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Is Geology Accreditation Needed? It Is Already Here!

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INTRODUCTION

In the 2000s, geoscience program accreditation was a regular topic in journal articles, opinion pieces, meeting sessions, and committee reports (e.g., Corbett and Corbett, 2001; GSA Ad Hoc Committee on Accreditation, 2008). Geoscience accreditation discussions subsequently subsided for apparent lack of proactive, interactive interest and with no consensus achieved (GSA Ad Hoc Committee on Accreditation, 2008; Bralower et al., 2008). Simultaneously, an increasing emphasis on continuous improvement in higher education has led to regular, formal assessment of student outcome achievement, efforts to align program outcomes to workforce needs, and expansion of competency-based learning. As a result, calls have been made for professional societies to develop certification, accreditation, or badging programs (Wikle, 2018; Mosher and Keane, 2021; Klyce and Ryker, 2022).

Two recent publications (Mosher and Keane, 2021; Klyce and Ryker, 2022) indicate that geoscience lacks an accrediting body, but accreditation of geoscience programs is already in place via ABET. The Applied and Natural Science Accreditation Commission (ANSAC) of ABET has adopted program criteria for "Geology, Geological Science and Similarly Named Programs." The first geology program was ANSAC-ABET accredited in 2017, and as of 2023, five geology programs (three international, two U.S.) have accreditation. These institutions are the University of Arkansas at Little Rock, South Dakota School of Mines and Technology, Universidad Industrial de Santander, United Arab Emirates University, and the University of Jordan.

We are three active geology program evaluators (PEVs) for ANSAC who have served in administrative roles in departments hosting geology programs. We wish to raise awareness of the ANSAC accreditation process, accreditation costs and benefits, and the need for additional geoscientists to become PEVs. All PEVs serve as ABET volunteers on behalf of their member societies for the program discipline(s) that they review.

ACCREDITATION PROCESS

ABET is a nonprofit organization of volunteers belonging to professional STEM member societies. General accreditation criteria evolve over time through the collective efforts of these volunteers. Program criteria, PEV training, and PEV assignments are administered by the member society (or societies) overseeing a discipline. The Society for Mining, Metallurgy, and Exploration (SME-AIME) is currently the lead society for geology programs, as well as mining engineering and geological engineering programs, and is a cooperating society for environmental and metallurgical engineering programs.

Each science and engineering discipline is represented on the relevant ABET commission (ANSAC for science; Engineering Accreditation Commission for engineering disciplines) by one or more commissioners from member societies. Each discipline has a pool of PEVs who conduct evaluations. Geology has one commissioner from SME-AIME on the ANSAC Commission, and, currently, many geological engineering PEVs also are serving as geology PEVs until a cadre of more geoscience-centric volunteers can be recruited.

ABET does not mandate a rigid curriculum of required courses. Instead, "[t]he program's faculty must assure that the curriculum devotes adequate attention and time to each component, consistent with the objectives of the program and institution, while preparing students for life-long learning" (ABET, 2023). The accreditation process uses an outcomes-based approach focused on what students learn and experience, and ABET provides a framework for a program to

1. articulate goals for professional attainment of recent graduates (program educational objectives [PEOs]);
2. define and consult constituencies for developing and revising PEOs;
3. establish additional student (learning) outcomes (SOs) beyond those in the general criteria, if desired (see Table S1 in the Supplemental Material[1] for full list of SOs);
4. assess acquired student knowledge and skills for each SO (see Table S1 for an example of performance indicators used in one geology program); and
5. use multiple data sources for improvement of courses, curricula, and/or programs.

Curriculum requirements for baccalaureate programs accredited under ANSAC are

1. a combination of college-level mathematics and sciences (some with laboratory

[1]Supplemental Material. Table S1: 2023–2024 ANSAC Student Outcomes (SOs); Table S2: ANSAC's geology program criteria, ASBOG Fundamentals of Geology (FG) exam topics, and California's educational requirements for professional geologist licensure eligibility. Please visit https://doi.org/10.1130/GSAT.S.24446617 to view the supplemental material, and contact editing@geosociety.org with any questions.

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and/or experimental experience) appropriate to the discipline;
2. advanced technical and/or science topics appropriate to the program;
3. a general education component that complements the technical and scientific content of the curriculum and is consistent with the program and institution objectives; and
4. capstone comprehensive projects or experiences based on the cumulative knowledge and skills acquired in earlier course work (ABET, 2023).

The six ANSAC SOs require assessment and focus on multiple skills, including application of mathematics and science knowledge to solve topics relevant to the discipline, effective communication, ethics, and teamwork (see Table S1). A program may develop additional SOs, and if it does, those outcomes must also be assessed.

Geology program criteria (see Table S2) are not a list of required courses, and course credits assigned to each topic are not prescribed. Instead, a program's curriculum must be consistent with its PEOs. Program criteria assessment is not required, although a program must demonstrate where topics are covered and how criteria are met.

COSTS AND BENEFITS

ABET accreditation is not feasible for all programs, especially if most of the content outlined in general and program criteria is not already part of the curriculum or the institution lacks other ABET-accredited programs. There are institutional (monetary and reporting) and program (assessment and reporting) investments. Geology program accreditation is more practicable on a campus with other ABET-accredited programs, as the workload documenting institutional-level resources and support can be shared, and expertise from across campus can be leveraged.

There are advantages for programs pursuing ABET accreditation. Regional accreditation organizations (e.g., Higher Learning Commission) require rigorous assessment of, and continuous improvement based on, student outcomes for all institutional programs. For public institutions, state governing boards or departments of higher education often mandate that degree programs undergo periodic program review, which may include self-studies with program assessment and paid external evaluators visiting campus. ABET accreditation can meet these requirements.

While ABET accreditation is not mandatory for the geology programs we represent, our programs are subject to student-learning assessment as part of university accreditation. When faced with the option to seek ABET accreditation or participate in another round of review to satisfy state and regional accreditation requirements, the choice was self-evident: Our programs could be ABET accredited with little additional work, we would receive quality feedback from trained PEVs, and we could bypass future in-house assessment exercises. Thus, rather than simply complying with a mandate, our programs receive an internationally respected accreditation and associated public recognition.

Accreditation may also help retain and secure resources. For instance, field methods are an explicit part of ANSAC's geology program criteria (see Table S2), which could help justify continuation of field courses or camps. Although both costly and labor intensive, and therefore a potential target of cost-cutting measures, these opportunities remain common in geoscience programs (Klyce and Ryker, 2022) and are required for professional licensure in some states (e.g., California; California Code of Regulations, 2023; see Table S2).

Accreditation also benefits graduates. The common perception that most professional geologists have master's degrees is not the case (Shafer and Viskupic, 2022). For professionals with bachelor's degrees, certification as professional geologists (through state licensure) and/or as certified professional geologists (through the American Institute of Professional Geologists) is often important for career advancement. Because geology program criteria are closely aligned with topics in the National Association of State Boards of Geology (ASBOG) Fundamentals of Geology exam (see Table S2), students are well prepared for professional practice. In fact, California recognizes graduation from an ANSAC-accredited geology or related program as meeting educational requirements for professional geologist licensure eligibility (California Code of Regulations, 2023).

NEED FOR GEOLOGY PEVS

ABET accreditation relies on PEVs from industry, agencies, and academia. Our SME-AIME colleagues in both engineering and geology were strong supporters as geology accreditation took shape. Current evaluators, however, do not represent the full spectrum of geoscience expertise. Becoming a geology PEV requires membership in SME-AIME and a PEV application to ABET (<30 min). Training involves ~20 hours of online work, a 1.5-day simulated campus visit at ABET (ABET supports this travel), a half-day training session led by the SME-AIME Volunteer Selection Committee (ABET does not support this travel), and participation as an observer during an ANSAC team visit (ABET supports this). Biennial refresher training is also required. Serving as a PEV, therefore, is a significant service commitment, but we feel that these efforts are important to our programs, our students, and the future of geoscience education.

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