



GEODYNAMICS @ GRAZ

Annual Report 2012 (Working Group Stüwe)



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After years of mostly conceptual studies in metamorphic petrology, structural geology and neotectonics, the year of 2012 saw the GEODYNAMICS@GRAZ group around Kurt Stüwe move towards more applied subjects. This shift is predominantly motivated by new, substantial, industry-funded research projects. We are now applying our skills and experience from high-grade Proterozoic terranes (in particular from the Arabian Nubian Shield) to other shield terranes in Arica. Our research activities accompany exploration programmes in African countries. We are also starting up with development aid programmes instigating exchange programmes with geologists from several African Universities. However, our research projects on Alpine tectonics also continue with one FWF and one ESF projects operating in 2012. Overall it has been a productive year

This annual report lists all activities performed through direct funding of Stüwe in 2012. Co-supervised theses, Co-PI ships and similar are not listed.

1. GROUP MEMBERS

Kurt Stüwe Group leader, department staff

Postdoctoral Research Staff:

Tamer Abu-Alam **(full time Postdoc 1.1.12 – 31.12.12)**
Interest: Metamorphic Geology of the Arabian-Nubian Shield
Funded by: FWF P22351-N22 >May, "Geol of Sudan" <May); tamer.abu-alam@uni-graz.at

Jörg Robl **(full time Postdoc 1.1.12 – 31.10.12)**
Interest: Numerical Modelling, remote sensing
Funded by: GRA project; contact: joerg.robl@uni-graz.at

Daniel Reif **(full time Postdoc 1.1.12 – 31.10.12)**
Interest: Structural Geology, field work, mapping
Funded by: GRA project; contact: daniel.reif@uni-graz.at

Farid Makroum **(full time Postdoc 1.1.12 – 31.10.12)**
Interest: geology of the Arabian-Nubian Shield, structural geology
Funded by: GRA project + independent funds; contact: fmakroum@mans.edu.eg

Stefan Hergarten **(75% Postdoc 1.1.12– 31.12.12)**
Interest: Geodynamics, numerical modelling
Funded by: ESF project I-152; GRA to end of year; stefan.hergarten@uni-graz.at

Karin Ehlers **("geringfügig" Postdoc 1.1.12– 31.12.12)**
Interest: Project management; international relations
Funded by: GRA project; karin.ehlers@uni-graz.at

PhD students (only full time students with Stüwe as principal advisor listed)

Angela Oswald **(PhD student 1.1.12 – 31.12.12)**
Interest: Neotectonics, low-T geochron, Sinai
Funded by: FWF project P22351-N22; contact: angela.oswald@uni-graz.at

Mahmoud Hassan (PhD student 1.7.12 – 31.12.12)
Interest: Geochronology, Arabian Nubian Shield
Funded by: PAROWN Austria-Egypt; contact: mahmoud.hassan@uni-graz.at

Nicolas Legrain (PhD student 1.1.12 – 1.2.12)
Interest: Neotectonics, landscape evolution of the Alps
Funded by: ESF-FWF I-152; contact: nicolas.legrain@uni-graz.at

Masters Students with funding

Gustav Hanke (MSc student 1.1.12 – 31.12.12)
Interest: Neotectonics, low-T geochronology, Sinai
Funded by: supported by FWF Forschungsbeihilfe Najd Fault System project

Non-scientific

Gisela Domej (1.4.12 – 31.10.12)
Interest: Project Administration
Funded by: GRA project; contact: g.domej@gmail.com

Masters and Bachelors Students currently under principal supervision of Stüwe

Thomas Nigl	(MSc student)	Neotectonics Mürz valley
Christian Aufreiter	(MSc student)	Remote sensing, Sudan (with Sulzer - Geography)
Florian Dertnig	(MSc student)	No defined subject
Christian Aufreiter	(BSc student)	Augensteine provenance studies
Sandra Petersmann	(BSc student)	Augensteine provenance studies
Jürgen Lammer	(BSc student)	Augensteine provenance studies
Andreas Ploder	(BSc student)	Augensteine provenance studies
Andrea Höfler	(BSc student)	Augensteine provenance studies
Susanne Roskogler	(BSc student)	Hochschwab, structural geology.
Christoph Kralj	(BSc student)	Numerical modelling Mürz valley
Marl. Löberbauer	(BSc student)	Map interpretation Mürz valley
Erich Regelsberger	(BSc student)	Fluvial terrace mapping Drau valley
Thomas Gerstl	(BSc student)	Folding of Plattengneiss shear zone
Ines Korbuly	(BSc student)	Fluvial terrace mapping Drau valley

2. RESEARCH PROJECTS WITH FUNDING IN 2012

In 2012 a total of 4 research projects with substantial funding operated in our research group. In total, these 4 projects involve roughly 1.7 Mio Euro of which about € 600.000,- were spent in 2012.

TOPOALPS: 4D kinematics of the Neogene Eastern Alps

- **Granting Institution:** ESF / FWF project I-152 (PI Stüwe)
- **Covered time:** 1.1.2012 - 31.8.2012
- **Total Funding:** spent in 2012: € 50.000,- (total fund: € 364000)
- **Activity:** After 3 successful years, this project came to a final end in August 2012. Postdoc Wölfler was on paternity leave towards the end of the project and PhD student Legrain moved back to France. Therefore several manuscripts and the graduation of Legrain are still outstanding at the end of 2012, but great mapping results of paleosurfaces, U-He ages from many locations in the eastern Alps (with Ehlers in Tübingen), cosmogenic isotope data (with Blankenburg in Potsdam) from the Koralpe and fission track ages from the Katschberg detachment (with Fügenschuh in Innsbruck) are ready for publication.

Exhumation Mechanisms of the Najd Fault System

- **Granting Institution:** FWF project P22351 (PI Stüwe)
- **Covered time:** 1.1.2012 - 31.12.2012
- **Total Funding:** spent in 2012: € 90.000,- (total funding: € 87.000)
- **Activity:** After a slow start in 2011, this project is in full swing in 2012. Tamer returned to the project after a year interruption with the GRA project in mid 2012. PhD student A. Oswald and Postdoc T. Abu-Alam completed a 2nd field season in Saudi Arabia and in Sinai in March, analytical work is now in progress and first manuscripts are being written. Three core complexes in western Saudi Arabia were visited and mapped. Towards the end of 2012 Mahmoud Hassan started as a new PhD student on the project (independently funded) focusing on geochronology. A paralleling project in Mainz with C. Passchier (and PhD student Sven Meyer) operates in close coordination with our project.

Geology of Sudan

- **Granting Institution:** SPmining Madrid (industry funded)
- **Covered time:** 1.1.2012 - 31.5.2012
- **Total Funding:** spent in 2012: € 100.000 (total funds: € 210000).
- **Activity:** This project involved predominantly remote sensing studies of the shield terranes in northern Africa. The project operated in 2011 and 2012 and came to an end in May 2012. Postdoc J. Robl created country-wide coverage of high resolution imagery now readily usable through interactive online tools on the new web domain in the group: www.africageology.org. Geological mapping, geochemistry and geochronology of various granites in shield areas of Sudan was performed. Postdoc T. Abu-Alam was partially funded through this project until mid-2012.

Geological Research in Africa

- **Funding Institution:** SPmining Madrid (industry funded)
- **Covered time:** 1.1.2012 - 31.12.2012
- **Total Funding:** spent in 2012: € 420.000 (total funds: € 840000)
- **Activity:** Based on the successful preliminary project "Geology of Sudan", this project was instigated as a lead-in one-year project in preparation for larger activities in future. However, already, this project is one of the largest geological research projects in Africa at an Austrian University for many years. During the year of 2012 a total of 4 Postdoctoral fellow and 2 New PhD students were funded through this project. Exchange programmes with universities in Sudan, Chad and Mauretania were started. Government visits in Guinea Conakry, Guinea Bissau, Mauretania, Chad and Sudan were performed and university relationships established with several countries.



Field images of 2012, clockwise from top left: * Bakka student E. Regelsberger measuring elevations of terraces in the Drau valley. * Postdoc T. Abu-Alam discussing maps with geologists from Saudi Geological Survey in Saudi Arabia. * PhD student A. Oswald and MSc student G. Hanke mapping geomorphology in Sinai. * Field assistant sampling soils in Sudan. * G. Hanke sampling for cosmogenic isotope dating in Sinai. * Postdoc T. Abu-Alam and K. Stüwe with garnet crystals in Saudi Arabia.

3. 2012 SCIENTIFIC PUBLICATIONS

3.1. Articles of group in refereed journals that appeared in 2012:

- Gasser, D., Rubatto D., Bruand E., Stüwe K. (2012). Large-scale, short-lived metamorphism, deformation, and magmatism in the Chugach metamorphic complex, southern Alaska: A SHRIMP U-Pb study of zircons. *GSA Bulletin*, v. 124, p. 886–905; doi: 10.1130/B30507.1.
 - Wölfler, A., Stüwe K., Danisik M., Evans N. (2012). Low temperature thermochronology in the Eastern Alps: Implications for structural and topographic evolution. *Tectonophysics*, 541-543, p. 1-18.
 - Gasser D., Bruand E., Rubatto D., Stüwe K. (2012). The behaviour of monazite from greenschist facies phyllites to anatectic gneisses: an example from the Chugach Metamorphic Complex, southern Alaska. *Lithos*. ISSN 0024-4937. v. 134-135, p. 108- 122 . doi: 10.1016/j.lithos.2011.12.003.
 - Grosch, E.G., Vidal, O., Abu-Alam, T.S. & McLoughlin, N. (2012). PT constrains on the metamorphic evolution of the Paleo-Archean Kromberg type-section, Barberton greenstone belt, South Africa, *Journal of Petrology*, 53, 513-545.
 - Hergarten S. (2012). Branching with local probability as a paradigm of self-organized criticality. *Phys. Rev. Lett.*, 109: 148001, doi 10.1103/PhysRevLett.109.148001.
- Hergarten S. (2012). Topography-based modeling of large rockfalls and application to hazard assessment. *Geophys. Res. Lett.*, 39: L13402, doi 10.1029/2012GL052090.
- Dertnig F., Stüwe K. (2012). Neukartierung des Großen Beilsteins und des umliegenden Bereichs im Hochschwab Gebiet. *Mitteilungen des Naturwissenschaftlichen Vereins für Steiermark*, v. 142, p. 27-44.
 - Stüwe K., Drescher A. (2012). Wie verfasse ich einen Beitrag für eine Zeitschrift. *Mitteilungen des Naturwissenschaftlichen Vereins für Steiermark*, v. 142, p. 117 - 144.

3.2. Books and Maps:

- Stüwe K., Homberger R. (2012). High above the Alps. A Bird's Eye View of Geology. Weishaupt publishers. 297 p.
- Stüwe K., Homberger R. (2012). 4th edition of: *Geologie der Alpen aus der Luft*. Weishaupt publishers. 297 p. (The great success of the 2011 published book resulted in a fully revised 4th edition in 2012).
- Hand M., Scrimgeour I., Stüwe K., Arne D., Wilson C.J.L., Carson C. (2012). *Geology of northern Jetty Peninsula, Mac Robertson Land*, 1st edition, 1:25.000 Geoscience Australia.

3.3. Abstracts and conference presentations with publication year 2012:

EGU-POSTERS:

- Stüwe K., Hergarten S. (2012). An approximate fluvial equilibrium topography for the Alps Poster AS458, Session TS4.4/G6.1/GD3.8 TopoEurope, EGU2012-5573.

- Hergarten S., Stüwe K. (2012). A puzzle about the Scandinavian topography Session TS4.4/G6.1/GD3.8 TopoEurope, EGU2012-7397.
- Hergarten S. (2012). Topography-based modelling of large rock avalanches and application to hazard assessment. EGU General Assembly 2012, Geophysical Research Abstracts, 14: EGU2012—1973.
- Birk S., Hergarten S. (2012). Estimation of aquifer parameters from the recession of spring hydrographs – Influence of flow geometry. EGU General Assembly 2012, Geophysical Research Abstracts, 14: EGU2012—9777.
- Abu-Alam T., Stüwe K. (2012). Principal stresses flipping during the East-West Gondwana Collision. Session TS10.6 Gondwana, EGU2012-8237.
- Sultan Y., Abu-Alam T., Stüwe K. (2012). Tectonic setting of South Sinai metamorphic Belts. Session TS10.6 Gondwana, EGU2012-8344.
- Oswald A., Stüwe K. (2012). Geomorphology in a rifting environment. Can channel profiles from arid Sinai, Egypt provide constraints on tectonics? Session TS4.3 Orogen scale coupling tectonics-topography., EGU2012-7474.
- Hanke G., Oswald A., Stüwe K. (2012). U-He dating of the highest peak in Sinai, Egypt. Session TS4.3 Orogen scale coupling tectonics-topography., EGU2012-2427.
- Abu-Alam, T.S. & Hamdy, M. (2012). Thermodynamic modelling of Sol Hamed serpentinite, South Eastern Desert of Egypt: implication for two serpentinization stages in the Arabian-Nubian Shield ophiolites. European Geosciences Union General Assembly, EGU2012-8376.

EGU TALKS

- Abu-Alam T., Stüwe K. (2012). The Butana Region of Central Sudan: Sahara Craton or Arabian-Nubian Shield? Session TS10.6 Gondwana, EGU2012-8291.
- Hassan M., Fowler A., Hassan I., Abu-Alam T., Stüwe K. (2012). Tectonic evolution of the Pan-African arc assemblage in Southern Sinai An example from the Sa'al-Zaghra belt. Session TS10.6 Gondwana, EGU2012-8112.

OTHER CONFERENCE CONTRIBUTIONS:

- Stüwe K. (2012). Geology of the Alps and Glaciers. 5th HGSFP Winter School 21-25.Jan 2012 Obergurgl. Book of Abstracts. p. 7.
- Robl J., Stüwe K., Neubauer F. (2012). Alpine Landschaftsentwicklung in unterschiedlichen räumlichen und zeitlichen Skalen. Pangeo Austria 15.-20.9.2012. Abst. vol., p. 117-118.
- Abu-Alam T. Stüwe K. (2012). On the evolution of the Arabian-Nubian Shield and the largest shear zone on the Earth, AGU Fall meeting San Francisco.
- Johnston S., Hartz E., Stüwe K., Gehrels G.E. (2009). Small volume LA-MC-ICP-MS geochronology and evidence for Archean source terrains in Krummedal Sequence pelites, Milne Land, East Greenland. GSA Fall meeting 2009 (vergessen bei früheren Jahresberichten, daher hier angeführt).
- Hassan, M., Abu-Alam, T.S., Stüwe, K., Meyer, S. & Passchier, C. (2012). On the evolution of the Arabian-Nubian Shield and the largest shear zone on the Earth. American Geophysical Union's 45th annual Fall Meeting (AGU) – San Francisco; December 3-7, 2012 (abstract: T23B-2669).
- Abu-Alam, T.S. & Grosch, E. (2012). Metamorphic Evolution of Selected Pan-African Terrains across central Gondwana. American Geophysical Union's 45th annual Fall Meeting (AGU) – San Francisco; December 3-7, 2012 (abstract: V23D-2859).

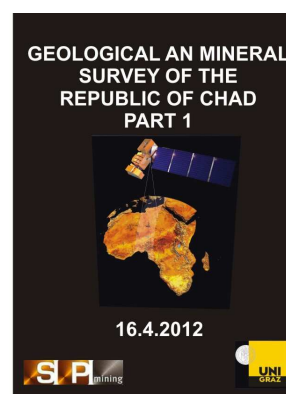
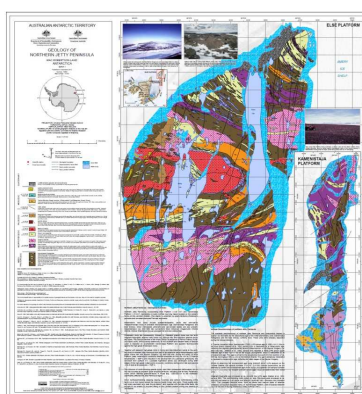
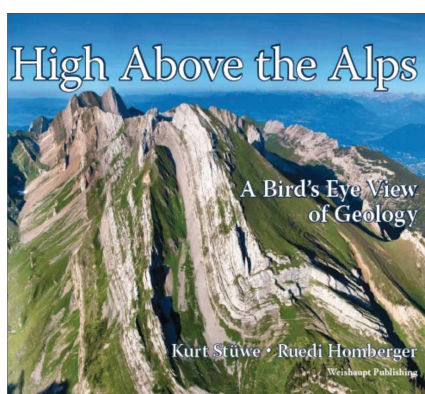
- Grosch, E., McLoughlin, N., Abu-Alam, T.S. & Vidal, O. (2012). A petrological study of Paleoproterozoic rocks of the Onverwacht Group: New insights into the geologic evolution of the Barberton Greenstone Belt, South Africa. American Geophysical Union's 45th annual Fall Meeting (AGU) – San Francisco; December 3-7, 2012 (abstract: V51B-2790).

3.4. Public Relations Articles, talks and activities:

- Stüwe K. (2012). Geologie der Alpen aus der Luft. Naturwissenschaftlicher Verein für Kärnten Frühjahrstagung. Spital an der Drau 5.5.2012.
- Stüwe K. (2012). Kontinentalverschiebung. Urania 15.5.2012 Graz public lecture within the Urania Series on Alfred Wegener.
- Stüwe K. (2012). Geologie der Alpen aus der Luft. Alpenverein Krieglach. 9.2.2012 Krieglach.
- Stüwe K. (2012). New aspects of the geology of the Alps. Freiburg im Breisgau, Department seminar 12.11.2012.
- Stüwe K., (2012). New aspects of the geology of the Alps. Salzburg University, Department seminar 13.11.2012.
- Stüwe K., (2012). Tectonic Aspects of Ore Deposit Formation on the Arabian-Nubian Shield. Lecture to Geological Research Authority of Sudan (GRAS), March 2012 in Khartoum.

3.5. Unpublished Reports:

- Stüwe K., Reif D., Regelsberger E., Robl J., Ehlers K., Domej G. (2012). Geological and Mineral Survey of the Republic of Chad. Part 1. SPmining survey team at Graz University, technical Report No 7, 159 p.
- Stüwe K., Abu-Alam T., Robl J., Ehlers K. (2012). 1st Geochemical Soil Survey of the Butana Concession C11. SPmining survey team at Graz University, technical Report No 6, 202 p. With 5 Maps.
- Stüwe K., Robl J. (2012). Geological and Mineral Survey of the Republic of Chad. Part 2. SPmining survey team at Graz University, technical Report No 8., interactive Website on remote sensing in Chad. <http://www.africageology.org>



Three of the most looked at publications of the group in 2012: **Left:** Picture book High above the Alps. **Centre:** Geological Map of Mac Robertson Land, Antarctica published by the Australian Geol. Survey. **Right:** a 159 page booklet on the geology of Chad as part 1 of a country-wide survey (Part 2 being an interactive website at www.africageology.org)

3.6. Events:

MAP OF THE INNER CITY OF GRAZ



Modern Structural and Metamorphic Techniques to Unravel Secrets of the Pan-African Orogeny



WORKSHOP PROGRAM

7.5. – 11.5.2012 University of Graz

Contacts:
If you need help, please contact the team of organisers:

- Gisi Domej (organisational ass.); email: gisi.domej@node.at; mobile: +43 681 10622318
- Dr. Daniel Reif (organisational ass.) email: d.reif82@gmail.com; mobile: +43 681 20921016
- Dr. Tamer Abu-Alam; email: tamer.abu-alam@uni-graz.at; mobile: +43 664 1521050
- Prof. Dr. Kurt Stüwe; email: kurt.stuewe@uni-graz.at; mobile: +43 664 1242418




Pan African Workshop. In the time 6.-12.5.2012 a workshop on the metamorphic geology of the Arabian Nubian Shield was organised by Abu-Alam and Stüwe. There were 35 attendants from 5 different African countries. The workshop was taught by B. Grasemann (structural geology), C. Passchier (field mapping techniques), J. Robl (remote sensing), T. Abu-Alam (metamorphic petrology) and K. Stüwe (ore deposits in Arabian Shield)

EINLADUNG



100 Jahre Plattentektonik
von Alfred Wegener
und ihr Einfluss auf die Biogeographie

Eintrittsgeld auslässlich des 100-jährigen Bestehens des Naturwissenschaftlichen Vereins für Steiermark
Aula der Karl-Franzens-Universität, Graz Freitag, 9.11.2012, 10:00 Uhr

Alfred Wegener Symposium. On 9.11.2012 a 1-day symposium in honour of the 100st anniversary of Alfred Wegener's discovery of continental drift was organized under the auspices of the Naturwissenschaftlicher Verein für Steiermark. Prof. C. Sengor (Turkey), S. Renner (Munich) W. Piller (Graz) and T. Drescher (Graz) were invited as speakers.

4. TEACHING AND EDITING ACTIVITIES

4.1. EDITORIAL RESPONSIBILITIES

- Lecture Notes in Earth Science (Springer) (Chief Editor Stüwe)
- Mitteil. des Naturwiss. Vereins für Steiermark (Editor: Earth Sci. Stüwe)
- Mineralogy & Petrology (Spec Issue guest ed.: Abu-Alam)

4.2. 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)

4.3. EDITED JOURNAL VOLUME

- Drescher A., and Stüwe K., 2012 (eds.)
Mitteilungen des Naturwissenschaftlichen
Vereins für Steiermark, vol., 142, 272 p.



4.4. REVIEWS AND EVALUATIONS

Kurt Stüwe was again involved in several reviews and evaluations of granted, selection committees, scientific publications both in Austria and several other countries. Stüwe continues to act as scientific advisor to book projects of Springer publishers, and works with Swiss Science fund, German science foundation DFG, as well as with ARC, NSF and FWF.

4.5. BSc and MSc COURSE WORK TEACHING

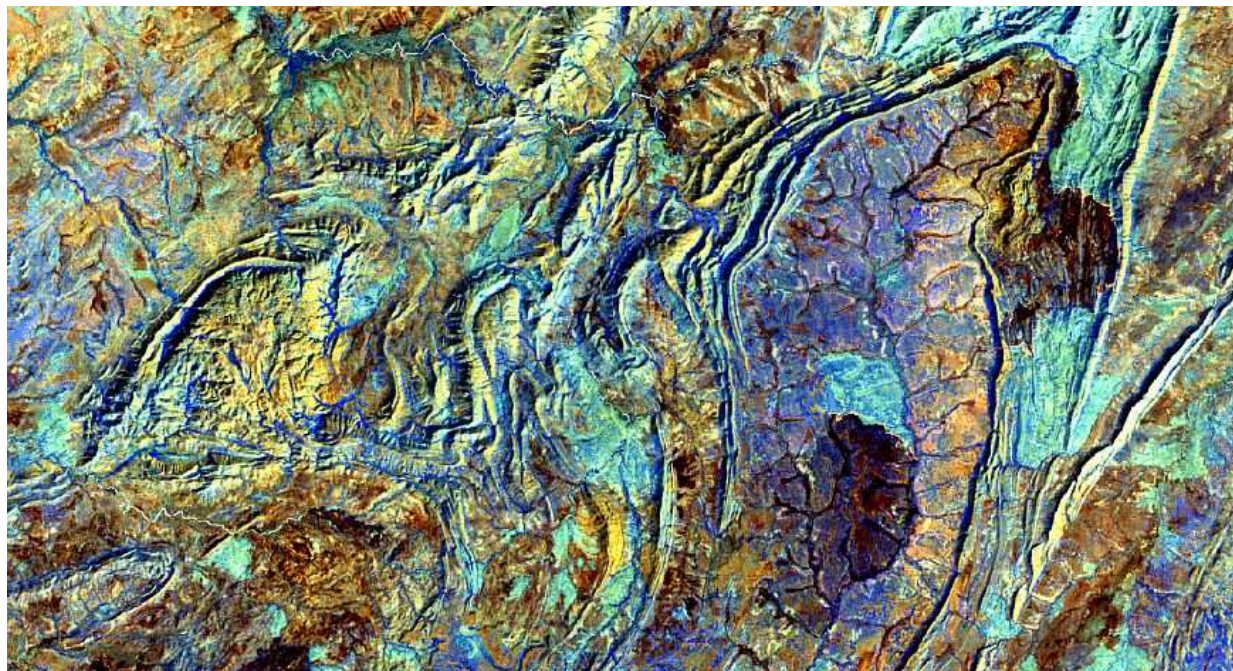
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|-----------------------------|------------------|------------|
| • Einführende Exkursionen | (2 days) | (Stüwe) |
| • Kristallingeologie | (3 hours a week) | (Stüwe) |
| • Lithosphärenprozesse | (2 hours a week) | (Stüwe) |
| • Geodynamics | (1 hour a week) | (Stüwe) |
| • Seminar for Bakkstudenten | (1 hour a week) | (Stüwe) |
| • Advanced Petrology | (2 hours a week) | (Abu-Alam) |

4.6. FIELD TRIPS AND OFF-CAMPUS ACTIVITIES:

- | | |
|---|---------------------|
| • Chad / Sudan field trip | January |
| • Sinai field trip Stüwe | February |
| • Sinai field trip Oswald / Hanke | April |
| • Saudi / Sudan field trip with students | March |
| • Chad field trip with mapping team | November |
| • Turkey, Alaska, Dolomites | (holiday Stüwe ;-)) |
| • Guinea Bissau / Mauretania field trip | June |
| • several trips to Madrid (sponsor reporting) | |
| • EGU conference Wien | April |
| • AGU conference San Francisco (Abu-Alam) | December |
| • Pangeo conference Salzburg | September |

4.7. OTHER:

- Two of our former PhD students obtained permanent academic positions in 2012: D. Gasser at the Norwegian Geol Survey in Trondheim, J. Robl at Salzburg University. Congratulations!
- Hassan Abbas (who had on a 6 month scholarship to work in our group in 2011) finished his MSc in Egypt this year. Congratulations!
- Stüwe continues to be president of the *Naturwissenschaftlicher Verein für Steiermark* in 2012. We continue to work the new face of this association in 2012. See: <http://www.uni-graz.at/~nwvst/>
- Bad news: several grant proposals were rejected in 2012: Jörg Robl was declined an FWF grant, Elena Siszova was declined a Lise Meitner Fellowship, a manuscript of PhD student Nicolas Legrain was rejected.
- The summer journal "Kinder-Kleine" published in 2012 a special article on Greenland activities of Stüwe.
- In fall 2012 Stüwe tackled to modernise the specimen exhibition in front of the institute. This project will take us still into 2013.



Our Research group maintains three web domains that contain more information on our activities:

<http://wegener.uni-graz.at>

<http://www.alpengeologie.org>

<http://www.africageology.org>