



GeoScience-Laboratory Internal ITC report 2008

J.B. de Smeth, Head GS-Lab.
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1. Overview

The GeoScience Laboratory operated successfully to fulfill the objectives for which it was created. It forms part of the ITC's Bureau Research Coordination (BRC). In 2008 the geochemical laboratory (GWS-Lab) was combined with the spectrometric facilities of the former RSG Lab. The GS-Lab was used intensively in 2008. Especially the months of September to November were full of laboratory activities related to MSc. research. The amount of chemical laboratory work was comparable to the previous year but the demand for the IR spectrometers increased so much that there was a shortage in field spectrometers.



Fig. No. 1: WREM course participants analyzing water samples using an ICP-OES and AAS



Fig.No. 2: AES students receiving training in the use of PIMA and ASD infra red field spectrometers.

2. Activities, description

The regular activities related to educational programs consisted of:

- Introduction visits including brief instrument demonstrations for NRM, WREM and AES students to the laboratory facilities as well as the new spectrometric lab.
- Student training & demonstrations of WREM students in the period of module 7 in water analysis, anion analysis by UV-Vis spectrometer, AAS and ICP-AES.
- Training of AES- Earth Resource Exploration stream students in geochemical mineral exploration techniques.
- Training of students as part of the Hydrologic and Environmental Modeling from the WRES Dept. The students mainly analysed water sample from the Drienense Beek for water quality analysis; major anions by spectrometry, pH, electric conductivity (EC) and major cations by ICP-AES and Flame-AAS.

Aside of these regular teaching activities, the following research related activities took place:

Staff Research:

A number of staff and PhD researchers from the ESA, NRS and WRS departments are using lab facilities for activities ranging from very simple sample treatment procedures to complicated tests and analytical procedures. Here below a few of the 2008 activities are listed and illustrated.

Note : There are no pictures of all staff and students who worked in the GS laboratory in 2008.



Fig No. 3: Ms. Fekerte Yitagesu, PhD researcher ESA Dept. determining the swelling clay capacities of her soil samples from Ethiopia using the methyl blue method as part of her research on the estimation of swell-shrink parameters by RS methods.

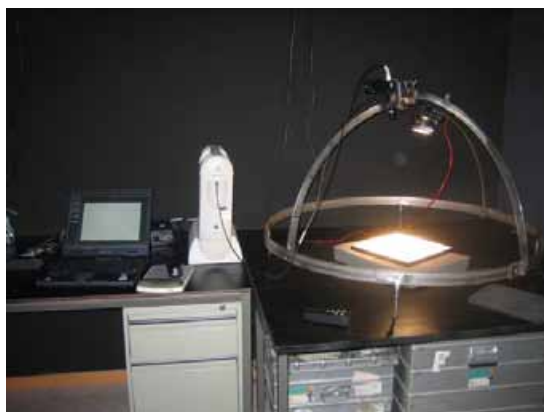


Fig. No.4: Angular scanning sphere for the ASD field spectrometer as developed for the research of Ms Mila Luleva , PhD researcher ESA Dept. on spectral reflectance, chemical analysis and RS for the identification of soil erosion and desertification in Murcia province SE-Spain



Fig.No.7: Mr. Chris Hecker MSc, staff member of ESA Dept. is the main operator of the Bruker-Optosol FTIR equipment. He also uses the instrument for his own PhD research on silicates.



Fig. No.5: Ms. **Thi Tam Nguyen**, PhD researcher ESA Dept. and **Ms. Regina Brown**, AES-MSc, worked on hyperspectral remote sensing detection of hydrocarbon polluted soil from a NAM site near Assen using the Bruker Vertex 70 FTIR.



Fig. No.6: **Ms. Mariela Yevenes**, PhD researcher WRS Dept and **Ms. Fransiska Gamises**, WREM MSC, carried out denitrification tests on soils from Alentejo, Portugal over a period of 30 days involving daily sampling and measurements.



Fig. No. 8: **Alain Frances**, PhD researcher WRS Dept., extensively tested three different chlorine determination methods suitable for measuring his water samples in Spain.



Fig No. 9: Mr. **Leonardo Reyes**, PhD researcher WRS Dept. comparing the accuracy of different soil moisture meters under lab conditions before starting his work in Spain

The PhD- and MSc research required extensive use of the HACH spectrophotometer, the Perkin-Elmer Flame AAS and the Varian ICP-OES for cation and anion concentration measurements. All three instruments performed without problems.

The laboratory gas consumption in 2008 amounted to six bottles of Argon, one bottle of Acetylene and three bottles of Nitrogen. The nitrogen bottles are used for the flushing of the Bruker FTIR. About 70 liter of liquid nitrogen was obtained in ten liter portions from the University of Twente, free of costs.



Fig No. 10: After field spectrometric measurements **Ms. Si Yali**, PhD researcher NRS dept., dried grass samples from Groningen which will be further analysed in an external laboratory



Fig. No.11: Mr. **Juan Francisco Sanchez** PhD researcher ESA Dept. re-developed a classical raindrop energy measurement device to compare with modern measuring instruments



Fig No. 12: Ms. **Laura Dente** PhD researcher WRS Dept. is calibrating her soil moisture probe on a day to day basis in different soil samples with constant bulk density.



Fig.No13: Ms. **Filiz Bektas Balcik** and Ms **Nicky Knox**, PhD researchers NRS Dept. test the ASD spectrometer under "field conditions" under supervision of **Dr. H. van der Werff**, ESA Dept. before starting fieldwork in South Africa

M.Sc research related :



Fig. No.14: **Dr. A. Gieske**, staff member WRS Dept. with WREM MSc. students **Mr. Getinet Jebessa** and **Mr. Alema Tesfay Fissuh** optimize Chlorine analysis by ion selective electrode



Fig.No.15: **Ms Fransiska Gamises**, AES-MSc student determining total organic carbon content in soils using the Walkley-Black method



Fig. No. 16 : **Ir. G. van Hummel**, UT, and **Mr. Gayantha Kodikara** (AES) in the Nano Laboratory of University of Twente where samples were analysed using an X-ray diffractometer to determine mineral composition in support of infrared determinations. This research revealed some unusual evaporate minerals on the surface around lake Magadi in Kenya

Fig.No. 17: **Dr. C. Mannaerts**, WRS dept. with **Ms.Fransiska Gamises**, **Ms. Imuwahen Igbinosun** and **Mr. Imesh Chanaka Bihawala Vithanage**, all three WREM MSc course participants, in preparation of their water quality analysis. An impressive amount of samples was analysed in a short period of time.



There are no pictures Ms.Pilar Lozano Rivera, Mr. Ricardo Ontiveros Enriquez and a few others.



Fig.No.18 and 19:Ms. **Attah Motunrayo Fakeye**, AES MSc, started her research in Thailand using a gamma-ray spectrometer and completed her lab work with particle size analysis.

Fig. No.20, 21 and 22: Sample preparation and sample decomposition by NRM and AES MSc. course participants, preparing soil samples from Thailand for particle size analysis and dolomite mixtures for FTIR analysis.

Below, Mr. **Cosmas N. Walyaula Watsusi** ,
Right Mr. **Zaini Nasrullah**,
Lower right Mr. **Bharat Babu Shrestha**.



PGD related:

Fig.No. 23:: AES PGD course participants analyzing polluted sediments from near the Rodalquilar gold mine in SE Spain for the amount of bio-available toxic elements by flame AAS as part of their final project. Measuring bio-availability of toxic elements has become increasingly more important, more important than “total” element concentrations which include insoluble (= not available to organisms) mineral forms.



Fig.No.24 : Water quality field training along the Driense beek behind the UT Campus



Fig.No. 25 : Heavy mineral separation using high density liquid allowed separation of specific ore minerals

Visitors

Several delegations of foreign visitors visited the laboratory as part of their tour through the ITC building and its facilities. On 23 of January a delegation of ECCA, Nepal and Adelphi Research, Germany, KAPRIMO project visited the GS-Lab. The laboratory is also incorporated in the introduction tour of new staff through the ITC building.

3. Operation laboratory and instrumentation

The laboratory space for the IR field and lab spectrometers in 0-034, 0-036 and a corner of the former darkroom were reconstructed by Facility Management in January 2008. This part of the laboratory now consists of two more spacious rooms which are directly connected. In Room 0-036 a water tap and kitchen sink arrangement were installed.



Fig. No. 26: The new room 0-034 for the field spectrometers



Fig. No. 27: The new Room 0-036 for the Bruker FTIR spectrometer

In January C. Hecker and B. de Smeth visited Optosol in Freiburg, Germany for an acceptance test of the **Optosol custom-built integrating sphere** for the Bruker Vertex 70 FTIR instrument. The integrating sphere comes with two detectors, one for the near IR and a liquid nitrogen MCT detector for the thermal IR wavelength range. A number of modifications were required and it took several months before Bruker could install the integrating sphere. As the combination was not working optimal, an extra strong water cooled light source was added to the Vertex instrument. Also an automatic computer steered switch was designed by A. Blenke, C. Hecker and H. Wilbrink to facilitate automatic switching of the measurements between sample and reference. The switch engine comes from a Fleischman electric toy-train but the designed steering software is more advanced. This final addition completed the purchase of the Bruker-Optosol configuration and ended within the planned budget for this instrument. The instrument was immediately put to use in three PhD- and four MSc- research topics.



Fig. No.28: The installation of the Optosol integrating sphere on the Bruker FTIR called for a celebration for all parties.

From left to right Mr. H. Wilbrink, GS-Lab, Mr. C. Hecker MSc., from ESA Dept., Mr. M. van der Haven and Mr. A. Snel both from Bruker Optics in Delft.



Fig. No. 29: Bruker Vertex 70 FTIR (2007) with the new liquid nitrogen cooled
The thermal range of ITC's Laboratory

During the summer months an **inventory list** of all GS-Lab equipment with a value of more than € 500.- was made as part of ITC full equipment inventory listing which will become accessible via Topdesk. The GS-lab equipment is already in Topdesk so that there is clarity about availability of spectrometers and this way timely reservations can be made.

There were several double reservation requests for the field spectrometers. Most of these “clashes” could be solved by careful planning. Mr. Wilbrink maintained the overview in Topdesk. As an illustration the ASD reservations for 2008 and 2009 are given here below.

ITC's Topdesk reservation overview showing use in 2008 and reservations in 2009												
Current period: 2008												
Facility	January	February	March	April	May	June	July	August	September	October	November	December
INCOOL Spectrometer ASD Field spectr	Jan 15, 2008 Ethiopia Hecker, C		Mar 14, 2008 Ethiopia Ruterik, N	Apr 27, 2008 Ethiopia Ruterik, N	May 12, 2008 Ethiopia Ruterik, N	Jun 1, 2008 Ethiopia Ruterik, N	Jul 16, 2008 Ethiopia Ruterik, N	Aug 27, 2008 Ethiopia Ruterik, N				Dec 04, 2008 Ethiopia Hecker, C
Note: This schedule does not show double booking requests												
The reservation for Oct.-Nov. for mangrove PhD research in Indonesia was cancelled at the very last moment												
Current period: 2009												
Facility	January	February	March	April	May	June	July	August	September	October	November	December
INCOOL Spectrometer ASD Field spectr	Dec 17, 2008 Ethiopia Wilbrink		Mar 20, 2009 Ethiopia Girma, A		May 21, 2009 Ethiopia Luleva, M	Jun 1, 2009 Ethiopia Luleva, M	Jul 1, 2009 Ethiopia Luleva, M	Aug 1, 2009 Ethiopia Luleva, M	Sep 1, 2009 Ethiopia Luleva, M			
Note: incidental use for education or measurement within ITC is not shown												

In view of the amount of requests for the use of the ASD field spectrometer and in view of its age, nearly seven years old, a proposal for the **purchase of a new ASD spectrometer is made in 2009**. There is simply too much PhD and MSc research depending on the availability of a single seven year old instrument.

A new **SPAD chlorophyll meter** was purchased from the GS-budget as there was an unexpected large demand for such instruments for MSc and PhD research. Three more SPAD instruments were purchased from other budgets in 2008.

In December an order was placed for a **thermal range FTIR field spectrometer** from MIDAC, USA. This completes the institute's investment in thermal range infrared equipment, approved in 2007. The instrument will be equipped with a liquid

nitrogen cooled detector and with additional custom built fore-optics to allow field measurements under various angles. Delivery of the instrument will be around May 2008.

The ITC Intranet pages were updated from GWS-Lab to GS-Lab. Their main purpose is to provide staff and students information about the facilities the laboratory can offer to their research.

4. Staffing

The permanent laboratory staff consists of B. de Smeth, 0.5 fte, as Head of the GS-lab and H. Wilbrink, 0.3 fte.

Mr. B. de Smeth manages all planning and operational aspects of the laboratory.

Mr. H Wilbrink runs the daily matters on equipment in lab. rooms 0-034 and 0-36 including the maintenance of the field spectrometers and cameras. He also provides technical assistance to staff and students using the three field spectrometers, special cameras and other special field equipment. Mr. Wilbrink organised an efficient reservation system via Topdesk/ITC intranet. This system is accessible to all staff and students and demonstrates the high demand for certain instruments

Due to a seniority arrangement, Mr. Wilbrink input is 1.2 days per week effectively. A request to cancel the seniority time reduction arrangement as per the start of 2009 was denied by P&O in December.

5. External support & contacts

During the year contacts were maintained with

- The geochemical groups of Utrecht University / TNO-Bouw & Ondergrond (formerly NITG) at the Utrecht University campus headed by Dr. G. Klaver. TNO has offered the donation their flame AAS and a graphite furnace AAS. The technical details are not exactly known yet but If this flame AAS fits the hollow cathode lamps of the GS-laboratory, this would allow a cheap replacement of the 25 year old PerkinElmer 2380 which is presently installed in 0-060.
- The University of Twente, Dept. of Science and Technology (TNW) section CPM, infrared spectroscopy group of Dr. B. Mojet.
- The University of Twente, Dept. of Science and Technology (TNW) section IMS, XRD analysis, Dr. Ir. G. Koster and Ing. G.J. van Hummel

New contacts were made with :

- Sita Eco Services laboratory, Almelo, The lab. manager, Ir. HJ Wesseler visited the GS-Lab. His laboratory specializes in organic industrial waste analysis. A counter visit is planned in 2009.
- The geochemical laboratory of Waterschap Regge and Dinkel in Almelo. Thirteen soil samples from the Beja area in Alentejo, Portugal, were send to this laboratory for total nitrogen (Kjeldal method) and total phosphorous analysis as part of the WREM- MSc. research of Ms. F. Gamises.
- Dr. R.G. Garret from the Canadian Geological Survey who kindly provided several protocols for "near total" heavy metal analysis

6. Budget

In 2008, the GS-lab exceeded its budget as the allocated budget was only based on the operational costs of the former GWS lab and did not incorporate the costs for the added former RSG laboratory spectrometers as per 2008. This budget allocation for 2008 did not take into account the extension of the GWS-lab with the spectrometer facilities (€ 275.000 in instrumentation).

The total budget for salaries and operational costs was € 57.000.-

The operational budget and expenses is presented in detail the following table. The € 3410.-maintenance bill for the ASD spectrometer is still pending. The bill is dated December 2008 but will only be paid upon return of the ASD instrument from calibration by ASDi in the USA.

Description	Realisation 2007 GWS-Lab	Budget for 2008	Realisation upto 20 Jan.'09	Difference 2008	Budget for 2009
Work materials	3,224.90	1,000	1,173.03	-173.03	5,000
Chemical for the Lab.	3,559.61	2,000	3,261.39	1,261.39	2,000
Other Lab. expenses		1,000	0.00	1,000.00	0
Maintenance EO Sites WRS					5,000
Total in Teaching Material	6,784.51	4,000	4,434.42	-434.42	12,000
Representation		200	0.00	200.00	500
Travel expenses in the Netherlands	63.43	600	520.09	79.91	500
Travel expenses, other		200	235.60	-35.60	
Total Travelexpenses	63.43	1,000	755.69	244.31	1,000
Instruments, purchase & maintenance	584.69	3,000	3,133.58	-133.58	4,000
Maintenance spectrometers and balances		3,000	3,410.00	-410.00	3,000
Total Instrument costs	584.69	6,000	6,543.58	-443.58	7,000
Total Lab expenditure	7,432.63	11,000	11,733.69	-633.69	20,000

7. Outlook for 2009

A year-plan for the GS-Lab can be found on the ITC Intranet pages under Research / GS-Laboratory.

J.B. de Smeth,
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