제 1 주 지형·지질 항목의 의의 및 개념

<일러두기>

- 본 강의는 이전의 강의내용을 상당부분 수정하여 강의 주제와 내용을 변경하였다. 특히 환경영향평가에서 실무적으로 다루어야 할 사항을 반영한 것이 가장 큰 차이점이다.

■ 이 강의의 주요 내용

○ 본 강의에서는 환경영향평가의 지형·지질 항목에서 다루어야 할 사항을 중점적으로 논의함

○ 환경영향평가서 작성규정을 개괄하여 살펴보고, 기타 추가할 사항을 논의하고자 함

■ 본 강의의 주요 대상

○ 본 강의는 지구과학의 전문적 지식이 있는 사람들을 위하여 준비되었음
- 환경평가서류는 전문적·기술적 내용을 일반인이 알 수 있도록 작성되어야 한다는 개념을 고려하면 조사·분석 및 평가 등은 모두 전문가의 영역이고, 다만 작성은 자격요건을 가진 사람이 수행할 수 있도록 하고 있음.
- 따라서, 이러한 견지에서 보면 환경평가에서 지형·지질은 이미 어느 정도 전문적 지식을 갖춘 사람들이 보아야 할 내용임
- 그러므로 어떤 경우에는 전문적 용어나 영어원문 그대로를 사용하였음

※일반인을 위한 것은 별도로 준비되어 있는 것을 참조

■ 환경영향평가에서 지형·지질 항목의 필요성

○ 지구의 장구한 역사의 무대
- 원시 지구는 무생물 상태였으나 46억년이 지나는 동안 많은 변화를 통하여 지구에는 생물이 탄생하고 번성하여 오늘날에 이르렀음

○ 지구역사의 기록체
- 지구기후의 변화(온난화/빙하), 해수면 상승/하강, 대홍수, 극심한 가뭄, 소행성 충돌, 대륙이동, 판의 충돌, 생물의 탄생과 진화, 제4기 지형변화 등은 모두 암석에 기록되어 있음

- 지구변화는 지표면의 암석, 토양층, 해양, 대기 등에 나타나고 이 변화는 인간에게 영향을 주고 있음

○ 인간의 생존과 지구환경

- 인간의 인위적인 변화/변질이 인간을 포함하여 생태계에 영향을 주고 있으므로 우리는 지구의 환경을 이용할 때 어떤 영향이 있는지 알고자 함

- 이러한 면에서 보면 지형·지질 항목은 지구의 역사를 주의깊게 관찰하여 장단기간의 관점에서 인간의 활동이 지구환경에 미치는 영향을 평가하는 것이 필요함

○ 지질유산의 인식

- 지구의 46억년의 기록은 지구자체 즉 암석에 고스란히 기록되어 있다. 역사기록은 아무리 사소한 것이라도 그 자체가 중요한 사항을 간직하고 있음

- 지구의 지질시대의 변화와 현세의 지형변화는 모두 중요한 역사적 기록이므로 우리는 **지형·지질 유산** [geo(morpho)logical heritage*] 이라고 함

- 지질유산에 대하여 유럽 등지에서는 법적 규정을 마련하여 활발히 보존하고 있음

> * 지질유산 관련 개념
>
> 예) 유럽회의(Council of Europe)의 지질유산 보존 권고안
>
> Recommendation Rec(2004)3
> on conservation of the geological heritage and areas of special geological interest
>
> *(Adopted by the Committee of Ministers on 5 May 2004*
> *at the 883rd meeting of the Ministers' Deputies)*

○ **결론적으로** 지형·지질 항목은 어떤 사업의 계획/추진/시행/종료 후에,

1) 지형·지질 현황을 조사하고

2) 사업으로 인한 영향을 예측하여

3) 중요한 지형·지질 자원은 지속가능한 이용을 유도하고

4) 중요한 지형·지질 유산 정보는 보존하여

5) 현재 및 미래의 세대가 지구환경의 변화에 올바르게 대처할 수 있는 기반을 마련하는 것이다.

○위의 사항을 다루기 위해 이 강의는 다음과 같이 구성되어 있다.

< 1> 주별 강의내용

주	주제	강의 제목(내용)
1	EIA에서 지형·지질의 의의	지형·지질 항목의 의의 및 개념
2	지형·지질 보전·관리	I. 지형·지질 유산의 개념
3		II. 지형·지질 유산 국내 관리 현황(법제도 측면)
4		III. 지형·지질유산 : 한국의 사례와 과제
5		산줄기의 보호방안
6		고생물 자원(화석)의 관리방안
7	지질재해	산성배수와 환경영향 - I. 원인 및 영향
8		산성배수와 환경영향 - II. 미생물 작용과 대책
9	환경평가시 고려사항	환경평가시 고려사항- I. 총론
10		환경평가시 고려사항 - II. 현황조사
11		환경평가시 고려사항 - III. 영향예측 및 평가
12		환경평가시 고려사항 - IV. 저감방안 및 사후관리
13	사업별 EIS 작성방안	사업별 EIS 작성방안 - 면적사업
14		사업별 EIS 작성방안 - 하천골재 채취사업
15		사업별 EIS 작성방안 - 골프장 조성사업
16		사업별 EIS 작성방안 - 도로 건설사업

○ 주별 강의에 대한 일러두기

- 각 주별 강의는 독립적으로 이루어 졌다.

- 주별 강의는 시간배분이 서로 다르므로, 수강자는 자신의 시간에 따라 적절히 조정하면 된다

■ 지형·지질 항목의 평가 목표와 평가 대상

○ 환경훼손의 예방 혹은 최소화도 환경오염의 예방과 마찬가지로 중요한 환경보전 대상이다.

- 환경정책기본법 제1조 내용 참조

○ 따라서, 자연환경의 변화를 초래하는 내용을 평가대상으로 하게 된다. 평가대상을 살펴보면 다음과 같이 나눌 수 있다.

1) 자연환경 변화를 최소화하는 것을 **목표**로 한다

- 지형개변의 최소화 목적
·토공량 규모
·절·성토 규모의 적정성
·토취장 및 사토장의 규모 등

2) 자원의 절약과 재사용을 **목표**로 한다.

- 사용되는 재료가 지속 가능한지 평가한다.
·재료원의 수급 계획의 적정성
·재료의 재사용성 여부

- 사업지역 주변에 중요한 자원의 개발에 미치는 영향을 평가한다
·천연자원의 개발 및 이용에 미치는 영향
·효율적인 자원의 활용 등

3) 지구과학적 연구대상을 **평가대상**으로 한다.

- 중요한 지형·지질 유산의 존재 여부
·화석, 중요 지질구조, 특이지형, 사구, 우수한 지형경관 등

- 중요한 자연환경의 변동의 정도를 평가한다
·하천의 모양 변화, 해안선의 변화 등

4) 사업으로 인한 부차적인 환경영향을 **평가대상**으로 한다

- 환경영향평가의 본래 목적이 안전한 국민생활을 도모하는 것이므로 (환경·교통·재해 등에 관한 영향평가법 제1조),

- 사업으로 인한 직접적인 영향과 사업의 입지를 선정함으로써 발생하는 모든 문제를 평가대상으로 하는 것이 바람직하다.

- 따라서, 다음과 같은 것을 평가대상에 포함한다.

·지반안정성의 정도(지반침하로 인한 영향, 사면안정성의 정도 등)
·지구화학적 영향의 정도(중금속이나 방사성 등 자연적 오염물질의 노출 및 확산으로 인한 영향 등)
·수리지질학적인 영향의 정도(지하수의 변동, 지하수질의 변동으로 인한 영향 등)

■ 지형·지질 항목의 특성

○ 현재 환경영향평가에서 지형·지질 항목은

1) 자연환경의 형태와 분포를 주로 다루는 **지형**과,

2) 지구의 내부구조, 조직이나 조성을 중점적으로 다루는 **지질**로 나눌 수 있다.

○ 외국의 지형·지질 항목의 명칭 비교

- 자연환경에 대한 평가항목의 명칭은 나라마다 다른 데, 우리나라와 일본은 **지형**과 **지질**로 분류하고

- 미국과 영국은 지질과 **토양**으로 분류하고 있다.

○ 각국의 지형·지질 항목의 평가내용(<표 1-1> 참조)

- 지형·지질 항목에 대한 평가내용은 각국이 다소 다르며, 이는 그 나라가 자연환경의 현황을 중요시 하는가 혹은 오염물질을 통제하는데 중점을 두는가에 따라 그 평가내용은 많은 차이점을 가지고 있다.

- 미국은 지질 및 토양(geology and soil), 혹은 지질 항목 내에 토양을 포함하고 있음

- 일본은 지형·지질에 토양을 포함시켜서 평가하고,
· 이때 토양은 우리나라의 토양오염이 아닌 토양단면도, 토양의 이화학적인 성질, 토양의 분류, 토양의 분포 현황 등 자연환경적인 측면에서 다루고 있다.

○ 우리나라는 토양 항목이 당초 생활환경 분야로 분류되었으나, “토지환경” 분야에 토지이용, 지형·지질 등과 함께 포함되는 것으로 변경되었다.

- 토양항목의 주요 평가내용은

1) 기름, 독극물, 슬러지 및 오염물질의 저장, 운반, 이용 등에 따른 영향 및 대책

2) 비산먼지 등의 대기오염물질로 인한 영향 및 대책 등이다.

- 토양오염에 대한 관심은 산업활동에 의한 부지의 오염이라는 측면에서 출발하였으므로 이에 대한 향후 명확한 개념정립과 구체적인 평가 내용의 선정이 필요하다.

○ 지형·지질 평가항목의 세분화의 문제점

- 환경영향평가의 지형·지질 항목을 지형과 지질로 분류하고, 각 항목에서 평가대상을 세분화하여 해안지형, 산지지형, 하천지형 등으로 나눌 경우 환경 현황을 파악하는 데는 편리하지만, 환경의 영향을 종합적으로 판단하는 데는 취약해진다.

- 또한 지질을 고생물, 구조지질, 퇴적층서, 암석, 광물 등으로 구분할 경우, 구분된 것만 평가서에 수록하는 경향이 있고, 다른 중요한 사항이 누락될 가능성도 많다.

- 따라서 지형·지질은 토지이용에 영향을 주는 요소가 주로 평가대상이 되는 경향이 있다.

< 1-1> 각국의 지형·지질 항목 평가내용

국가	평가항목의 분류	주요 평가내용
한국[1]	·지형 ·지질	·지형 ·지질 ·토질 ·토지의 안정성
미국[2]	·지질(Geology) ·토양(Soil Science)	·지형, 표고 특성 ·암상분포 ·지질재해(지진위험성, 침강, 사면붕괴 등) ·광물자원 ·지질특성(풍화정도, 지하수위, 불투수층의 두께, 지하수 유동 등) ·토양(비옥도, 유실율 등)
일본[3]	·지형 ·지질	·지형 ·암석·광물의 노두 ·지질구조 ·화석산지 ·자연현상 ·토양
영국[4]	·지질(Geology) ·토양(Soils)	·재료의 양 ·문화적 풍광 ·지반안정성 ·보존가치 지형·지질 지역(SSSI*, RIGS**등) ·토양비옥도(비옥토관리 등) ·토양의 혼염도

주:1) 환경부. 2001.5.「환경영향평가관련규정집(고시·훈령·예규등)」, p.46-47.

2) Marriott, BB. 1997. *Practical Guide to Environmental Impact Assessment*. McGraw-Hill, p.3, p.197-212.
USEPA. 1998. *Student Text for Principles of Environmental Impact Assessment Review,* p.8, pp.416-418.

3) 일본자연환경연구센터. 1998.「자연환경 영향평가 기술메뉴얼(번역서)」, p.23.

4) Wood. C. 1995. A Practical Guide to Environmental Impact Assessment. A Comparative Review. Longman, p.163-165.

*SSSI(Sites of Special Scientific Interest)

**RIGS(Regionally Important Geological/Geomorphological Sites)

자료출처: 환경영향의 합리적 영향예측에 관한 연구(김지영, 2002, 한국환경정책·평가연구원, 10쪽)

□ 참고: 지형학의 분류에 대한 논란

- 지형은 토지이용 측면에서 매우 중요하고 환경적 측면에서도 반드시 필요한 사항이다. 그러나 지형과 지형학 등에 대한 논란이 있으므로 참고로 다음의 사항을 염두에 둘 필요가 있음

지형학의 학제적 분류에 대한 논란

○ 지형학(geomorphology)이 지리학(geography) 혹은 지질학(geology) 분야인지에 대한 논란

○ 일반적으로, Geomorphology는
- 미국에서는 지질학과에 소속되어 있었음
  → physiography라는 용어를 대체하고 있음
  → physical geology 용어 사용

- 영국과 유럽에서는 지리학 분야에 속해 있음
  → physical geography라는 용어를 주로 사용함

○ 환경적 관심사에 의한 지질학 및 지형학 분야의 용어 사용
- 지질학 분야는 environmental geology(환경지질학)
- 지리학 분야는 geomorphology 라는 용어를 각각 사용

○ 지구에 대한 환경적 관심사가 증가하면서,
- 지질학은 환경오염(토양오염, 지하수 오염, 산성배수 등) 분야를 주로 다루게 되고,
- 지리학 분야는 토지이용, 경관, 생태 등을 지형과 관련하여 접근하면서 학제적 분화가 진행되었음

※ 보다 상세한 것은 http://www.staff.amu.edu.pl/~sgp/gw/gggeo/gggeo.html 혹은 본 강의에 부록으로 첨부된 것을 참조

- 지형·지질의 평가대상을 나열식으로 구분하는 것도 좋지만 종합적인 시각에서 접근하는 것이 필요하다.

→ 이러한 문제점을 극복하기 위하여 환경영향평가에서 유럽과 미국, 일본 등에서는 **지생태학적(地生態學, geoecology)** 혹은 **경관생태학적(景觀生態學, landscape ecology)** 접근을 시도하고 있다.

GEOECOLOY에 대한 인터넷 자료

http://www.mq.edu.au/study/Areas_of_study/science/Geoecology/

http://www.es.mq.edu.au/physigeog/geoecology/

http://www.igipz.pan.pl/geoeko/home.htm

http://www.geo.ruc.dk/research/researcharea2.html

○ 지생태학 혹은 지구생태학으로 번역됨

○ 우리 주변의 경관을 구성하는 모든 요소를 연관시켜서 상호 관련성을 연구하는 분야임

- 환경영향평가가 시행되면서 자연과 인간의 상호관계를 종합적으로 접근하려는 시도임

※경관생태학 (Landscape ecology)의 참고문헌

1) 한국경관생태학회, 2003,「경관생태학」. 동화기술.
2) 정흥락 외, 2003, 「경관생태학적 환경영향평가기법에 관한 연구」. 한국환경정책·평가연구원.

■ 지형·지질의 평가대상의 내용

<표 1-2> 지형·지질 평가항목의 세부 내용

현황조사 내용	주요 평가 내용과 평가목적
환경현황의 파악	영향의 정도 파악/대책의 수립 정도 평가
● 지형 현황 ● 지질 현황 ● 토양 현황 ● 토질 현황 ● 지반 현황 – 지진 현황 – 약대 지역 – 사태 지역 – 지반균열 지역 – 지반침하 지역 – 지하공동 지역 ● 지표수 및 지하수 현황 ● 광구 및 광물자원 개발 현황 ● 지하 매장물 현황 ● 해저시설물 현황	■ 중요 지형·지질에 대한 영향 여부 – 화석, 주요 지질구조, 특이 지형, 특이한 자연현상 등 → 국토의 중요 지형 보존 목적(백두대간, 주요 정맥 등) ■ 지형개변으로 인한 영향 – 환경기준이 없는 자연환경의 훼손을 최소화 ·절성토 규모 검토 →자연환경의 교란의 최소화가 목적 ■ 지반안정성의 정도 – 지반침하, 사면안정 등 → 2차적 환경영향의 최소화 목적 ■ 지화학적 영향 여부 – 지화학물질의 노출/누출/이동/집접/재유동 등에 의한 영향을 최소화 ·절개지 산성배수, 해수침투, 방사성 물질 누출등의 영향 및 평가 →물리적 환경뿐만 아니라 지화학적 영향을 고려하여 인간/생태계에 잠재적 위해성 최소화 모색

■ 지질재해와 환경영향

○ 사면붕괴, 지반함몰, 지반침하, 해수침투 등은 지질재해이다

○ 환경영향평가에서 지질재해를 다루어야 하는 사유

–지질재해의 원인이 인공적이든 자연적이든 인간과 자연환경에 큰 영향을 미친다.

–지질재해의 발생은 인명손실, 재산 손해, 복구시간 소요, 자원의 재투입으로 인한 낭비, 불필요한 개발사업의 초래 등 여러 가지 악영향이 발생한다.

– 따라서, 환경영향평가 대상으로 포함하는 것이 바람직하다.

■ 맺음말

– 지형·지질은 우리 삶의 기반이 되는 무기적 환경이고, 생물다양성이 유지되려면 지형·지질 다양성이 전제되어야 한다.
– 지형·지질은 자원으로서 높은 가치가 있으므로 지속가능한 이용을 도모하여야 한다.
– 지형·지질을 교란하는 경우 유발영향이 매우 크므로 되도록 그 교란을 최소화하는 것이 바람직하다.

<부록>

○ 지형학과 지질학의 학제적 논란

<자료: http://www.staff.amu.edu.pl/~sgp/gw/gggeo/gggeo.html>
※ 홈 페이지 주소의 변동이 있으므로 원문을 그대로 옮김

Is Geomorphology within Geography or Geology?
by *GEOMORPHLIST*

INTRODUCTION

Question

Date: Fri, 22 May 1998 11:05:26 -0600 (CST)
To: geomorph-l@ttacs6.ttu.edu
From: Paul R. Larson larson@edu-suu-scf.sc.suu.edu
Subject: geomorphology as a field of study

I have a question for everyone. What do you say to the geologists who claim that there is no longer a need for the study of geomorphology, that it is nothing more than physical geology? Our school is in the process of a semester conversion, and the geomorphology course was a casulty of the process. Geology dropped it, but I was successful in adding it to the geography curriculum. There seems to be no small degree of antipathy toward the subject among the geologists here on campus. So, I wondered how others have handled the question.

Thanks,

Paul R. Larson

Paul R. Larson, Ph.D.
Assistant Professor, Geography
Mail: Department of Physical Sciences
Southern Utah University
351 West Center Street

EDITORIAL

Geomorphology

from USGS dictionary

1. The science that treats the general configuration of the Earth's surface; specif., the study of the classification, description, nature, origin, and development of present landforms and their relationships to underlying structures, and of the history of geologic changes as recorded by these surface features. In the United States, it has come to replace the term "physiography" and is usually considered a branch of geology; in Great Britain, it is usually regarded as a branch of geography. *AGI*
2. Strictly, any study that deals with the form of the Earth (including geodesy, and structural and dynamic geology). This usage is more common in Europe, where the term has even been applied broadly to the science of the Earth. *AGI*
3. The features dealt with in, or a treatise on, geomorphology; e.g., the geomorphology of Texas. *AGI*

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from Water Words Dictionary

That branch of both physiography and geology that deals with the form of the earth, the general configuration of its surface, and the changes that take place in the evolution

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E-mail: larson_p@suu.edu
http://www.suu.edu/WebPages/Academic/Science/Geography
SUU Campus: latitude: North 37 degrees 40' 29.6404"
longitude: West 113 degrees 04' 05.5157"
elevation above ellipsoid: 1778.715 meters
UTM-12S E317608.88m N4171757.94m

of land forms. The term usually applies to the origins and dynamic morphology (changing structure and form) of the earth's land surfaces, but it can also include the morphology of the sea floor and the analysis of extraterrestrial terrains. Sometimes included in the field of physical geography, geomorphology is really the geological aspect of the visible landscape.

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from Hypertext Webster Gateway

geomorphology n : the branch of geology that studies the characteristics and configuration and evolution of rocks and land forms [syn: {morphology}]

WWW Editor of The Association of Polish Geomorphologists

RESPONSES

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from Mike Blum

I would say you have some un-enlightened geological colleagues, as this kind of thing was common 5-15 years ago, but geomorphology has made a true comeback in many departments due to (a) global change issues, and (b) environmental geology.

Prior to that, it may be fair to say that the very small-scale process-only problems many geomorphologists favored during the 80's had little significance to many traditional geologists, and much of it was done without any consideration of the role of tectonics and time in preservation of things in the stratigraphic record. This is, after all, a fundamental concern of most sedimentary geologists. It may be unreasonable to expect interest to be generated among others, i.e. many of the hard rock / structure / geophysics and geochemistry types, as they will always see geomorph and other soft-rock stuff as a lesser side of the discipline.

In short, it has been, in my view, a matter of geomorphologists not demonstrating relevancy of their studies to some their geological colleagues, with consequences being loss of faculty positions in many geology depts

during the late 70's and 80's. But I really believed the situation has turned itself around. I can only say that for my department the "Geomorphology" course has always been in the "Geology" curriculum, very popular among geology undergrads, and strongly recommended by my colleagues on the geology faculty. The same can be said for many other schools.

Regards, Mike Blum

Dr. Mike Blum

Associate Professor

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from Peter Ashmore

I guess the response to your geology 'friends' depends on their image of what geomorphologists do. If we are describers and categorisers of landforms, or recognisers of erosional discontinuities and surfaces they may have a point. But I would say at least the following:

4. Contemprary earth surface processes is a critical area for study when it comes to hazards and sustainability of the landscape.
5. There is plenty of (and growing) employment in environmental geology that requires geomorphology background. The current growth area for fluvial geomorphology is stream resoration where interaction with biologists, engineers etc. makes for a fascinating occupation.
6. Tectonic geomorphology is a crucial element of geology and of planetary history. and one in which there has been remarkable innovation in the last few years.
7. New terrain analysis tools are just starting to let us see geomorphology in new ways.
8. Far from being moribund, we are growing in national and international organisations and in journals.
9. Earth surface processes are a major challenge for geophysics (in the broadest sense) - they cover all time scales and all spatial scales and they challenge our understanding of fluid flow, sediment movement, mechanics of materials - all in a context that is readily seen and observed by students - done right, a geomorphology course is great training for the earth science mind.

Peter Ashmore

ps. I'm fed up with geologists who think that geomorphology is a breeze, can be picked up in a single course by any fool, and is largely irrelevant to the earth sciences - but don't actually know what geomorphology is!!!!

If you wait a day or two I might get really worked up about it!

Peter Ashmore, Ph.D.

Graduate Chair

Department of Geography

University of Western Ontario

London, Ontario, Canada

N6A 5C2

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from Jim Springer

I don't get it. How can someone be a geologist without a fairly advanced knowledge of geomorphology? I use it ever day in my practice. It would be difficult to pass the professional registration exams without having studied geomorphology. You can't function as a field geologist without it.

Jim Springer

Woodward-Clyde Consultants

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from Ted Hickin

I would suggest that you are confusing two issues. First, I believe that all geoscientists, regardless of their disciplinary backgrounds, would agree that the study of geomorphology is more important today than ever it has been in the past. The second and separate issue is where geomorphology finds its home: in physical geography or physical geology. Much of physical geography is geomorphology in many universities (esp in Canada &the UK) and much of physical geology is geomorphology at others (esp in the US). Perhaps the problem at your own institution is that two administrative units are claiming it as their own? In the end the resolution of such conflicts is as arbitrary as the way we divide up the sciences in general.

Cheers,

Ted

Ted Hickin

Professor, Earth Sciences & Geography,

Simon Fraser University

Burnaby BC V5A 1S6 CANADA

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from Jeffrey Kirtland

I will begin with a question, where are these geomorph naysayers from, the UK? As you may know, teaching geomorphology within geology departments is somewhat unique to the US. Geomorphology is often seen as "physical geography".

While I feel that geomorphology has the same connection to geography that let's say geophysics has to physics--this analogy can be extended to geochemistry and engineering geology--I do not think geophysics should be taught be the physics department. It sounds like some one found the support for teaching geomorphology to be weak and concocted this argument to save their own skin. I am here to say that this type of augment is shortsighted at best.

I received my Masters at Western Washington University, a school with a very strong hard rock tradition and a smaller, but lively, geomorphology program. While I was attending WWU 9 out of 10 incoming graduate students wished to pursue geomorphology and environmental projects. The department could not accommodate the incoming students needs so graduate admissions declined rapidly at the same time the university needed to cut programs. The WWU geology department was fortunate because several professors retired, freeing funds to hire new professors and diversify the department.

Geomorphology has become a hot topic in Western Washington because of state and industry efforts to understand the impact of timber harvest practices on salmonid habitat. Geomorphologist have also found a niche working for developers through the state growth management regulations. Some recent legal problems have slowed job growth, but in the long-term there will be a shortage of geomorphologist. So I feel your departments elimination of its geomorphology program is very shortsighted if not down right stupid. I feel very stongly about this subject.

Jeffey A. Kirtland, P.G.

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fax: 206-524-8599
e-mail: jak@mail.nwlink.com

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from Mark Melton

I ran into this attitude when I started looking for an academic position in 1955. Unfortunately, the geologists are correct, so far as geomorphology being a viable academic research field. That fact that can still read and criticise current geomorphic literature, despite the fact that I got my PhD in 1957 and have done nothing in particular to keep up with the field except read a published paper perhaps once or twice a year, tells you about how far the field has come in that time. It is understandable that the geography departments have pretty largely taken over the field, not only in Canada and the UK, but here also. There simply have been very few advancements in knowledge of a fundamental quality since! There are plenty of geological questions yet, but since they involve going beyond simply identifying features by their signatures, on satellite images, no one in academia seems to be studying these questions. Another reason is that the use of air photos and

satellite images to seek for oil, which used to be an interesting geomorphic activity, has largely been superceded by geophysical methods.

The problems still remain, e.g. how do structures 4-6000 feet below the surface, beneath one or more unconformities, affect surface drainage patterns? How do surficial properties affect morphometric properties when drainage is "inherited" from a higher surface with different properties? I think you get the drift.

Beyond that, because of the great age of landform studies (back to Herodotus, and his study of Nile floods, and other ancients who seldom are thought about, since the classicists who study them haven't a clue what they are talking about), and since there is a huge amount of observable data, most of it uncollated or organized, there is little novelty in geomorphic studies that are "plain and simple" i.e. are not based on fractals or some such fad. Of course we still can't predict catastrophic events with any degree of confidence, and here in Las Vegas they are still building large structures in dry arroyos (not as often as formerly, I admit). And in general, the public awareness of the landforms around them is less complete than their knowledge of DNA or other glamorous fields that receive a lot of attention.

I told my colleagues at the University of Chicago, a totally research-oriented department then and now, that geomorphology and physical geology in general belonged in the same category as Egyptology. It was information that should be preserved, that is interesting in its own right, and that should be taught in junior highschool; but as far as killer research projects competing with physics and molecular biology, no way! I left Chicago in 1959 and spent 4+ years at the U of Arizona where, at that time, they were in the same state of knowledge as say, Pennsylvania was in the middle 1800s. A lot of it was pure exploration. It was fun, but of no particular interest to anyone else.

Anyway, tell the geologists they would have precious little information to go on if they had no surface in formation, but had to rely entirely on drilling and mining information.

With best wishes,

Mark A. Melton

malton@accessnv.com

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from Jack Shroder

Well, as a geologist trained at the U of Utah I never discovered the antipathy that some geologists have about geomorph, and in fact I was sent over to the geography program for a minor so that I could pick up soils, water, and climate to be a better geomorphologist. Coupled with Quaternary stratigraphy, ground water, sedimentology, dating techniques, and other useful interdisciplinary (geol, geog, botany) techniques and you have a pretty powerful tool to undertake problems with Earth surface processes.

Then along come a few geologists ignorant of big picture interactions and geomorph gets lost in the shuffle. Congrats to you for picking it up. We had the same problem here on our Lincoln campus when a ground water type decided that geomorph was irrelevant in his scheme of things and could be done by others of his type. Better reason prevailed, however, when it was

realized that the huge environmental industry really needed students trained in geomorphology. I am in the process oif converting part of the Iowa State University Field Program (ISU, UNO &UNL) in Shell, WY, from a purely bedrock geology program to a parallel program with a good deal of geomorph, geotechnical, and water-related topics. Our first big project will be slope failure and human development in the Big Horns, a very geomorph project.

And another example, a group of hard-rock tectonicists with whom I work in the Himalaya have just written a paper for Science, entitled "The geomorphology of metamorphism," wherein the action of energetic surface processes unload the crust and cause significant temperature and pressure changes at depth sufficient to produce major effects in the bedrock and the tectonism. If that isn't enough to convince the hard-rock types that geomorph is important, then they just don't have a clue. Furthermore, it took the soft-rock, geomorph types to prove what the hard-rockers suspected from their bedrock data - they weren't able to do it without us! Now they are talking about a tectonic aneuryism caused by rapid denudation.

Departments who newly understand the importance of geomrphology coupled with remote sensing, digital elevation assessments, geomorphometry, measurement of process rates, and close temporal assessment of geomorphic change can rapidly find themselves in a powerful position in problem solving in our modern world. Losing geomorphology, in my opinion, is a good way to increase irrelevance.

Hope that helps.

Jack Shroder

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from Richard Marston

I'm disgusted and dismayed with geologists who proclaim that geomorphology is nothing more than physical geology. At this very time, GS is promoting a nationwide push to metamorphose geology into earth sciences because of declining enrollments and shrinking departments in geology. Do some geologists still believe that vegetation and animals play no role in the development of landforms...it's nothing more than physical geology? Do some geologists really think that the role of humans in landform development is trivial? You should remind your geology colleagues of the PARTIAL influence that geologic structure plays on surface expression of topography. Remind them that climate (and climate CHANGE) create polygenic landforms. In my mind, the most important theme in geomorphology today is separating change caused by human activities from change that would have occurred without human interference. Making this distinction is absolutely critical before formulating natural resource management decisions that may exacerbate existing problems of landscape instability. A second major theme that relates to the relevance of geomorphology concerns the interaction between geomorphic features-processes-materials and those of biogeography, climate, hydrology. Landscape ecologists and aquatic biologists have "discovered" that the concepts and techniques of geomorphology help explain and predict many phenomena in their subject areas. Most environmental problems today are

recognized as interdisciplinary, and geographers are better equipped to deal with this reality than geologists, who by their training and experience are not accustomed to examining more than what lies beneath the surface.

I will send you my chapter on "Geomorphology" from the 1989 book, Geography in America, edited by Gaile and Willmott. Although it is a decade old, it bears witness to the situation. You should also get in contact with Dave Butler who is updating this chapter for the next edition of Geography in America 2000. Dave is on top of what's happening in geomorphology as much as anyone and would be glad to carry-on a discourse with you on the topic. Geomorphology is growing within geography and shrinking in geology. The GSA Quaternary Geology and Geomorphology Division is dominated by Quaternary types and those of us more interested in surficial processes, earth system interactions, and the human role in geomorphology are turning to geography. Will Graf was able to document this with numbers in a column he wrote while serving as chair of the GSA-QG&G Division. I am a member of both the GSA and AAG, but its the AAG meetings and Binghamton meetings that attract my attention and dedication merely because I have found that geologists, as a gross generalization, are among the most parochial scientists of all scientific disciplines. 969 geomorphologists from 67 nations attended the 4th International Conference on Geomorphology in Bologna, Italy, last summer. Geomorphologists are being appointed to National Research Council Committees. The discipline is vibrant and contributing to solution of practical natural resource problems as never before.

I'm very glad to hear that you were able to save the geomorphology course for geography at SUU. Nice going! You live in a part of the country where geomorphology shines like a bright light in your face as you travel. I hope to take my family to your part of the world this summer to renew myself with the fantastic landscapes of southern Utah and to show my 12 year-old son, Bryce, his namesake, Bryce Canyon.

Dr. Richard A. Marston, Professor, AAG Secretary, Regional Councillor AAG

Great Plains-Rocky Mt. Div.

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from Anne MacDonald

When I attended my first QG&G luncheon at GSA in 1979, Vic Baker

announced to the assembled 200+ that Harvard had just announced that geomorphology was dead. After a stunned silence, there was much laughter. Vic is now president of GSA, and my advisors' (Tom Dunne and Ed Keller) geomorph students have never lacked for jobs, whether in neotectonics/tectonic geomorphology, landslides, soils, sediment routing in forested environments (important implications for the west coast salmonids on the endangered species lists), or fate and transport of hazardous wastes. Just ask the petrologists if they can match that. In fact, I've recently been involved in litigation in Utah over the specific timing and mode of transport of mine tailings – Stan Schumm was on the other side – and the arguments were based on sediment transport using reconstructions of land use, channel modifications, responses to storm flows, and redeposition of the transported sediments – all within the purview of geomorphology. Geomorphology may be covered in "just physical geology", but should be covered at a much more comprehensive level than can be attained in a one semester intro course. To work in this field, you have to read landscapes. And that takes time with what is going on in water quality (EPA's watershed focus, with sediment as a major source of impaired water quality and habitat either directly or because of metals/PCBs/phosphorus along for the ride), endangered species management (particularly in the west, where it is so often tied to aquatic habitat – think whooping cranes on the Platte, Prebles meadow jumping mouse here in the front range), habitat restoration, and understanding past responses to climate change as a predictor of the future, geomorphology is supremely relevant. Geology departments that don't recognize that will take on the fate of Snake River sockeye salmon or the whooping crane – endangered. Or at least irrelevant. Chalk one up for the geographers in avoiding that fate.

Can you tell you touched a nerve? Good luck!!!!!!!!!!!!!!!!!

–Anne

Anne MacDonald, P.G.

Senior Geomorphologist

Exponent Environmental Group

(Formerly PTI Environmental Services)

4940 Pearl East Circle, Suite 300

Boulder, Colorado 80301

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from Jack Vitek

As a geographer who moved into a geology department by choice, I would ask them where in physical geology they discuss the atmospheric characteristics and processes that generate precipitation that causes rainfall and runoff. Rainfall is hardly a geologic topic.

Ask how they address temperature changes and the causes for them...hardly geologic in nature EXCEPT for long term events such as raising a mountain range.

Ask how the wind is created and how that is a geologic force...

If they are older, they will not understand and they don't want to. I learned early on at Iowa that pre-Pleistocene geologists haven't got a clue about present processes. I have asked questions about aspect with regard to the receipt of energy on surfaces facing different directions and to most they ignore the variable.

How do they treat environmental geology without reference to atmospheric processes? How do they deal with soil? biologic forces?

BUT....as you collect ammunition to support your position, remember you catch more bears with honey than vinegar. Whereas geomorphology can be in either department, it still involves the same variables. Emphasis can change from instructor to instructor....but we must be certain that the students learn about the entire system and not just one full of bias.

Hope these random thoughts help.

CHEERS

Jack Vitek

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from Donald L. Johnson

I would say that inasmuch as the roots of geology lie in geomorphology, and inasmuch as the entire field of environmental geology -- not to mention engineering geology -- deals with real geomorphological-societal problems, and inasmuch as geomorphology is NOT just physical geology, and inasmuch as geomorphology has much to offer many other disciplines (pedology, forestry, environmental studies, erosion-flood-landslide control, etc., etc., etc.) that whomever said that is either not very observant, is stupid, is so extremely narrowly focused on his/her own specialty that he/she is oblivious to professional reality (a generous way of defining stupidity), or is all of these.

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from Victor Baker

What do you say to the geologists who claim that there is no longer a need for the study of geomorphology? First you might note that the President of the Geological Society of America (that's me) disagrees vehemently with them, not merely because I am a geomorphologist, but because the surface of the Earth and the processes acting upon it are at least as important for scientific inquiry (a science called "Geomorphology") as any other branch of geology/geophysics. If you want to add a bit about societal relevance, the fact that humans live on the surface of the Earth (not at the core-mantle boundary or the bottom of the ocean) has something to do with why society might be especially interested in the science of geomorphology. Perhaps your colleagues in geology need to stop talking to one another and think about the future of their discipline and its connection to allied sciences of societal relevance. You might also contact the officers of the Quaternary Geology and Geomorphology Division of The Geological Society of America (one of the largest and most active divisions of the society), who I am sure will be happy

to provide some enlightenment to counter the bizarre and parochial views that seem to held by your local geologists

Cheers,

Vic Baker

President, The Geogical Society of America

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from Richard A. Marston

It has been said that scientists tend to take-on the qualities of the objects they study. Therefore, I bet the obstinate geologist who opposses your curriculum in geomorphology and GIS is a paleontologist who studies long-extinct dinosaurs.

Dick

Dr. Richard A. Marston, Professor,

AAG Secretary,

Regional Councillor AAG

Great Plains-Rocky Mt. Div.

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from Antony Orme

I am delighted that you have been able to acquire geomorphology from those grumpy geologists who no longer believe. Good luck to you.

Your situation is reminiscent of UCLA in the mid-1960s when Bill Putnam, a distinguished geomorphologist in the geology department died suddenly and his department took this as an oppportunity to abandon geomorphology. Geography picked it up and I was brought in from Ireland to begin the program. Over the years we have been very successful and I alone have produced 26 Ph.D.s and 40 M.A.s in the field, many of whom have become quite distinguished in their chosen areas. Meanwhile, our geology department sought to dismiss sedimentology, languished for a long time, was fused with astronomy, planetary science, and geophysics into a department of earth &space science, and still has trouble in seeking enough undergraduates to justify its existence. Many of our geologists are indeed quite distinguished in geophysics and geochemistry, but continue to struggle for undergraduate justification.

In many respects, physical geology is geomorphology for the quantitatively challenged. It emphasizes descriptive notions of surface processes, generally at the lower division level, with little attempt at understanding process, at linking with the process-oriented and quantitative components of hydrology. oceanography and glaciology. In short, physical geology looks backward to the so-called 'heroic age' of geology in the early nineteenth century, rather than espousing the continuing discoveries of the later twentieth century.

Of course, our human geography colleagues can be just as blind to the posssibilities of geomorphology. Now that you have brought geomorphology into the geography fold, your human geography colleagues will need some nurturing and education but, if they are wise, they will encourage you in the interests of a more complete geography. As for those geologists, cultivate those who show some residual interest for the field, forget the rest. Geography's gain is geology's loss.

Good luck in your efforts,

Antony Orme,

Professor of Geography

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from Jon Harbor

Your geomorphlist message struck a chord with me. The quick response to geologists who question the relevance of geomorphology is to write them off as so out of touch with their subject as to not be worth the time you spend on them. Do they not realise that the Quaternary Geology and Geomorphology Division of GSA is one of the largest in the society? The fact that they regard geomorphology as being basically physical geology is telling – in fact geomorphology is dominating intro geology these days (just browse thro the intro texts) because it is so central to the discipline. However, traditional geology programs and traditional geologists are perhaps reacting to the rising emphasis on 'environmental' in geology by trying to remove the more environment oriented courses that are drawing away the geology students who might otherwise have taken more traditional geology paths. Geomorphology is a natural target in this reaction. This doesn't mean that they no longer teach geomorphology – in fact they are increasing the geomorphology content of more traditional courses.

So, is moving the geomorphology course to geography a bad thing for your program? In most areas of the world geomorphology is primarily taught in geography departments. The US is in fact very unusual in having geomorphology so heavily skewed towards geology. There are historical reasons for this, of course, but it seems to me that it helps geography departments to be able to offer strong geomorphology as an integral part of physical geography. Ideally the subject should perhaps be taught jointly between geography and geology (both disciplines have a lot to offer the field), but this is probably rare to find given the realities of departmental politics.

Jon Harbor

(geomorphologist with degrees in both geography and geology)

Jon Harbor

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from R. Forrest Hopson

Dr Larson, I'd say they're crazy. Of course, much of geomorph is probably just as well taught in a geog dept. Glacial geomorph is an example. But so much of geomorph also involves a helluva lot of geology such as development of landscapes by folding, faulting, mass waisting, and so forth.

I took a general geomorph course taught in the geography dept when I was college. In general it was good course, but as a geologist, I would have preferred to gotten a geologist's "bent" on the subject. My prof said a couple of things about volcanoes that were just plain WRONG!

I do think that geomorph is a useful course. I think you did the right thing by adding the class to your geog curriculum.

Sincerely, Forrest Hopson

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from Carlo Bartolini

Geologists say that because many of them ignore the essence of geomorphology. They believe, for instance, that a fault-scarp IS a fault, so skipping the intriguing problem of tectonic versus erosion "competition".

We must not give up!

With all my best wishes

Carlo

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from Bill Locke

- If the geologists aren't interested in the largest nonfuel geological resource (sand and gravel),
- If they have no interest in groundwater quantity and quality,
- If they don't care about analogs for sedimentary depositional environments,
- If they are unconcerned with process-related hazards such as floods,
- If they find human/landscape interactions (construction, reclamation) irrelevant, and
- If they find planetary geology uninspiring,
  Then they should definitely relegate those topics to someone (like a physical geographer) who is interested in them.
- William W. Locke; Professor, Geology
- Department of Earth Sciences

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- from Carol Jaworowski
- The study of geomorphology is very relevant to many applied problems. It's use in petroleum geology for exploration of hydrocarbons is a current topic. Recently, AAPG (in Salt Lake) had a special session on geomorphology and tectonics. And of course, landuse decisions relate to geomorphology. Becuase of its association with landuse, geomorphology appeals to curious public citizens. Although I am not personally invovled in geohydrology, geomorphology is a relevant base for those studies.
- Some objections about geomorphology relate to theories about landform development that are hard to prove. Geomorphic studies that do not numerically constrain processes or landform development are not looked on favorably. In fact, they may be seen as out-dated.
- Sincerely,
- Cheryl Jaworowski, Ph.D.
- Post-Doctoral Researcher
- Institute for Energy Research
- University of Wyoming
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- from Bill Mahaney
- Is Geomorphology geography or geology? This was a question on the final exam in a 300-level course in geology at Indiana University taught by Bill Thornbury back in the mid-60's. As a grad student in geography at the time I was told by my peers that the only answer possible was that geomorphology was geology. Thornbury would not accept any other possibility. I got round this by arguing that 'geomorphology is geomorphology' and making it subservient to one field or the other was merely bureaucratic, more or less a waste of time. Geomorphology might just as well be allied with chemistry, atmospheric sciences or agricultural sciences. WT (William Thornbury) was stumped, hardly amused but he had to admit I had a point and he handed out a rather high grade. Later, I found out it all had to do with politics. WT had been tossed out of geography and landed in geology, apparently much to his chagrin. This is hardly an itellectual exercise and amounts to little more than academic hubris or hunting for increased enrollment to satisfy administration quotas.
- Bill Mahaney
- Toronto

- More opinions

Edited by The Association of Polish Geomorphologists
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