



Session 187

Tuesday, 27 September 2016: 8:00 AM-12:00 PM

SUCCESS AS A SMALLER FISH IN A BIG POND: A HOLISTIC APPROACH TO UNDERGRADUATE GEOLOGIC EDUCATION AS A COMPETITIVE ADVANTAGE FOR SECURING POST- BACCALAUREATE OPPORTUNITIES

Uwe Kackstaetter, Ph.D.¹

Presenter

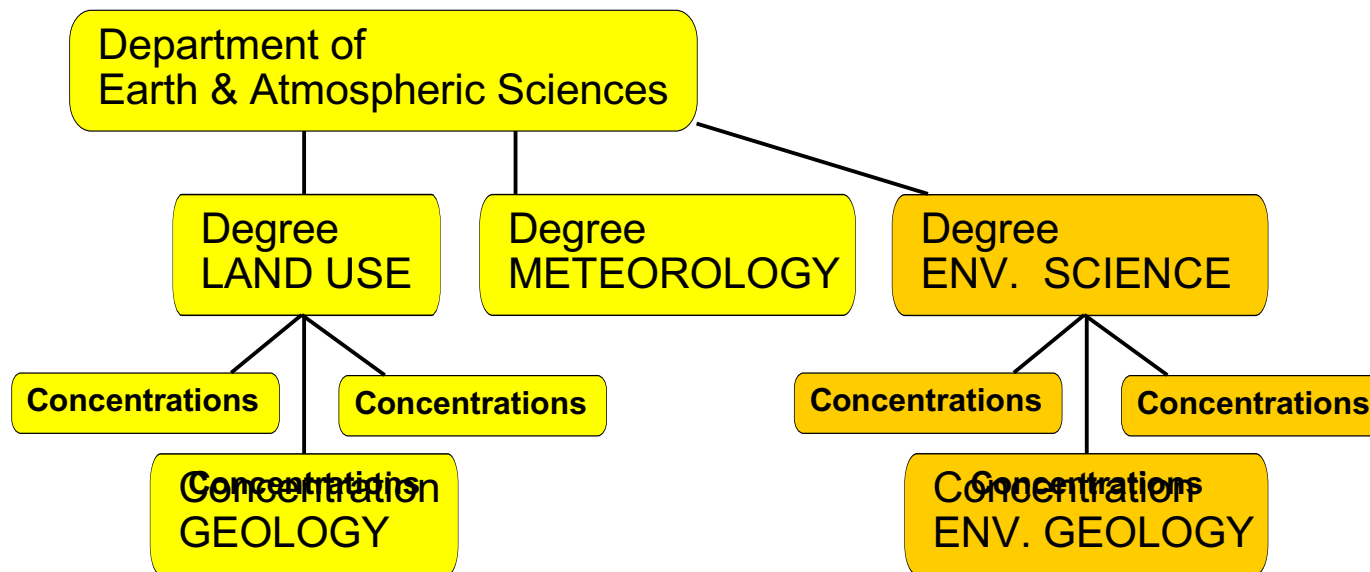
Barbara EchoHawk, Ph.D.¹

¹ *Metropolitan State University of Denver*

Background

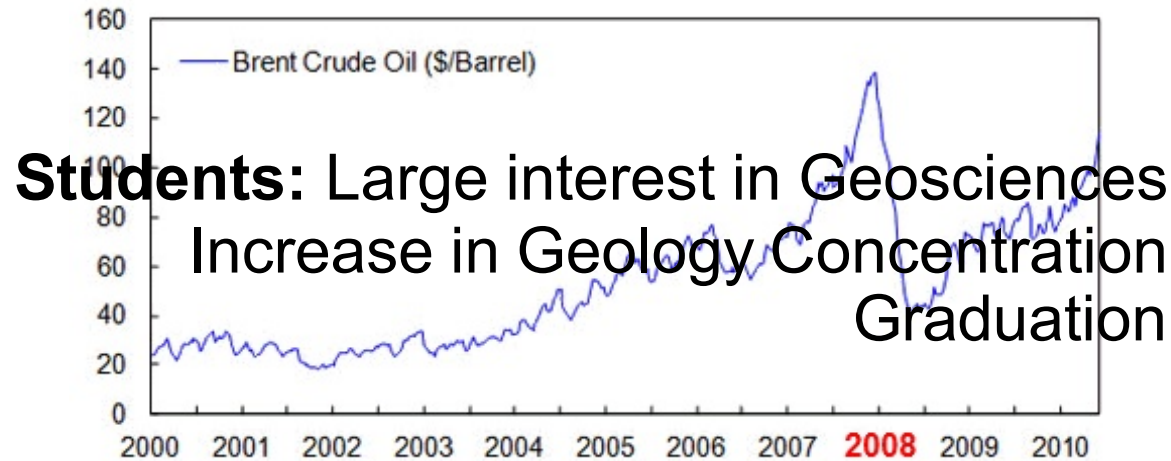
Geology at Metropolitan State College of Denver

GEOLOGY



The Change

Metropolitan State University of Denver



“New Degrees”

“No duplication of degrees”

Stand-Alone Geology Degree that does NOT duplicate traditional Geology Degrees offered elsewhere?



The Study

Developing the Concept

Geoscience Graduate Profile

~30% Graduate School

~70% Workforce

Focus

Next to academically sound proficiency... workforce readiness?

Available Resources

1. Faculty Expertise

International, Field, Equipment, Industry, etc.

2. Courses

Established Field Courses, International Courses, Internships

3. Equipment

USED

Thin Section Lab, PLM, XRD, SEM, etc.

Developing the Concept



Peter D. Hart Research Associates. 2013. *It Takes More Than A Major: Employer Priorities for College Learning and Student Success*, An Online Survey Among Employers Conducted On Behalf Of The Association Of American Colleges And Universities By Hart Research Associates

The Study

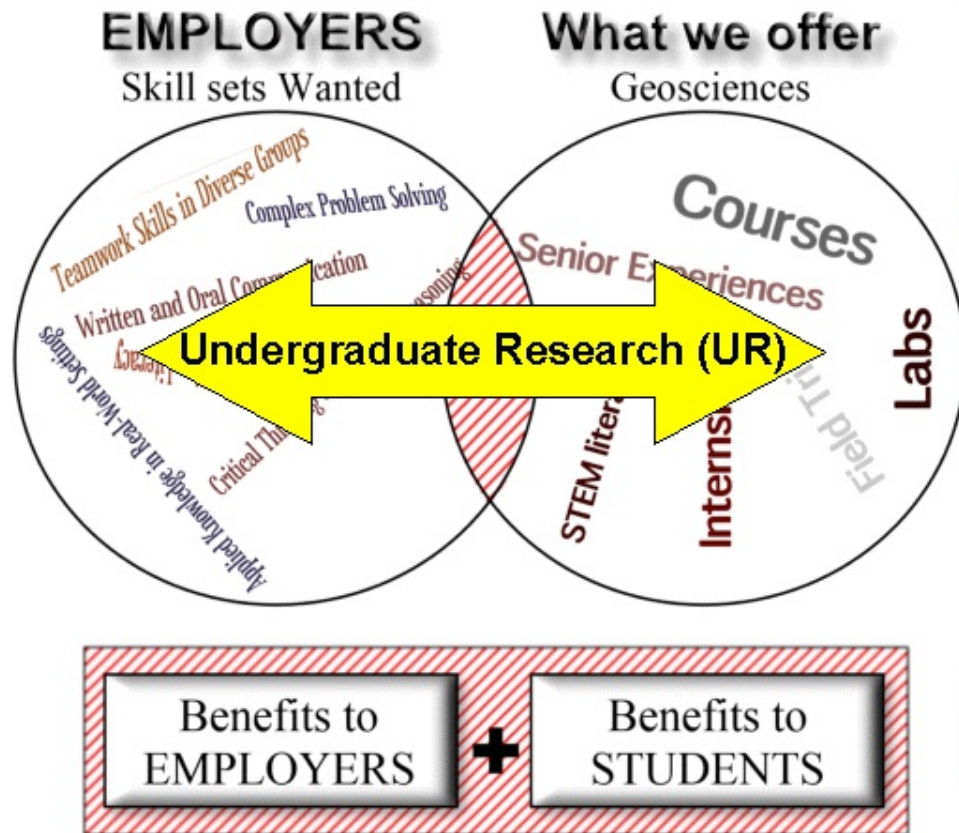
Developing the Concept

What Employers Want?



The Study

Developing the Concept Traditional



?

Skills in Diverse Groups

Applied Knowledge in Real-World Settings

Applied Thinking and Analytic Reasoning

UR Focused Approach

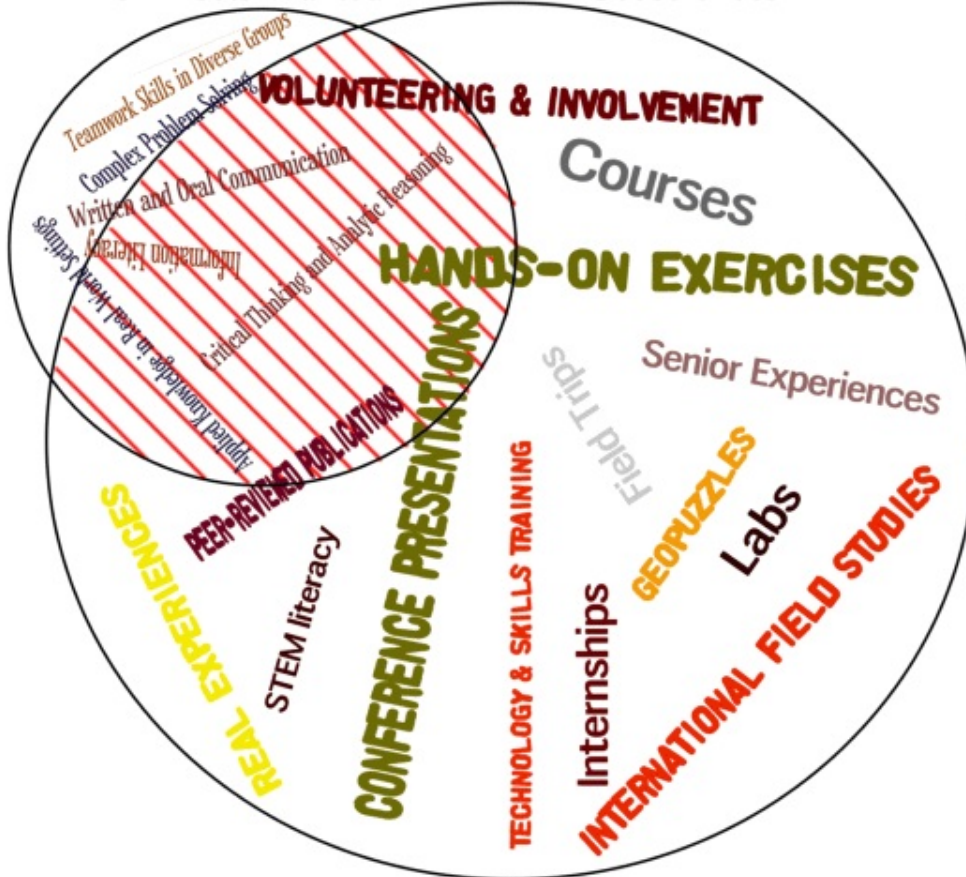
The Study

EMPLOYERS

Skill sets Wanted

What we offer

Geosciences



Benefits to
EMPLOYERS

+

Benefits to
STUDENTS

UNDERGRADUATE RESEARCH

Our Niche?

1. NOT popular
Time consuming; NO real compensation; NO real publishable results; Limited pub outlets
2. Limited Resource Friendly
NO large research expenditures;
Simplified Grading; Private Partnership Opportunities
(European Model)

ical Thinking a

l-World Settings

Courses

UR Skills Incorporation into Course Offerings

■ No NEW Course Resources

- ▶ Incorporate Work Force Readiness / UR skills into existing coursework
- ▶ Make **Assignments RELEVANT** to real skills without compromising foundational content

Applied Knowledge in Real-World Settings

Critical Thinking and Analytic Reasoning

Teamwork Skills in Diverse Groups

Information Literacy

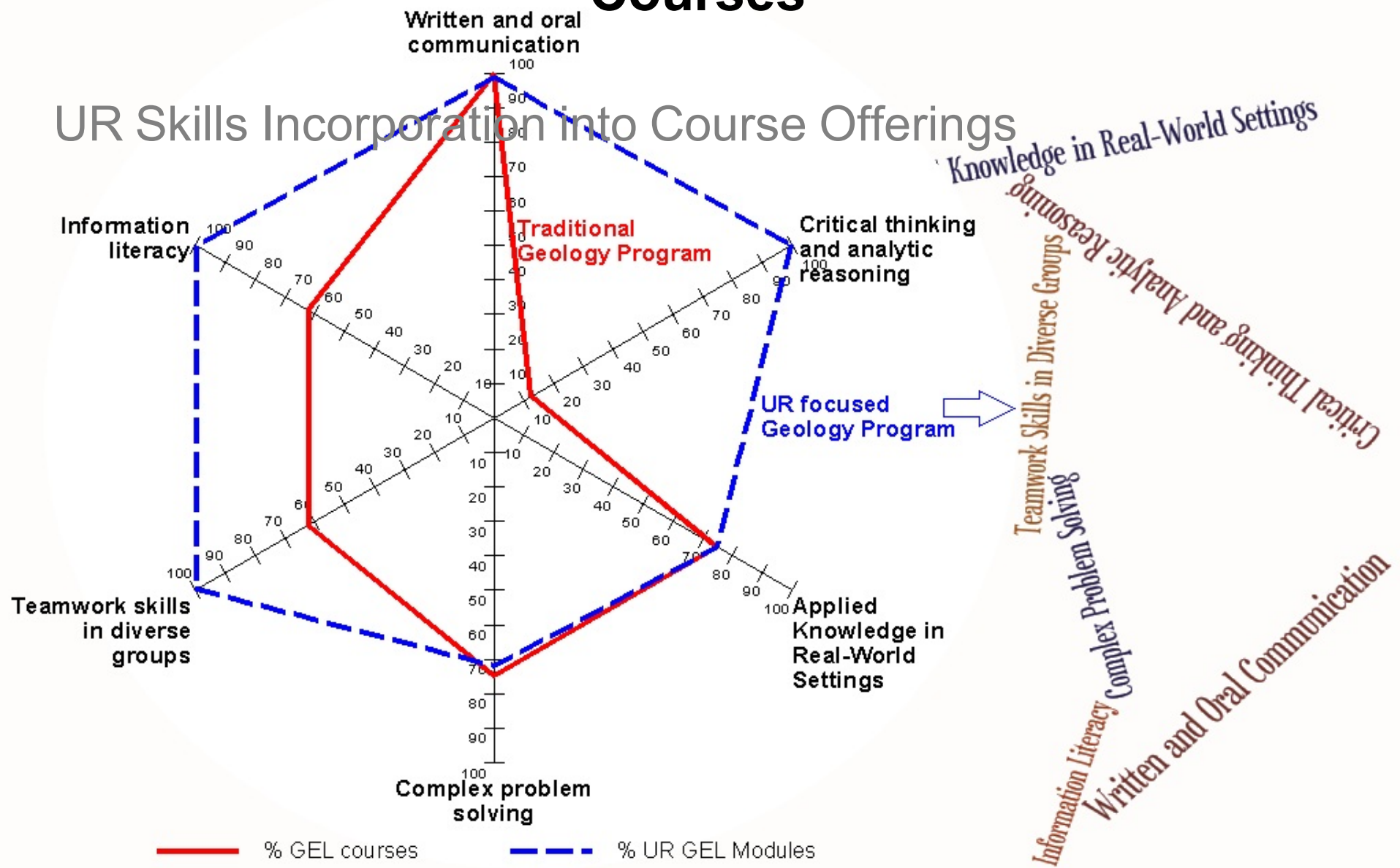
Complex Problem Solving

Written and Oral Communication



Courses

UR Skills Incorporation into Course Offerings



Participating in Undergraduate Geoscience Research Builds Skills that Employers Value

Barbara Echolfaw, Claire M. Hay, Uwe
Richard Kockstaeter, MEM-2437, and
Stella W. Todd,
Metropolitan State University of Denver
Dept. of Earth & Atmospheric Sciences
Campus Box 22, P.O. Box 173362
Denver, CO 80217

Abstract

The value of participation in undergraduate research (UR) in preparing students for future employment or graduate school is reaffirmed through an assessment of employer-identified essential learning outcomes (ELOs) and their relationship to skill sets learned through traditional coursework compared with those gained through UR at Metropolitan State University of Denver (MSU Denver), a four-year liberal arts institution of higher education. Traditional coursework required for the geoscience degree may not fully support the development of employer-valued essential learning outcomes (ELOs) unless it is enhanced by the integration of UR into the geoscience curriculum. Embedding UR-based modules throughout the geoscience curriculum, emphasizing quality faculty mentorship for students in UR, promoting active engagement by potential employers in UR internships and projects, and encouraging students to take ownership of their own UR opportunities all can enhance UR as a meaningful component of undergraduate education. The additional time commitment required to participate in UR in the geoscience is more than offset by the development of skill sets that benefit both students and employers by expanding the intersection between skills sought by employers and skills possessed by new graduates.

Key Words: undergraduate research, UR, geoscience, employer, graduate school, essential learning outcomes, ELO, Metropolitan State University of Denver, student benefits, employer benefits

Introduction

Participation in undergraduate research (UR) as a college student requires a time commitment greater than that required for a "traditional" degree awarded solely for the satisfactory completion of a specific set of courses. In participating in UR worth the extra time? Do students who participate in UR gain skill sets that enhance their opportunities for employment in geoscience careers after graduation? In order to answer these issues for undergraduate geoscience students at Metropolitan State University of Denver, the relationships between skill sets emphasized in "traditional" undergraduate geoscience courses, skill sets emphasized in geoscience-based undergraduate research, and skill sets identified as essential learning outcomes (ELOs) by employers were examined. In

this paper, we consider courses to be "traditional" if they are lecture-, laboratory-, or field-based but not designed around individualized undergraduate research.

Methods

For this study, we concentrated on students enrolled in undergraduate geoscience courses in the Department of Earth and Atmospheric Sciences (EAS) at Metropolitan State University of Denver (MSU Denver), a four-year liberal arts institution in Denver, Colorado.

As our proxy for skill sets that are highly desirable to employers, we adopted essential learning outcomes (ELOs) identified in recent surveys of employers conducted by Hart Research Associates (2007, 2010, 2013) for the Association of American Colleges and Universities (AAC&U).

We evaluated which of these employer-identified ELOs are emphasized in a variety of geology courses and closely allied geographic information systems (GIS) courses offered by our EAS department. Through this assessment, we identified the intersection of employer-identified ELOs with the skills gained through the "traditional" coursework that leads to the completion of a four-year geoscience-based degree at MSU Denver.

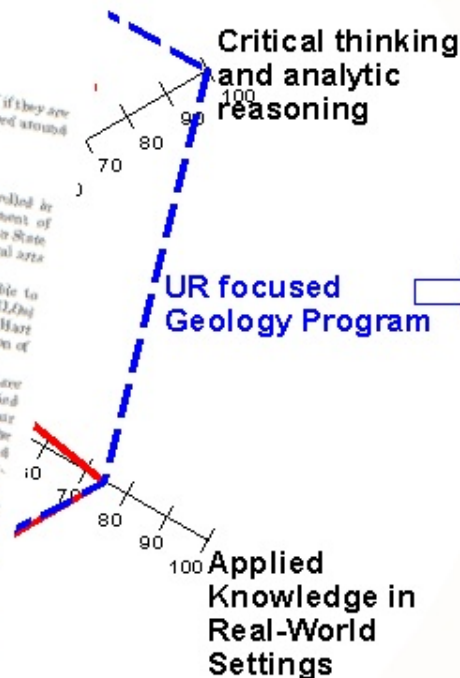
Next, we evaluated which of the employer-identified ELOs are emphasized in undergraduate geoscience research undertaken by students in geology concentrations in our department and assessed the intersection of employer-identified ELOs with the skills gained through participation in UR.

We also conducted an anonymous survey of students in upper-division geology courses in EAS at MSU Denver to obtain informal data on student perceptions of undergraduate geoscience research.

Results

Skills Employers Want

A survey of employers who have hired recent two- or four-year college graduates, conducted on behalf of the Association of American Colleges and Universities (AAC&U) by Hart Research Associates (2010), indicates that "a candidate's demonstrated capacity to think critically, communicate clearly, and solve complex problems is more important than their undergraduate major."



Knowledge in Real-World Settings

Critical Thinking and Analytic Reasoning

Teamwork Skills in Diverse Groups

Complex Problem Solving

Information Literacy

Written and Oral Communication

UR focused Geology Program

Applied Knowledge in Real-World Settings

% GEL courses

% UR GEL Modules

JUL/AUG/SEP 2014 • TPG 55

www.agu.org

GEL3050 MINERALOGY & OPTICAL MINERALOGY

■ Skill Sets:

- ▶ Thin Sections & PLM
- ▶ Rapid Mineral ID Procedure

- Real Clients

- Instrumentation:

Portable XRF, Scintag XRD, PLM

■ PROJECT:



MINERALOGY PROFESSIONAL MINERAL ID PROJECT (250 pts)

This course offers free non-destructive & certain destructive mineral identification services to outside clients, community and industry. You will be assigned a client sample to provide analytical services on the unknown mineral. In the end you will be required to present the client(s) with a full analytical report. Your work must meet a minimum standard of quality and professionalism.

GEL4250 HYDROGEOLOGY (Groundwater)

- Skill Sets:
 - Data Analysis
 - Result Application

**Successful job search credited
to this project alone reported
by alumni**

- PROJECT:



GEL4250 Groundwater (Hydrogeology)
Percolation Test Project

Page 1

YOUR ASSIGNMENT

- ☐ You may work in groups. Selected a suitable field site (someone's property) to dig percolation test holes and do the field study and measurements.
- ☐ Do the perc test. Record all data. You may share the results among your group.
- ☐ Do the computations and generate the professional report. This part must be uniquely yours. NO group work allowed!
- ☐ Turn in the report by the deadline(s) indicated for grading.

known volume of water is poured into the subsoil. In general, the rate of percolation is determined by the water level in the hole at the end of 5 minutes. The rate of percolation is determined by the water level in the hole at the end of 5 minutes.

Undergraduate Research Projects

New Suspected Kimberlite

Northern Colorado

Stephanie Gallegos and Uwe Kackstaetter, Ph.D.
Undergraduate Research



**METROPOLITAN
STATE UNIVERSITY
OF DENVER**

Department of Earth and
Atmospheric Sciences

Introduction

Abstract

Kimberlite pipes are used in diamonds, coarse shaped, geologically coherent, silica melt, igneous structures which are penetrating the crust of the very from the mantle. They often occur in streams, such as in the Colorado. Wandering streams are primary sources under the diamonds, and are very difficult to find. A small Kimberlite is believed to exist in a road cut on County Road 336 and Highway 287, just North of Virginia Dale, Colorado, in a more fault line. While first surveys confirmed the presence of olivine, a common characteristic of ultra-mafic lithologies, additional data such as PLM (Polarized Light Microscopy) investigation of thin sections, XRD (X-ray Diffraction), chemical testing through the ICP (Inductively Coupled Plasma) and XRF (X-ray Fluorescence) analysis, as well as heavy mineral identification, strongly supports the initial hypothesis. Additionally, preliminary results, strongly support the initial hypothesis (Kimberlite mineral analysis), but unequivocally show the presence of garnet, garnet, olivine, diopside and megacrysts using indicator minerals of kimberlite rocks.



Figure 1: Location of study area

Area of Research: Virginia Dale, Colorado

This suspected small Kimberlite pipe exists in a road cut on County Road 336 and Highway 287, just North of Virginia Dale, Colorado. The mineral composition, leading to the proposed use ultra-mafic lithology, was discovered by evidence during a meteorology (petrology) field trip held by Dr. Uwe Kackstaetter. The area was first surveyed in 1980 by Williams, A. B. and David H. Fegley, leading to numerous of such a structure. These findings indicate that the area is mostly composed of Silica, Plagioclase and "Lower Cap Rock phase". There are several known Kimberlite pipes in the vicinity, for example, "only being the diamondiferous Mount St. Helens". The best lithology in the area are very different, consisting of granites and quartz monzonites of the Virginia Dale ring-like complex. It is believed that this small previously undetected kimberlite belongs to the Mount St. Helens and instead the entire igneous system of the area.



Figure 2: Photo of mineral grains, sample 100, showing the presence of olivine, garnet, diopside and megacrysts.

Methodology

Identification of Kimberlite

In order to properly identify this small Kimberlite Pipe the following analytical procedures were employed:

1. Thin section analysis. Selected samples were ground to standard thickness of 30 microns and investigated under the PLM (Polarized Light Microscopy) to identify mineralogy and diagnostic textures.
2. XRD analysis. Samples were powdered and subjected to X-ray diffraction, then comparing minerals with a library (such as 3000) from those of known source. Products were analyzed under the PLM and standard mineralogy for mineral identification.
3. XRF analysis. Samples were powdered and analyzed using a wet digestion method (HNO₃). Positive identification of certain minerals even in mineralogical sections were obtained.
4. ICP-MS chemical analysis. Selected samples were digested using hot aqua regia and then analyzed using the ICP-MS (Inductively Coupled Plasma - Mass Spectrometry) to obtain the geochemistry of the rock. ICP-MS can calculate and analyze samples, which is comparing kimberlite rock samples to known kimberlite geochemistry.
5. ICP-MS Integrated Mineral Analyzer (IMA) to IMA, a fully automated analytical scanning electron microscope (SEM) system (Fig. 3). Selected sample sections of 30 microns were thoroughly analyzed using this system, state of the art IMA system, an approach never attempted before in assessing kimberlite materials.

Kimberlite Indicator Minerals (KIMs)

Kimberlite hosts a suite of heavy minerals, which have unique geochemical and physical characteristics. Cr groups garnet, calcic garnet, almandine garnet, Mg, diopside, Cr, diopside, Cr, garnet, Mg, olivine, and garnet are the most common KIMs (Fig. 4). These minerals are used in kimberlite reconnaissance studies because of their uniqueness in diamond bearing ultramafics. However, Mg, garnet may also occur in other ultramafic lithologies.

1. Garnet. Garnet-derived grains are considered to be the most important kimberlite indicators. Chemical composition in garnet-derived grains are Ca, Mg, Fe, Ti, and Na.
2. Olivine. Olivine-bearing, green to bright green in thin sections, are easily identifiable in heavy mineral concentrates and are therefore considered effective KIMs.
3. Garnet. This most widely and kinetically indicator mineral is a common member of the pyroxene series. Major elements include Fe, Mg, Ca, Cr, Mn, Ti, and Na, and are used in kimberlite reconnaissance studies.



Figure 3: Photo of a rock sample showing mineral grains, garnet, olivine, diopside and megacrysts. The right side shows the mineral grains, which are used in kimberlite reconnaissance studies.

References

1. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

2. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

3. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

4. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

5. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

6. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

7. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

8. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

9. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

10. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

11. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

12. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

13. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

14. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

15. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

16. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

17. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

18. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

19. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

20. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

21. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

22. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

23. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

24. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

25. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

26. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

27. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

28. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

29. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

30. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

31. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

32. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

33. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

34. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

35. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

36. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

37. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

38. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

39. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

40. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

41. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

42. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

43. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

44. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

45. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

46. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

47. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

48. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

49. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

50. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

51. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

52. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

53. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

54. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

55. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

56. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

57. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

58. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

59. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

60. Gallegos, Stephanie. "New Suspected Kimberlite Pipe in Northern Colorado." Undergraduate Research. Metropolitan State University of Denver. 2013.

61

Using Specific Gravity to Determine the Solid Solution Variation of K^+ , or Na^+ and Ca^{2+} in Feldspar Hand Samples

By Timothy Olson, EAS Department at Metropolitan State University of Denver
With Assistance from Dr. Uwe Kackstaetter

Abstract

Plagioclase and alkali feldspar minerals have a varying specific gravity, due to changing chemical compositions within their respective solid solution and exsolution series. While quantitative chemical analysis in investigating compositions is desirable, it is either confined to the laboratory or requires expensive field instruments. However, advances in inexpensive load cell scale technology has led to the development of pocket scales that can be used to make rapid, precise field measurements of specific gravity [50] on rock and mineral samples using a single pan hydrostatic method (Kachaturian, patent pending). Accuracies such attained show enough resolution to enable differentiation in chemical compositions of feldspar samples. Specific gravity measurements were performed on known feldspar species and data was scrutinized through regression analysis. Additionally, geochemical data of each sample was obtained through acid digestion and Flame Atomic Absorption Spectroscopy to determine the exact proportions of K^+ , or Na^+ and Ca^{2+} . Trend line regression for solid solution plagioclase samples as well as alkali feldspar exsolution series can now be developed to relate the specific gravity to the chemical composition of each sample. Densities can now be assigned to exact chemical compositions within feldspars. By using the field portable single pan hydrostatic method for SG determination, an accurate and rapid identification of specific feldspar species is now possible.

Introduction

Specific gravity is measured using the single pan hydrostatic method (Jackstaetter, patent pending). This method finds the volume of an object by measuring the weight of the water that it displaces. Since the density of water is 1g/cm^3 , the weight of the displaced water is equal to the volume. Specific gravity is then determined by dividing the weight of the object by the weight of the water that the object has displaced.

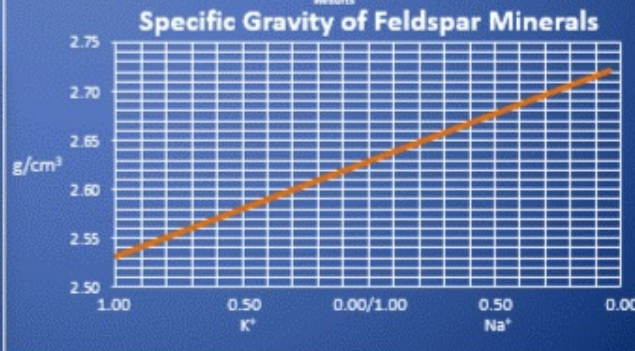
$$S_{\text{eff}} = M_{\text{eff}} / N_{\text{eff}}$$

Where, W_A = weight of the sample in air and W_W = weight of the water that the sample displaces.

References

Various feldspar species were obtained from around the world. The specific gravity was then measured and recorded for each sample. Portions of each sample were then crushed and powdered and passed through a 230 mesh sieve. 200mg of each of the powdered feldspars were then subjected to HF acid digestion and analyzed with AAS to measure the exact proportions of K⁺, or Na⁺ and Ca²⁺. The ratios of K⁺, Na⁺, and Ca²⁺ were then compared to determine the exact feldspar species of each sample.

References



1st Place



- Pocket scale with 0.03g resolution
- Small cup (pee cup)
- String
- Feldspar Sample
- Feldspar

Kach
and
Acc
Rock
Retrie
<http://www.rockwell.com>
4_TPGA

Special thanks to Dr. M. J. Griffin for research assistance.

**AIPG National
Conference 2015**



Figure 1. Location of study area.

Area of Research: Virginia Dale, Colorado

This suggested novel *Kamburba* gipsy exists in a road cut on County Road 438 and Highway 267, just north of Virginia Dale, Colorado. The unusual morphology, leading to the proposed new ultra-micro lithology, was discovered by students during a sedimentology / geology field trip led by Dr. Uwe Kamburba. The area was first surveyed in 1980 by William A. Rastbach and David H. Jaggard, making no mention of the existence of *Kamburba*. It is difficult to see how a competent lithologist, like Philip Dineen and "Boss" Giff Rock, might find these unusual lenses *Kamburba* gipsy in the vicinity, the different layers, "well being the diamorphous *Kamburba* gipsy. The best lithology in the area are very different, consisting of granitic and quartz monzonite of the Virgin. This ring also complex. It is believed that this soil previously underwent of *Kamburba* belongs to the *Muse* zones and around the north-south system of the area.



Methodology

Identification of Kinschmitt

In order to positively identify this unique Kumbharin Type the following analytical procedures were employed:

- [illegible]

Kimberlite Indicator Minerals (KIMs)

Kambholia hosts a suite of heavy minerals, which have unique geochemical and physical characteristics. Cr pyrope garnet, eclogitic pyrope-almandine garnet, Mg-ilmenite, Cr-diopside, Cr-augite, Mg-olivine, and omphacite are the most common KFM (Fig. 1). These minerals are used for Kambholia metamorphic studies because of their uniqueness in diamond-bearing ultramylonites. However, Mg-olivine may also occur in other ultramylonitic lithologies.

- Diagram:** Mainly, heavy metals are considered to be the most important leachables indicators. Chemical elements present in mainly-derived glasses are Cu, Ca, Mg, Fe, Ti and Na.
- Chlorophyllase:** Chlorophyllase, known as bright green fluorescent, are usually attributable to heavy mineral contamination and are therefore considered effective R&Bs.
- Diagrams:** This most widely used indicator indicator mineral is a common member of the pyroxene group. Major elements include are TiO₂, MgO, CaO, MnO₂ and Fe₂O₃.
- 

Endorsement

Table 1. *Mean values of the dependent variables and the independent variables in the two groups of patients. The mean values of the dependent variables were calculated from the mean values of the dependent variables in the two groups of patients. The mean values of the independent variables were calculated from the mean values of the independent variables in the two groups of patients.*

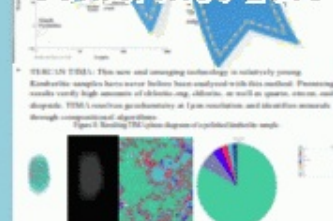
Results and Conclusions

5/20/2015

^a P1-M, an *Escherichia coli* phage.

1st Place

**AIPG National
Conference 2013**



Conclusions

* Analytical results indicate instead a newly discovered thin, low-kindred pipe, also heavily weathered, as explained by:

- * Common decomposition mineral: Mg-chlorite [XRD]
* K2Mn Pyrope garnet, Diopside, Phlogopite, Biotite [PLM]
† Possible new technique for kankarite identification: Trace²⁰ mineral analyzer [TEC-A.N. 3.2, Libussa Works 21 623 00, Brno, Czech Republic]



Using Specific Gravity to Determine the Solid Solution Variation of K+, or Na+ and Ca2+ in Feldspar Hand Samples

By Timothy Olson, EAS Department at Metropolitan State University of Denver
With Assistance from Dr. Uwe Kackstaetter

Abstract

Plagioclase and alkali feldspar minerals have slightly varying specific gravities, due to changing chemical compositions within their respective solid solution and exsolution series. While quantitative chemical analysis in investigating compositions is desirable, it is either confined to the laboratory or requires expensive field instruments. However, advances in inexpensive load cell scale technology led to the development of pocket scales that can be used to make rapid, precise field measurements of specific gravity (SG) on rock and mineral samples using a single pan hydrostatic method. (Kackstaetter, patent pending). Accuracies such as attained show enough resolution to enable differentiation in chemical compositions of feldspar samples. Specific gravity measurements were performed on known feldspar species and data was scrutinized through regression analysis. Additionally, geochemical data of each sample was obtained through acid digestion and Flame Atomic Absorption Spectroscopy to determine the exact proportions of K⁺, or Na⁺ and Ca²⁺. Trend line regression for solid solution plagioclase samples as well as alkali feldspar exsolution series can now be developed relate the specific gravity to the chemical composition of each sample. Densities can now be assigned to exact chemical compositions within feldspars. By using the field portable single pan hydrostatic method for SG determination, an accurate and rapid identification of specific feldspar species is now possible.

Introduction

Specific gravity is measured using the single pan hydrostatic method (Kackstaetter, patent pending). This method finds the volume of an object by measuring the weight of the water that it displaces. Since the density of water is 1g/cm³, the weight of the displaced water is equal to the volume. Specific gravity is then determined by dividing the weight of the object by the weight of the water that the object has displaced.

$$SG = W_A / W_W$$

Where, W_A=weight of the sample in air and W_W=weight of the water that the sample displaces.

Materials

- Pocket scale with 0.01g resolution
- Small cup (pee cup)
- String
- Feldspar Samples
- Feldspar



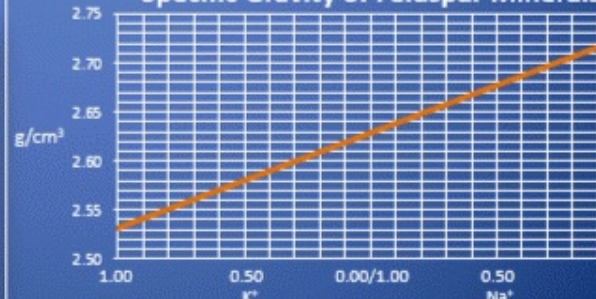
1st Place

Methods

Various feldspar species were obtained from around the world. The specific gravity was then measured and recorded for each sample. Portions of each sample were then crushed and powdered and passed through mesh sieve. 200mg of each of the powdered feldspars were then subjected to HF acid digestion and analyzed with AAS to measure the exact proportions of K⁺, or Na⁺ and Ca²⁺. The ratios of K⁺, Na⁺, and Ca²⁺ were then compared to determine the exact feldspar species of each sample.

Results

Specific Gravity of Feldspar Minerals



TOXICITY OF HEAVY METAL ABSORPTION BY PLANTS NEAR MEDIEVAL-AGED MINE DUMP MATERIALS

Misty Porter

Undergraduate Student of Geology and Botany

Metropolitan State University of Denver, Denver, Colorado, USA

Abstract

- Rumors that cattle that graze on a hillside with mine tailings get sick, whereas, the other side of the hill is perfectly safe grazing grounds
- The longer mine waste rocks are around the longer they have to leach heavy metals into the environment

GSA 2014

AIPG National Conference 2015



Figure 1: Feldspar Minerals

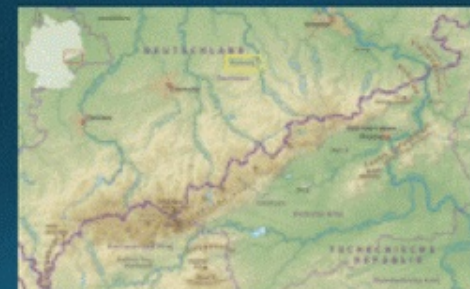
Area of Research: Virginia Dale, Colorado

This research area is located in a field on the Virginia Dale Highway (207) just North of Virginia Dale, Colorado. The research area is in the proposed new astronomical observatory site discovered by Indian astronomer / geologist David W. Allen by Dr. Uwe Kackstaetter. The area was discovered in 1988 by William A. Kackstaetter and David W. Allen, making use of such a situation. These findings indicate that the area is mostly composed of Plagioclase and "Iron Cap" phases. There are several known K-feldspar in the vicinity, the closest (approx. 100m) being the "Iron Cap" K-feldspar. The best lithologies in the area are very different, consisting of and quite massive of the "Iron Cap" K-feldspar. It is believed that small portions of the "Iron Cap" K-feldspar are in the area and are small portions of the area.



Figure 2: Feldspar Minerals

Erzgebirge, Germany



The origin of a layer of subcircular mudflakes in the Ross Sandstone Formation of County Clare, Ireland

Katharine Robinson, Dr. Uwe Kuchta, Dr. Barbara Schindler
Microplasma State University of Dörm

Introduction: This study investigates the formation of unique circular to oval impressions densely covering approximately 100 square meters of an exposed bedding plane within the Ross Sandstone Formation on the western coast of Ireland (Fig. 1). Two broad possible origins are discussed: a primary sedimentary origin, i.e. turbidite channel mudflake conglomerate, or a post-depositional soft sediment deformation origin due to either (i) sediment loading and dewatering, or (ii) outgassing of methane, possibly by release from methane hydrates. Subcircular mudflakes preserved on bedding planes may indicate rapid sedimentation in deep-sea turbidite systems like those that have previously been identified in the Ross Sandstone.

Geological Setting

The Ross Sandstone Formation is a Devonian (late Frasnian) turbidite sequence deposited in a deep-sea environment. It is composed of alternating sandstone and shale units. The sandstone units are typically 10-20 cm thick and contain small-scale cross-bedding. The shale units are typically 10-20 cm thick and contain small-scale cross-bedding.

The mudflake impressions are typically 1-2 cm in diameter and are arranged in a regular pattern. They are composed of sandstone and shale units. The sandstone units are typically 10-20 cm thick and contain small-scale cross-bedding. The shale units are typically 10-20 cm thick and contain small-scale cross-bedding.

Figure 1: Profile of a mudflake impression showing its shape and size. The mudflake is typically 1-2 cm in diameter and is arranged in a regular pattern.

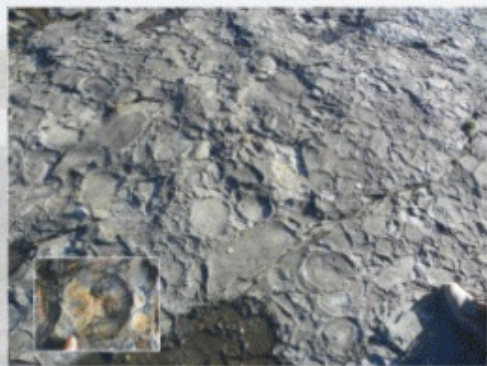
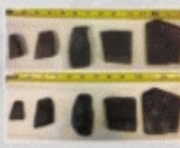


Figure 2: Detailed view of a mudflake impression showing its shape and size. The mudflake is typically 1-2 cm in diameter and is arranged in a regular pattern.

Mudflakes
Samples were collected from the Ross Sandstone Formation. The mudflakes are typically 1-2 cm in diameter and are arranged in a regular pattern. They are composed of sandstone and shale units. The sandstone units are typically 10-20 cm thick and contain small-scale cross-bedding. The shale units are typically 10-20 cm thick and contain small-scale cross-bedding.



Acknowledgements
I express my gratitude to the following individuals for their support and assistance during the course of this project: Dr. Katharine Robinson, Dr. Uwe Kuchta, Dr. Barbara Schindler, Dr. Katharine Robinson, Dr. Uwe Kuchta, Dr. Barbara Schindler.

References
Robinson, K., Kuchta, U., & Schindler, B. (2015). The origin of a layer of subcircular mudflakes in the Ross Sandstone Formation of County Clare, Ireland. *Journal of Sedimentary Research*, 100(1), 1-10.

Figure 3: Close-up view of a mudflake impression showing its shape and size. The mudflake is typically 1-2 cm in diameter and is arranged in a regular pattern.

Methods
The Ross Sandstone Formation was sampled using a hand-held coring device. The samples were then analyzed using a scanning electron microscope (SEM) and a backscattered electron (BSE) detector. The SEM images were then processed using a computer program to enhance the contrast and highlight the mudflake impressions.

Figure 4: Close-up view of a mudflake impression showing its shape and size. The mudflake is typically 1-2 cm in diameter and is arranged in a regular pattern.

Conclusions
The mudflake impressions are interpreted as being formed by the collapse of a soft sediment layer. This is supported by the fact that the mudflakes are typically 1-2 cm in diameter and are arranged in a regular pattern. They are composed of sandstone and shale units. The sandstone units are typically 10-20 cm thick and contain small-scale cross-bedding. The shale units are typically 10-20 cm thick and contain small-scale cross-bedding.

OF HEAVY METAL PTION BY PLANTS R MEDIEVAL-AGED DUMP MATERIALS

and Botany
Denver, Colorado, USA

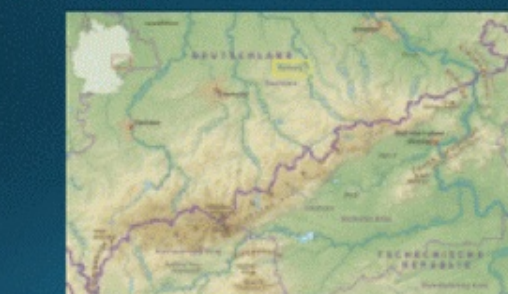
that graze on a hillside with
ick, whereas, the other side of the
e grazing grounds
aste rocks are around the longer
heavy metals into the

GSA 2014 Presentation

AGU 2015 Conference 2015 Poster Presentation



Erzgebirge, Germany



Development Incorporating our Findings

Title: **APPLIED GEOLOGY MAJOR (B.S.)**

*"No duplication
of degrees"*

Program Goals

1. To build student's knowledge base in geoscientific concepts, principles and processes;
2. To prepare and train students in field and laboratory technologies and techniques used in geoscientific investigation and interpretation; **Skills with a purpose!!!**
3. To develop competency in written and oral scientific communication and presentation; **Not only research papers!!!**
4. To construct habits of critical thinking and creative problem solving that lead to informed decision making, life-long learning, and leadership based on current scientific knowledge; and
5. To prepare students for successful entry into **career** or **graduate** programs .



Geology Program

Development Incorporating our Findings

Title: **APPLIED GEOLOGY MAJOR (B.S.)**

Applied Geology Major Required Core Courses

			Prerequisites
GEL	1010	Physical Geology	Pre-assessment
GEL	1030	Historical Geology	
GEL	2530	Introduction to Field Methods 10 days in the field	
GEL	3050	Intro to Mineralogy and Optical Mineralogy	GEL 1010 & 1030
GEL	4450	Sedimentary Geology and Stratigraphy	GEL 1010, GEL 1030, MTH 1120 or MTH 1120 or
GEL	4460	Structural Geology and Mapping	GEL 4450
GEL	3120	Geomorphology	GEL 1010 or 1030
GEL	3530	Adv. Geology of the Colorado Plateau ←	9 hours of GE
GIS	1220	Introduction to Geospatial Sciences	CSS 1010 or 1020
GIS	2250	Geographic Information Systems	GIS 1220

Applied Geology Core Credits

Applied Geology Degree Totals

General Studies (includes the Global Diversity and Multicultural Requirement)
 Applied Geology Degree Required Core Courses
 Mathematics Electives **beyond Algebra**
 CHE and PHY Electives **beyond General Chemistry and College Physics**
 Applied Geology Degree Electives **11 with GEL prefix**
 Internship
 Senior Experience **GEL 4970 Undergraduate Research in Geology**
 Unrestricted Electives*

Applied Geology Total Credits

*Students must have 40-hours of upper division course work (3000 & 4000 level)

GEL Field Course Offerings *National & International*

Samples:

Applied Volcanology

3,400 miles: Incl. Yellowstone, Craters of the Moon, Mt. Rainier, Mt. St. Helens, Crater Lake, Lassen Volcanic Park, and more!

Variable Topics

10 days in the field **10 days**
 Can be taken up to 4 times; 4 different destinations

Burren Geologic Field School

Caherconnell, Ireland **2 weeks**
 In conjunction with NUIG (National University of Ireland - Galway)

Structural Geology & Mineralogy of the Alps

Germany, Austria, Italy, Switzerland
2 weeks

17

120



Questions, Comments,...

