. \* Birthday cake by Elena. \* Watching mass movement experiments with Jörg Robl in Salzburg, \* Mahmoud Hassan graduated with his PhD. \* Kurt Stüwe with pilot Paul Claus in Alaska preparing for the Wegener Expedition. \* At GSA in Vancouver, \* With Christian Berg and Toni Drescher working on the NaWi Verein.

### 3. SCIENTIFIC PUBLICATIONS

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#### Articles of group in refereed journals:

- Hassan, M., Abu-Alam, T.S., Stüwe, K., Fowler, A. & Hassan, I. (2014): Metamorphic Evolution of the Sa'al- Zaghra Complex in the Northern Arabian-Nubian Shield: Evidence for Tectonism During Mesoproterozoic Rodinia Break-up? *Precambrian Research.*, v. 241 p. 104-128.
- Eberli T., White R., Johnson T., Roffeis C., Stüwe K., (2014). Thermobarometric constraints on pressure variations across the Plattengneiss shear zone of the Eastern Alps: implications for exhumation models during Eoalpine subduction. *Journal of Metamorphic Geology.* doi:10.1111/jmg.12069
- Hergarten, S. Robl J. & Stüwe K., (2014) . Extracting topographic swath profiles across curved geomorphic features. *Earth Surface Dynamics*, v. 2 p. 97-104
- Legrain N., Stüwe K., Wölfler A., (2014). Incised relict landscapes in a never glaciated part of the Eastern Alps. *Geomorphology*. V. 221, p. 124-138, doi:10.1016/j.geomorph.2014.06.010
- Bruand E., Gasser D., Stüwe K., (2014): Metamorphic P–T conditions across the Chugach Metamorphic Complex (Alaska)—A record of focussed exhumation during transpression. *Lithos*, v. 190–191, p. 292-312.
- Meyer S.E., Passchier C., Abu-Alam T.S., Stüwe K., (2014). A strike-slip core complex from the Najd fault system, Arabian shield, Terra Nova, doi: 10.1111/ter.12111
- Abu-Alam T.S., Hassan M., Stüwe K., Meyer S., Passchier C., (2014) Multistage Tectonism during Gondwana Collision: Baladiyah Complex, Saudi Arabia *Journal of Petrology*, p. 1-24 ; doi: 10.1093
- Legrain N., Dixon J., Stüwe K., Blanckenburg FvB., Kubik P., (2014) Post-Miocene Landscape Rejuvenation at the Eastern End of the Alps, *Lithosphere*.

#### Abstracts and conference presentations with publication year 2014:

##### EGU-ABSTRACTS:

- Meyer E., Passchier C., Abu-Alam T., Stüwe K., (2014). Strike-slip linked core complexes: A new kinematic model of basement rock exhumation in a crustal-scale fault system. EGU2014-14755.
- Stüwe K. and Piller W., (2014). The Wegener Memorial Expedition to the Greenland Caledonides. EGU2014-5128
- Stüwe K., Kadi K., Abu-Alam T., and Hassan M. (2014). The Najd Fault System of Saudi Arabia. EGU2014-5945
- Hassan M., Abu-Alam T., Hauzenberger C., Stüwe K., and Tiepolo M. (2014). Geochronological and geochemical study of the Pan African intrusive rocks along the Najd Fault system in El Wajh area, Saudi Arabia. EGU2014-12997
- Hassan M., Abu-Alam T., Stüwe K., Meyer S. And Passchier C. (2014). Metamorphic evolution of the Qazaz metamorphic complex, Saudi Arabia. EGU2014-13201
- Robl J., Prasicek G., Stüwe K., and Hergarten S., (2014). How Steep are the Alps? EGU2014-6959

REPORTS TO SGS:

- Hasan M., Stüwe K., Abu-Alam T., 2014. Geochronology and Tectonomorphic Implications of the Ajjaj Shear Zone, Saudi Arabia

OTHER CONFERENCE CONTRIBUTIONS:

- Wagner T., Fritz H., Stüwe K. (2014) Young landscape evolution around Graz at the Eastern Alps - Pannonian Basin transition zone. Pangeo Austria, Graz
- Robl Prasicek G., Hergarten S. and Stüwe K. (2014). Alpine Topography - young uplift and glacial buzz saw. Pangeo Austria
- Dertnig F., Stüwe K. and Woodhead J. (2014). Geomorphic analysis of karstifiable areas of the Niedere Tauern Region. Pangeo Austria
- Hassan M., Hauzenberger C., Abu-Alam T., Stüwe K. (2014) Geochemical signature of Pan-African intrusives along the Najd Fault System, Saudi Arabia. Pangeo Austria
- Sizova E., Gerya T., Stüwe K., Brown M., (2014) Variety of geological settings for continental silicic melt formation in th Archaean. Pangeo Austria
- Hassan M., Stüwe K., Abu-Alam T., Klötzli U. and Tiepolo M. (2014). Geochronological and petrological constraints in the evolution of the Pan African Ajjaj Shear Zone, Saudi Arabia. (AGU- San Francisco)
- Dixon J., Legrain N., Blanckenburg F., Stüwe K., (2014). Post-glacial topographic vs. tectonic forcings on erosion in the E. Austrian Alps. Goldschmidt Conference.

SAUDI GEOLOGICAL SURVEY REPORT:

- Abu-Alam, T.S., Hassan, M., Stüwe, K., Al Garani, S., Albarakati, A., Alnahdi, M. & Alshammari, A. (2014): Tectonic and Metamorphic Evolution of The Baladiyah Complex, Saudi Arabia. Saudi Geol Survey Technical Report SGS-TR-2014-1 1435H 2014G p. 1-26. (see Fig 6 for image of cover).

Public Relations Articles, talks and activities:



Figure 3: Newspaper article on the Alfred Wegener Expedition

- Kronenzeitung Freitag 22.August 2014: Grönland Abenteuer mit Uralt Flieger (Kopacka)
- Barbara Feier 5.12.2014 Die Alfred Wegener Memorial Expedition nach Grönland
- Film: The Alfred Wegener Expedition (for download at [wegener.uni-graz.at](http://wegener.uni-graz.at))
- Imatgeo on Mondays EGU Blog Nov. 24th 2014



*Figure 4: One of the photos from the EGU blog-series "Imatgeo on Mondays"*

### Cooperation partners:

In 2014, we had a close cooperation with the following partners:

- **Prof. Fin Stuart** (Glasgow University): Prof. Stuart is involved as a co-supervisor for Syed Turabs Phd. Fin also came to Graz for a week to present a talk and do field work with Stüwe and Flor Dertnig to sample pegmatites for He isotopes and Augensteine for Ne<sup>21</sup> dating.
- **University of Malaya:** Through the contact of Christoph Hauzenberger, a cooperation with the Earth Science department at the University of Malaya in Kuala Lumpur was established. Prof. Tham Fatt and his PhD student Mustafa (working on Neotectonics of the Malay peninsula) are now close cooperation partners. Several trips to Malay Uni were done in 2014.
- **Dr. Massimo Tiepolo** (University of Pavia) was involved in Zircon dating for Mahmoud Hassans Phd.
- **Prof. Urs Klötzli** (Vienna University) was involved in the Najd Fault System project and helped with zircon dating.
- **Prof. Christoph Spötl** (Innsbruck) helped with the dating of speleothems in the Nieder Tauern region
- **Prof. Jon Woodhead** (Melbourne University) helped with U-Pb dating of speleothems from the Niedere Tauern.
- **Gerald Raab** came with us to Greenland to help as a field assistant to Felix Rauschenbusch for his MSc mapping project in The NE Greenland Caledonides.





**Figure 5:** Images of the Alfred Wegener Expedition: Clockwise from top: \* Supervising students Gerald Raab and Felix Rauschenbusch in the field in Greenland. \* Spectacular camp in Greenland \* Alfred Wegener's sled - discovered for the first time in 100 years! \* Spectacular geology of Greenland. \* Plane and iceberg. \* Paul and Kurt in the 62 year old Cessna 180. \* Landing between icebergs in Greenland. \* Felix Rauschenbusch and Gerald Raab after their successful field work.

## 4. TEACHING AND EDITING ACTIVITIES

### EDITORIAL RESPONSIBILITIES

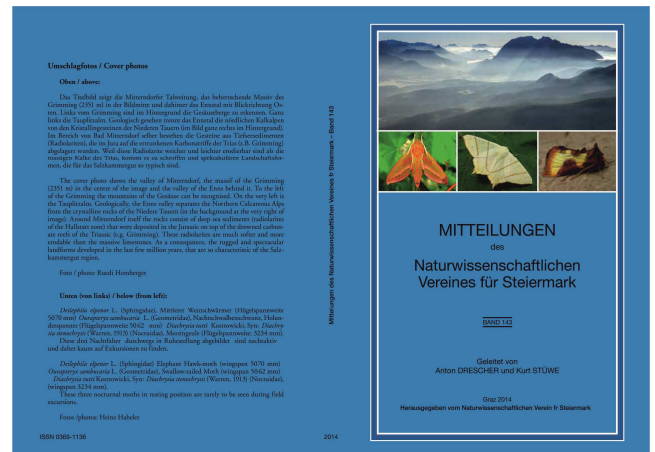
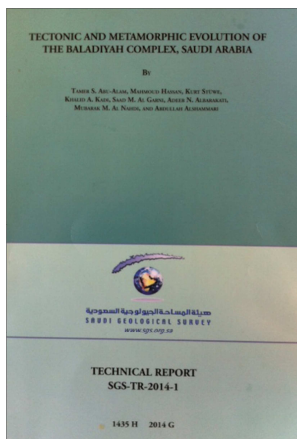
- Lecture Notes in Earth Science (Springer) (Chief Editor)
- Mitteil. des Naturwiss. Vereins für Steiermark (Editor: Earth Sci.)

### EDITORIAL BOARD MEMBERSHIPS

- Journal of Metamorphic Geology (editorial board member)
- Journal of the Virtual Explorer (editorial board member)
- Journal of Asian Earth Science (editorial board member)
- Austrian Journal of Earth Science (editorial board member)

### EDITED JOURNAL VOLUMES

- Drescher A., and Stüwe K., 2014 (eds.) Mitteilungen des Naturwissenschaftlichen Vereins für Steiermark, vol., 143, 256 p.



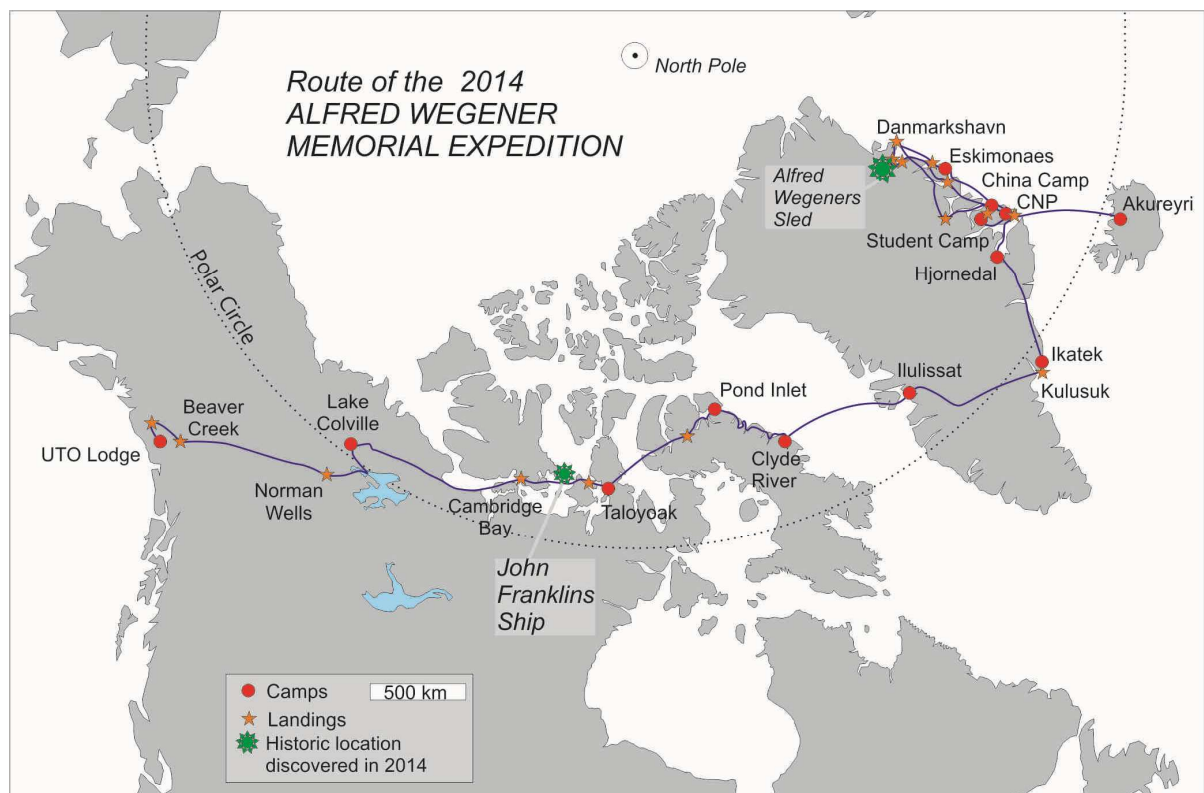
**Figure 6:** Saudi Geol Survey Report SGS-TR-2014-1 and volume 143 of the Mitteilungen of the Naturwissenschaftliche Verein Steiermark. Both volumes were written and edited by the research group in 2014.

## UNDERGRADUATE TEACHING

*Einführende Exkursionen (2 days)*  
*Kristallingeologie (3 hours a week)*  
*Lithosphärenprozesse (2 hours a week)*  
*Geodynamics (1 hour a week)*  
*Neotektonik (2 hours a week)*

### Field trips, conference trips and other activities:

- EGU (27.4. - 2.5.2014 in Vienna) (K. Stüwe)
- Pangeo Austria (14.9. - 19.9.2014 in Graz) (E. Sizova, F. Dertnig and M. Hassan)
- GSA (19.10.-22.10.2014 in Vancouver) (K. Stüwe)
- Dr. Khalid Kadi and Dr. Mubarak Nahdi from the Saudi Geological Survey in Jeddah came for a brief visit to Graz in April.
- Several trips to the University of Malaya in Kuala Lumpur



**Figure 7:** Route of the Alfred Wegener Memorial Expedition



*Figure 8: Logo of the Alfred Wegener Expedition*