Final Report of the American Geosciences Institute ad hoc Committee on Academic Geoscience Program Classification

Charge:

The Ad Hoc Committee on Classification was given the following charge in 2012:

"Consider the possibility of academic classification of academic geoscience programs, its potential value to students, faculty, employers, and licensing agencies, and determine if AGI and/or the member societies should engage in such a practice. If the answer is affirmative, make specific recommendations, ready for implementation, for a classification procedure. This would include specific classifications (or mechanisms to establish them), and the review and award process."

Terminology is defined in Appendix I. The committee was comprised of people nominated by their Member Societies; a list of members is attached as Appendix II.

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Background:

The question of accreditation of academic geoscience programs (see Appendix I: Terminology) received considerable attention in recent years. Surveys of geoscience department chairs and all geoscience employment sectors were conducted (e.g., GSA ad hoc committee, 2008), but both the surveys and the movement towards accreditation met with objections for various reasons (Bralower et. al, 2008; Pennington, 2008). Some societies made plans to move ahead with voluntary accreditation (Blythe, 2011), and accreditation was established outside the United States (e.g., Geological Society of London program). By 2010, AGI was formally requested by ten Member Societies to facilitate a community-wide discussion on program accreditation. This ad hoc committee was constituted in May 2012 as the result.

Meetings were held online; attendance usually consisted of about one-third of the committee membership, but recordings of the meetings were made available online. Recognized experts in specific forms of accreditation, classification, or related subjects were invited to speak, and active discussion followed. Materials related to accreditation and professional licensure in Europe and Canada were reviewed, as well as other items. During the time that the committee was active, new approaches for recognition of student accomplishments were emerging, and these also entered discussion with experts.

The National Science Foundation in early 2014 convened a "Summit" on geoscience education and its future, and has assumed a principal role in attempting to define the discipline and expand opportunities for students at a disadvantage, including those enrolled at institutions unable to offer a complete geoscience curriculum. Several members of this committee took part in that summit, sharing their experiences. NSF is continuing its leadership in this area by instituting an "Ideas" lab to examine options and create new approaches, and planning to follow up with a major program.

As a result of the quickly shifting field of educational paradigms and the NSF efforts, this ad hoc committee will disband, with the following observations.

Observations — Three Paths Exist:

Maintaining the status quo exists as one obvious choice: provide no discipline-wide sanctioned options for verification of programs in the geosciences. However, for programs that are interested in external validation of their program, there are several approaches that they might pursue in order to provide students, recruiters, licensing offices, or other stakeholders with confidence regarding the nature of the education being provided to those students. These approaches can be grouped into three categories, and each will be described in more detail in following sections and Appendix II. In general, these approaches are voluntary, and of course any department could choose not to enter their program(s) into any of these systems.

1) **Accreditation** — a department-centered approach which could be implemented through ABET for engineering or applied science programs, or through another existing agency, particularly the Geological Society of London, providing rigor in the assessment and an external reference for stakeholders;

2) **Classification** — a set of guidelines defining skills, knowledge sets, and ways of thinking to which academic programs could voluntarily align their academic degree programs and courses. Such an approach could have multiple tracks regarding specific target outcomes based on student/program goals;

3) **Competency-based "badging"** — a student-centered form of certification of various levels of knowledge or skills based on demonstration through passing courses or through other means. Rather than a focus on the program's defined suite of courses, it is the student portfolio which defines the outcomes from the student's academic pathway.

Accreditation is generally recognized as being least accommodating to variations in content or student situations, classification a bit more accommodating, and competency-based system the most flexible, allowing students to move from two-year to four-year institutions easily regardless of articulation agreements.

The competency-based approach is not exclusive of the other approaches. In particular, though, it is highly compatible with the voluntary classification approach, by giving students the options required to match their learning styles, career goals, and life situations.

AGI should remain ready to assist the corporate and academic communities in further developing proposals that incorporate feedback from the communities. This committee recommends that AGI be responsive to community demand for these approaches and engage all stakeholders including member societies, academia, corporations, and funding agencies to generate community action.

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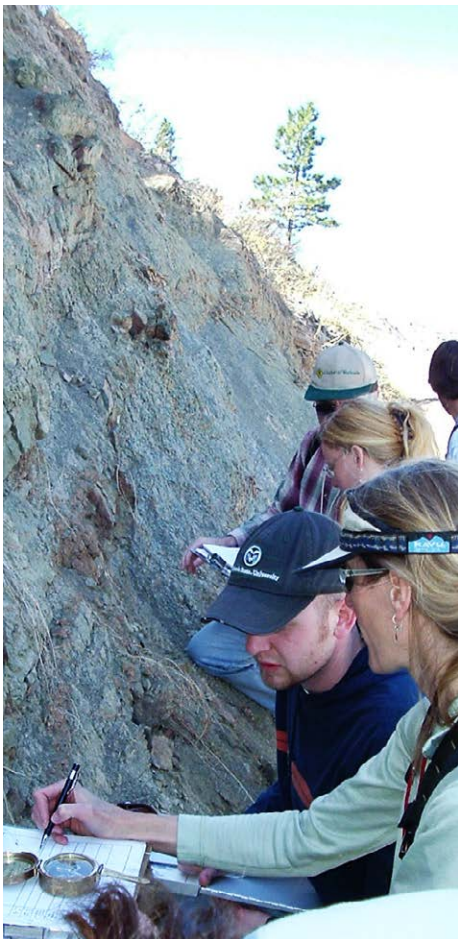

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Accreditation: ABET and GSL

The most recognizable example of program accreditation is ABET (formerly the Accreditation Board for Engineering and Technology; see www.abet.org), a federation of engineering, computing/computer science, engineering technology, and applied science professional societies (one of which, the Society for Minerals, Mining, and Exploration [SME], is a member society of AGI and was represented on this ad hoc committee). ABET also provides for accreditation of applied science programs, an avenue being actively pursued by some geoscience departments. The discipline-specific requirements for accreditation are determined by the appropriate member societies (SME for Geological Engineering, Geophysical Engineering, and Mining Engineering) and vetted by the respective commission to agree upon the program-specific criteria for that discipline's degree programs. There are overall institutional and other criteria, but most attention from the geoscience community has tended to focus on what they consider to be the "curricular" requirements. ABET does not require specific courses, but does require certain "outcomes" – that is, a student who completes a degree is expected to have mastered the material listed as outcomes. This provides to each degree program on each campus considerable leeway in course development, while ensuring that students are indeed prepared for a career in the career areas served by that degree program or for graduate school acceptance. ABET accreditation requires a lot of effort: there is an extensive self-study (in part, similar to a regional accreditation agency self-study) and a site visit conducted by evaluators from within the academic and professional community, who volunteer and are trained by ABET as well as through the appropriate professional societies. Essentially all engineering programs using the title "engineering" are accredited through one of the commissions within ABET; a growing number of applied-science programs are also accredited through one of the commissions within ABET, but geoscience programs are still experimenting with the concept.

The Geological Society of London (GSL) also maintains a geoscience program accreditation process. Launched in 1997, the GSL accreditation scheme has been awarded to over 140 programs around the world. The scheme assesses programs in an effort to promote a strong geoscience profession, ensures that degree recipients are prepared to enter as competent practicing geoscientists ready to pursue appropriate professional certifications for practice. The accreditation scheme assesses geoscience programs on their preparation of graduates with a solid foundation in the basic physical sciences and math, rigorous understanding of geoscience processes and roles in society, and a strong development of geoscience habits of mind, such as 3D thinking and managing large spatial data sets. Specific courses are not part of the GSL evaluation. More information about the GSL's program is available at http://tinyurl.com/GSL-process.

Advantages of Accreditation:

- **Strong confidence in conformance to requirements**
- **Guidelines are clear**
- **Evaluation by peers**
- **Strength of evaluation is recognized by administrators**
- **Students, recruiters, and others understand program goals**
- **Recognition by licensing agencies**

Issues of Accreditation:

- **Labor-intensive, both for program personnel and evaluators**
- **Perceived lack of flexibility or impediment to program changes**

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Classification: Voluntary, Self-Assigned

This method does not yet exist for the geosciences, but was one of the main considerations for adoption by the committee as it began its deliberations. Classification involves characterization of a degree track. It defines the content and skills a student should acquire in a class (e.g., geophysics, environmental geology, liberal arts geoscience, etc.), but is theoretically open to an unlimited number of "classes". Implementation could be by one or more committees given the authority (such as a professional society), which would canvas the community and determine student outcomes (not course titles) required for conformance with disciplinary expectations and other concerns as appropriate. These could include graduate school admission expectations, licensing requirements, universal knowledge goals, or other factors depending on the purpose and constituency of each classification. A classification scheme could be enforceable, in that programs would need to submit their program requirements and outcomes to an agency (such as a professional society) for approval. But another approach could be entirely voluntary: compliance would be self-determined by each program. The various classifications and their criteria would be developed with buy-in from employer, academic, and society communities, and classifications would include outcome tracks such as liberal education and graduate-school preparation as well as teacher education and industrial employment. Departments could align their degree requirements and courses with as many classifications as they wished and advertise to students, parents, and employers that they do so.

Advantages of Structured Classification:

- **Well-defined disciplinary tracks**
- **Aligns with current accountability standards in most institutions**
- **Prospective nature provides sense of certainty for recruiters, students, etc**
- **Line of authority is clear**

Issues of Structured Classification:

- **Expensive to administer, perhaps prohibitively**
- **Would require fees from participating programs**
- **Conflict resolution process required**
- **Flexibility somewhat discouraged**

Advantages of Voluntary Classification:

- **Community-defined (through professional societies)**
- **Many different program tracks would arise through community involvement**
- **Does not disadvantage small programs with limited teaching resources**
- **Low cost**
- **Promotes self-assessment**
- **Responsive to changes in discipline**
- **Provides guideposts for new programs**
- **Defines community-accepted outcomes**
- **Appears proscriptive to external community (parents, recruiters, etc)**

Issues of Voluntary Classification:

- **Requires some cost to maintain**
- **Compliance enforceable only through peer pressure**
- **Potential for proliferation of finely detailed program tracks**
- **Ownership of authority may not be clear**

Competency-Based Badging or Portfolios

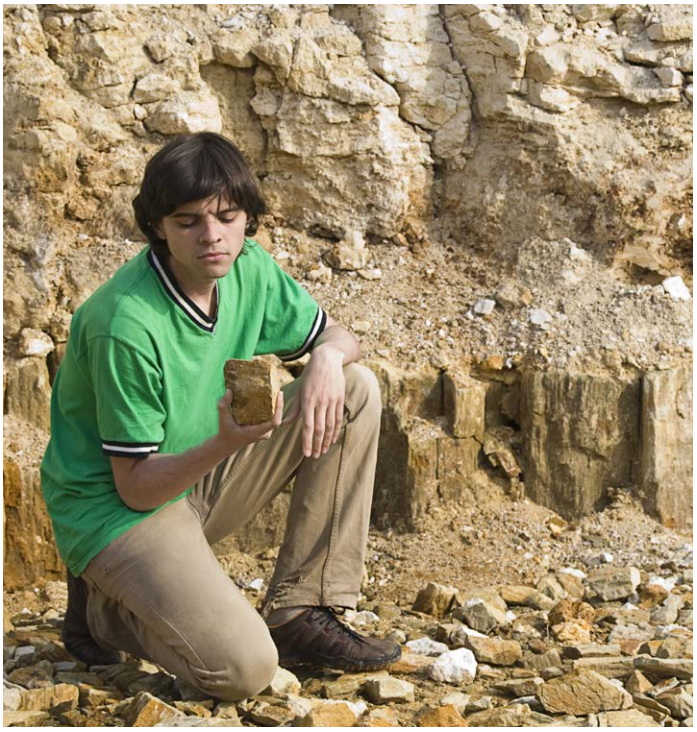
This method would provide a student-centric approach to program development. Students collect recognition of knowledge and skills, and follow a "track" that meets goals described by the professional and academic community (providing such tracks are vetted and published). It would allow a mix-and-match method for students using elective choices available, including a greater acceptance of external components, such as business, policy, or non-traditional education. It may encourage viewing the degree process as one step in a life-long learning continuum. Academic programs would find that the driving force for revision of course offerings comes from the students and from external drivers for employment, graduate schools, or other life choices facing the students.

Advantages of Competency-Based "Badging":

- **Promotes trans-disciplinary approaches that may not fit traditional tracks**
- **Less proscriptive, allowing great flexibility**
- **Permits competencies to be developed outside the university**
- **Expands opportunities for students at institutions with limited resources**
- **Expands opportunities for students who change career goals during college**
- **Could encourage repeated efforts at topics (courses) until successful**
- **Could help address social, economic, and place-based challenges**

Issues of Competency-Based "Badging":

- **Original definitions required**
- **Clearinghouse necessary; some cost involved**
- **May be difficult to vet and to maintain**
- **Less proscriptive – may be difficult for external community to assess**



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Next Steps:

AGI should stand ready to serve the community as these ideas mature and develop. The ad hoc committee will have served its purpose on the issuance of this report, which provides observations for the community, but does not specifically recommend any specific action.

The NSF-sponsored "Summit" held in January 2014 in Austin, TX, provided considerable material for contemplation by the community, and is leading to one of the NSF-conducted Ideas labs under the IUSE program being held as this report is finalized. These efforts, and any AGI follow-up that may occur, are all being conducted in a manner that ensures community direction, and not a top-down determination of best practices or program requirements. AGI should follow the developments of the NSF-sponsored activities, and participate in them to the extent practical or appropriate, whether through staff involvement or the involvement of member-society volunteer member activity, keeping AGI informed as the efforts proceed.

References

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Appendix I: Terminology

Academic Distinctions:

Program: an academic program in a given discipline, such as "geology".

Department: an institutional component or unit that may administer one or more degree programs.

Processes:

Accreditation: an authorization indicating that some entity (university, department, or program), meets the standards of an accrediting agency. All serious universities and colleges receive general accreditation under some regional authority, such as the North Central Association of Colleges and Schools of the Higher Learning Commission. Specific degree programs may also receive accreditation: engineering degree programs are accredited under ABET, many business degrees under another organization, and so forth. Departments may undergo reviews, perhaps involving external committees, but this is not the same as accreditation, and departments are generally not accredited themselves, while the academic programs that they administer may be accredited.

Approval: Similar to accreditation is program "approval" as employed by the American Chemical Society, a process through which academic programs can be "approved" by the governing society. This enables graduating students to receive certification in the field (see below, and http://tinyurl.com/ACS-document).

Certification: People can be certified for competency in fields, such as a certified professional geologist or certified petroleum geologist, or they may obtain a certificate for certain skills, such as one for GIS, based on courses passed or some other criterion. The certification is generally performed by an organization that establishes the criteria themselves; this may be an educational institution, a professional organization, or some other body. Certification is not applied to departments or programs. But students who graduate from accredited or approved programs often find it much easier to achieve certification than those who do not graduate from such programs.

Classification: This is a form of approval of a program's compliance with guidelines, such as outcomes associated with that program's classification. There could be a variety of approaches to classification as discussed in this document: classification could be a component of accreditation or of program "approval" for example. As imagined in this document, it could be a voluntary self-assessment leading to a classification of a program as one of many possible program types or "tracks" in the broad field of geosciences. For example, a program could be classified as a liberal-arts geoscience program, or an applied geophysics program. Criteria would be published in order to ensure full awareness of the programs' qualities among the various stakeholders, including students, parents, licensing or certifying agencies, or recruiters.

Licensure and Licensing: People can be licensed to practice as professionals in some field, such as licensed professional engineer. Licensing is usually provided through a state agency established for this purpose, and will vary from state to state. For example, geologists can be licensed in 30 states, but there is no mechanism for licensure of geoscientists in the remaining states or the territories. ASBOG (National Association of State Boards of Geology www.asbog.org) is the agency that assists states in establishing licensure for geoscientists.

Appendix II: Committee Membership

Member Society	Name	Affiliation
AAPG	John Holbrook	Texas Christian University
AASP	Frederick Rich	Georgia Southern University
AEG	Darrel Schmitz	Mississippi State University
AGI	Wayne Pennington	Michigan Tech
AGI	Christopher Keane	American Geosciences Institute
AGU	Lydia Fox	University of the Pacific
AIH	Stephan Nix	Texas A&M-Kingsville
AIPG	Ronald Wallace	Georgia Dept. of Natural Resources
ARMA	Azra Tutuncu	Colorado School of Mines
ASBOG	Randall Kath	West Georgia University
ASBOG	Richard Spruill	East Carolina University
GSA	Murray Hitzman	Colorado School of Mines
GSL	Edmund Nickless	Geological Society (London)
IMGA	Robert Finkelman	University of Texas at Dallas
MSA	David Mogk	Montana State University
NAGT	Tim Bralower	Penn State University
SEPM	David Budd	University of Colorado
SExG	Louise Pellerin	Green Engineering, Inc.
SME	Dale Elifrits	Northern Kentucky University
SSA	Rick Aster	New Mexico Tech
SSSA	Randall Southard	University of California, Davis
NSS	David Decker	(grad student perspective)