BOARD FOR PROFESSIONAL ENGINEERS, LAND SURVEYORS, AND GEOLOGISTS
2535 Capitol Oaks Drive, Suite 300, Sacramento, California, 95833-2944
Telephone: (916) 263-2222 – Toll Free: 1-866-780-5370
Facsimile: (916) 263-2246
www.bpelsg.ca.gov

GEOSCIENCES DEGREE WORKSHOP AGENDA
Qualifications for Licensure as a Professional Geologist
Public workshops regarding the minimum curriculum for a qualifying geological sciences degree

The Board for Professional Engineers, Land Surveyors, and Geologists (BPELSG or the Board) is holding two workshops to receive input to identify the minimum curriculum required for a qualifying geological sciences degree in order to apply for licensure as a Professional Geologist.

The minimum qualifications for licensure as a geologist in California are described in Business and Professions Code section 7841 (see box for complete text).

The Board has long recognized that there is confusion among potential licensees regarding the requirement for "*Graduation with a major in geological sciences from a college or university*". The confusion appears to be due to several factors including:

- the lack of a standardized university curriculum for a geology or geoscience degree;
- the lack of a national accreditation program for a geology or geoscience degree;
- the proliferation of interdisciplinary earth science and environmental degrees in response to current environmental challenges;
- the misperception by some that because geologists often work in the environmental field, environmental science (or related interdisciplinary degrees) and geology are equivalent.

7841. Qualifications for registration as a geologist
An applicant for licensure as a geologist shall have all the following qualifications:

(a) Not have committed any acts or crimes constituting grounds for denial of licensure under Section 480.

(b) Graduation from a college or university with a major in geological sciences or any other discipline that, in the opinion of the board, is relevant to geology.

(c) Have a documented record of a minimum of five years of professional geological experience of a character satisfactory to the board, demonstrating that the applicant is qualified to assume responsible charge of this work upon licensure as a geologist. This experience shall be gained under the supervision of a geologist or geophysicist licensed in this or any other state, or under the supervision of others who, in the opinion of the board, have the training and experience to have responsible charge of geological work. Professional geological work does not include routine sampling, laboratory work, or geological drafting.

Each year of undergraduate study in the geological sciences shall count as one-half year of training up to a maximum of two years, and each year of graduate study or research counts as a year of training.

Teaching in the geological sciences at college level shall be credited year for year toward meeting the requirement in this category, provided that the total teaching experience includes six semester units per semester, or equivalent if on the quarter system, of upper division or graduate courses.

Credit for undergraduate study, graduate study, and teaching, individually, or in any combination thereof, shall in no case exceed a total of three years towards meeting the requirement for at least five years of professional geological work as set forth above.

The ability of the applicant shall have been demonstrated by the applicant having performed the work in a responsible position, as the term "responsible position" is defined in regulations adopted by the board. The adequacy of the required supervision and experience shall be determined by the board in accordance with standards set forth in regulations adopted by it.

(d) Successfully pass a written examination that incorporates a national examination for geologists created by a nationally recognized entity approved by the board, and a supplemental California specific examination. The California specific examination shall test the applicant's knowledge of state laws, rules and regulations, and of seismicity and geology unique to practice within this state

The Board intends to amend Title 16, California Code of Regulations section 3031 to define the minimum curriculum for a qualifying geological sciences degree and to clarify the educational and experience requirements for licensure as a Professional Geologist. The Board is asking for input from academia, licensed geologists, and members of the public and is hosting two workshops to provide a forum to communicate with interested parties. The agenda for each of the two workshops will be identical and is described below. A copy of the presentation will be posted on-line, 10 days prior to the first workshop.

The proposed requirements could include:

- granting 2 years of experience credit for a geology degree meeting the proposed minimum curriculum.
- defining the minimum curriculum based upon
    - the State of California and Association of State Boards of Geology (ASBOG) geologist task analysis surveys,
    - the 2012 recommendations by the Geologist and Geophysicist Technical Advisory Committee,
    - a 2015 informal coursework survey of colleges/universities in California offering geology or related degrees
    - a review of published research papers on the topic of geologist qualifications
    - a review of licensure requirements for other US States and Puerto Rico
    - ASBOG and professional society models
- granting 1 year experience credit for
    - a geology degree with a non-approved curriculum; or,
    - a related science degree with a reasonable and rational nexus to geology, plus completion 30 semester units in geologic science of which 24 units are in the third or fourth year, or graduate courses
- granting an additional one-half year of experience credit for upper division coursework that specifically addresses the seismicity and geology unique to the State of California [the subject of the California Specific Examination required by §7841 (d)].
- Granting credit for graduate work.

The current language from §7841 stating that "*In no cases will a candidate be granted more than 3 years of education credit, in any combination of the following, towards the total educational and work experience requirement of 5 years*" would be preserved.

Workshop Dates

February 19, 2016, 10 am – 12 noon
Dept. of General Services
Highgrove Room, 2nd Floor
3737 Main Street
Riverside, CA 92501

February 26, 2016, 10 am – 12 noon
BPELSG Conference Room
2535 Capitol Oaks Drive, Suite 300
Sacramento, CA 95833

Agenda

1. Opening remarks (BPELSG Executive Officer or Board Member)
2. Presentation by Laurie Racca PG, Senior Registrar for Geology & Geophysics
    - History of geology licensure qualifications in California
    - Description of the basis for the proposed draft requirements
    - Summary of the proposed draft minimum curriculum for a qualifying geoscience degree
3. Comments and input from the public

After the February 26, 2016 workshop, a web video of the presentation will be posted on-line for viewing by interested parties unable to attend one of the workshops.

Interested parties may also submit comments to the Board via email (Laurie.Racca@dca.ca.gov) or U.S. Mail (Attn: Laurie Racca, 2535 Capitol Oaks Drive, Suite 300, Sacramento, CA 95833). Comments are requested by March 31, 2016. After considering all input, the proposed amendments to Section 3031 would be presented at a future Board meeting with a request that the Board approve moving forward with rulemaking. Additional opportunities for public comment will be available during the formal rulemaking process.

BOARD FOR PROFESSIONAL ENGINEERS, LAND SURVEYORS, AND GEOLOGISTS
2535 Capitol Oaks Drive, Suite 300, Sacramento, California, 95833-2944
Telephone: (916) 263-2222 – Toll Free: 1-866-780-5370
Facsimile: (916) 263-2246
www.bpelsg.ca.gov

PUBLIC COMMENT FORM
GEOSCIENCES DEGREE WORKSHOP
Qualifications for Licensure as a Professional Geologist
Public workshops regarding the minimum curriculum for a qualifying geological sciences degree

You may use this form to send in your written comments and suggestions regarding the development of a minimum curriculum for a qualifying geological sciences degree. Use of this form is optional and it is provided for your convenience. Comments will be accepted with or without the use of this form. Interested parties may submit comments to the Board via email (Laurie.Racca@dca.ca.gov) or U.S. Mail (Attn: Laurie Racca, 2535 Capitol Oaks Drive, Suite 300, Sacramento, CA 95833). Comments are requested by March 31, 2016. After considering all input, the proposed amendments to Section 3031 will be presented at a future Board meeting with a request that the Board approve moving forward with rulemaking. Additional opportunities for public comment will be available during the formal rulemaking process.

Name:

Agency or Organization (if applicable):

Address:

Telephone:

Email:

Comments:

If you wish to receive occasional news and important updates regarding BPELSG activities, please subscribe to our mailing list at http://www.bpelsg.ca.gov/ by selecting the green "subscribe" button and then entering your email address.

California
Board for Professional Engineers, Land Surveyors, and Geologists (BPELSG)

Defining the Minimum Curriculum for a Qualifying Geological Sciences Degree for the California Professional Geologist License

Laurie Racca, PG – Senior Registrar, Geology & Geophysics

February 19 and 26, 2016

Statement of the Issue

Valid criteria to achieve professional licensure includes **equal** parts education, work experience, and success in passing the appropriate examinations.

The purpose of this workshop is to gather information to help define the education part of the requirement.

The education requirements for geologist licensing in California are described in §7841 (b) of the Geologist and Geophysicist Act (Cal. Bus. and Prof. Code §7841).

"Graduation from a college or university with a major in geological sciences or any other discipline that, in the opinion of the board, is relevant to geology."

Agenda

- Introduction
  - Purpose of the Board
  - Statement of the issue
  - The process
- Professional Geologist Licensing in California
  - History of licensing
  - Current requirements
  - Trends and issues
- Major in Geological Sciences
  - 2012 G&G TAC evaluation
  - California 4-Year college & university requirements

Agenda (cont.)

- Licensure Models Outside of California
  - American Institute of Professional Geologists (AIPG)
  - Association of State Boards of Geology (ASBOG)
  - Other US States & Puerto Rico
  - Canada
- Occupational Surveys and Competency Models
- Major Elements of the Proposed Regulation
- Defining a Geological Sciences Degree for Licensing
- Next Steps

Purpose of the Board

- **Protection** of the Public
  - **License** qualified individuals
  - **Enforce** laws and regulations
  - **Establish** regulations
  - **Promote** professional conduct
  - **Provide** information to the public
  - **Anticipate** changes in the professions

Board Composition

- **15 Board Members:**
  - **8 Public Members**
    - 6 appointed by Governor
    - 1 by Senate Rules Committee
    - 1 by Speaker of the Assembly
  - **7 Practitioners (Engineers, Land Surveyor, and Geologist or Geophysicist)**
    - All appointed by Governor
    - Betsy Mathieson is the geologist member

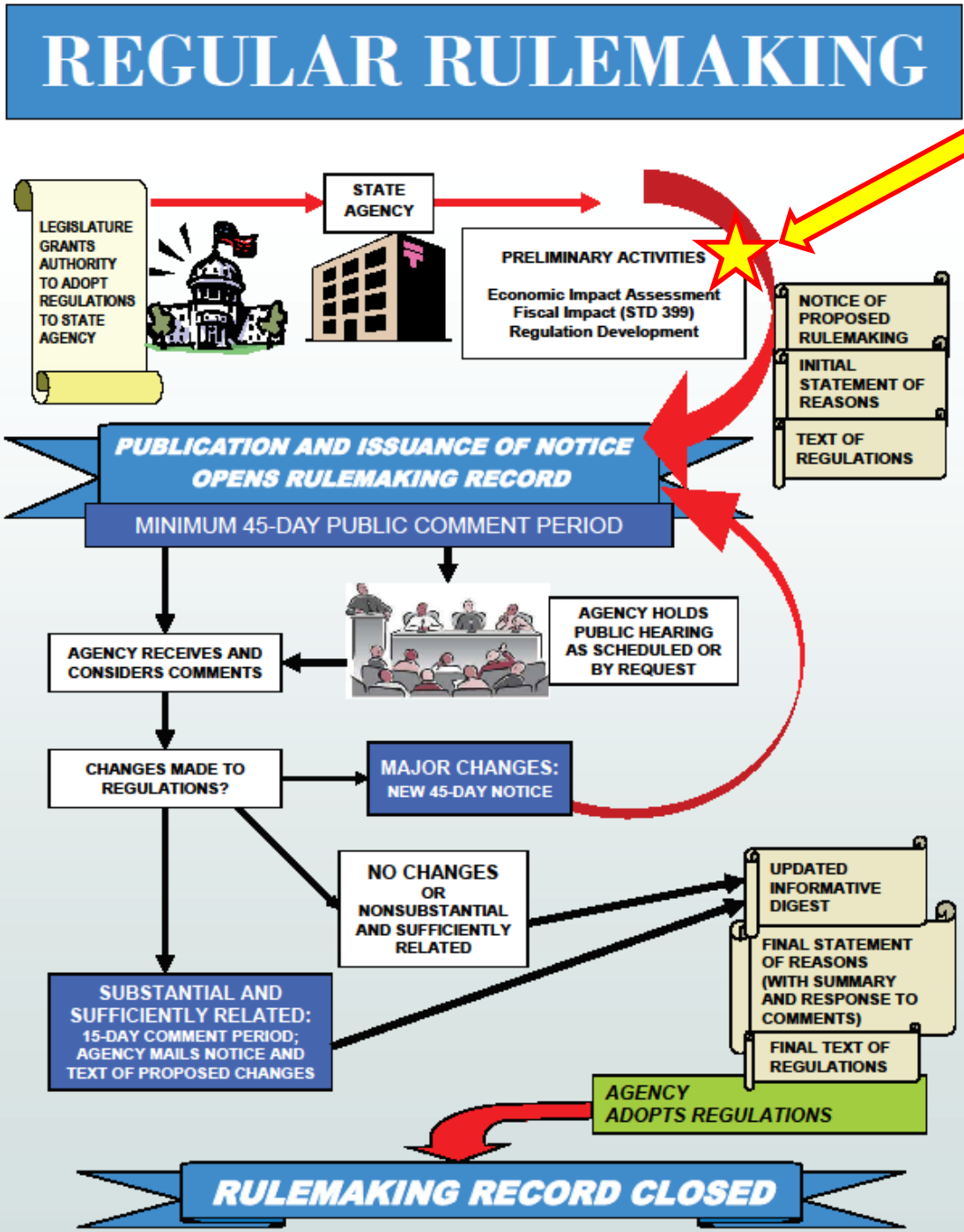
Statement of the Issue

- The Board has long recognized that there is confusion regarding the geology education requirement due to:
  - The flexibility and variety of geology curricula
  - The lack of national accreditation for geology programs
  - The proliferation of interdisciplinary degrees
  - Applicants misinterpreting *"major in geological sciences"*
  - Non-licensed professions (soil science, hydrology, environmental science) seeking a pathway to PG licensure, typically in the environmental field

The Process

The Board intends to define the minimum curriculum for a qualifying geological sciences degree for licensure as a Professional Geologist.

- The existing law (Business and Professions Code §7841) will not change.
- The implementing regulations will be amended (Title 16, Division 29, California Code of Regulations §3031).
- Sources of information used to inform the Board are listed in the bibliography provided as part of the meeting materials for the workshops.



The Process

We are in the *Preliminary Activities* phase.

- Draft language for the regulations will be submitted to the Board for approval.
- After Board approval, a "Notice of Proposed Rulemaking" will start the process.
- There will be many more opportunities for public comment and input.

PG Licensing in California

- 1968: The former Board of Registration for Geologists and Geophysicists (BGG) was created.
- 1968 to 2003: The text and substance of the geology license qualifications changed very little.
- 2004: The former BGG changed the education and experience requirements in the law.
- 2009: The former BGG was eliminated by the legislature and its functions transferred to BPELSG.
- 2016: The phrase "…*or any other discipline that, in the opinion of the board, is relevant to geology"* was added.

PG Licensing in California

California Geology License Qualifications Cross Reference		
§7841 (b) 1968 to 2003	**§7841 (b) 2004 to 2015**	**§7841 (b) 2016**
(b) Meet one of the following educational requirements fulfilled at a school or university whose geological curricula meet criteria established by rules of the board: *(1) Graduation with a major in geology.* *(2) Completion of 30 semester units in geological science courses leading to a major in geology, of which at least 24 units are in the third or fourth year, or graduate courses.* *(c) Have at least seven years of professional geological work….*	*(b) Graduation with a major in* ***geological sciences from college or university.*** *(c) Have a documented record of a minimum of* ***five*** *years of professional geological experience….*	*(b) Graduation from a college or university with a major in geological sciences* ***or any other discipline that, in the opinion of the board, is relevant to geology.*** *(c) Have a documented record of a minimum of five years of professional geological experience….*

PG Licensing in California

- Evaluation of a PG applicant's education requirements is based on a review of college transcripts:
  - Is the institution accredited? (Not same as Program accreditation)
  - What degree was awarded (2 year, 4 year, graduate)?
  - Is there a concentration in upper-division geology coursework?
  - Is there breadth and depth to coursework?
  - Additional information is often requested for non-traditional course names (course catalogs, course syllabi, textbook information, etc.) to verify course content.

PG Licensing in California

A sampling of PG applications 2012 to the present:

Applications Approved

- Geology
- Geological Sciences
- Earth Sciences
- Engineering Geology
- Hydrogeology
- Geoscience
- Geo-Environmental Science
- Geological Engineering
- Soil Science
- Geophysics
- Environmental Sciences and Policy
- Geology with Paleontology focus
- Natural Resources Management

Applications Not Approved

- Degrees with **the same or very similar** titles
- These degree titles appear most often in applications not approved:
  - Earth Science (general or non-geology focus)
  - Soil Science
  - Hydrology
  - Environmental Sciences
- The predominant practice area for denied applicants is the environmental cleanup industry.

Major in Geological Sciences

- 2012 Evaluation by Geologist and Geophysicist Technical Advisory Committee (G&G TAC)
  - May 1, 2012 meeting discussion:
    - TAC members' suggestions for core and elective courses
    - Review of university geology departments' requirements
    - Contact with Dr. David Bowman from CSU Fullerton
  - July 31, 2012 meeting recommendations/discussion:
    - Suggested list of core and elective courses
    - Provided recommended change to §7841 (in the law)

    "Graduation with a major in geological sciences from a college or university, ***which includes at least 30 semester units in courses, which in the opinion of the Board are relevant to geology; of which 24 units must be upper-division or graduate courses."***

Major in Geological Sciences

- Updated informal review of California four-year university requirements in September, 2015
  - 35 geoscience departments (private, CSU, UC)
  - 16 on quarter system, 19 on semester system
  - 96 geoscience, earth science or other related majors
  - Both BA and BS degrees
  - Included 27 traditional BS Geology degrees
  - Based on departments' websites and online university catalogs

Major in Geological Sciences

- Difficulties encountered during the review of university requirements
  - Lack of standardized courses (content within similarly titled courses)
  - Varying course names
  - Large number of electives available
  - Multiple options or pathways to receive degree
  - Varying degree names and requirements
- A separate course for California Geology is not a requirement for most of the majors, despite the specific licensing test on the subject.

Major in Geological Sciences

- Results for all 96 majors (core + required electives)
  - Semester system: on average, degrees require 41 units of geology courses
  - Quarter system: on average, degrees require 47 to 49 units (equals 31-32 semester units) of geology courses
- Results for 27 traditional BS Geology degrees (core + required electives):
  - Semester system: 33-60 geology units
  - Quarter system: 47-132 units (equals 31-88 semester units)
    - Outlier schools on high end are CalTech (132 quarter units) and Stanford (75 quarter units)

Table 2
Comparison of College/University Courses to 2012 G&G TAC Recommended Coursework

G & G TAC Recommended Core Classes								
Course Name	All 96 Majors				27 BS Geology Majors			
	Number Required	Percent Required	Optional	Not Required	Number Required	Percent Required	Optional	Not Required
Physical Geology*	53	55%	30	13	21	77%	4	2
Historical Geology*	60	63%	18	18	20	74%	3	4
Mineralogy/Petrology[1]	76	79%	3	17	27	100%	0	0
Stratigraphy/Sedimentology	57	59%	3	36	24	88%	0	3
Structural Geology	58	60%	5	33	27	100%	0	0
Field Geology[2]	52	54%	8	36	25	92%	1	1

G & G TAC Recommended Upper Division Electives				
Course Name	All 96 Majors		27 BS Geology Majors	
	Number Required	Optional	Number Required	Optional
Paleontology	18	7	9	3
Geophysical/Remote Sensing Methods[3]	NA	NA	NA	NA
Geomorphology-Land form interpretation	14	5	3	2
Hydrogeology/Environmental Hydrogeology	13	6	5	1
Tectonics	17	3	3	0
Engineering/Economic Geology	2	2	1	1
Geochemistry/Environmental Geochemistry	17	23	11	2
Geophysics/Applied Geophysics	24	4	7	1
Senior Thesis *(listed separately from summer field)*	37	6	11	0

*lower division courses

"Optional" in this context means it is one of several choices to meet the major requirement.

1—For mineralogy/petrology 26 of 27 BS Geology programs require mineralogy or mineralogy/crystallography; 23 of 27 require igneous/metamorphic petrology. All 27 programs require at least one of these classes, most require both. One school appears to incorporate mineralogy into the petrology class.

2—This category includes both upper division field classes and the traditional summer field class. Of the 27 BS Geology programs, 15 require a summer field class and 1 program lists it as an option. Many schools appear to be incorporating upper division field work into the day to day coursework and/or an upper division field course instead of the traditional summer field camp.

3—It appears this skill is incorporated into other coursework. This is not typically listed as a separate class

Licensure Models Outside of California

- American Institute of Professional Geologists (AIPG) Certified Professional Geologist (CPG)
- Not a license but used by some states as a registration requirement.
- The original BGG discussed the AIPG requirements as well as AIPG approved courses in 1969 before starting to issue licenses in 1970.
- CPG *educational* requirements: Bachelor's degree or higher in the geological sciences with a minimum of 36 semester hours of geology…acceptable continuing education.
- AIPG recognized a core of required courses including:
  - Physical Geology - 4 semester hours or equivalent
  - Historical Geology - 4 semester hours
  - Rocks & Minerals - 4 semester hour
  - Structural Geology - 3 semester hours
  - Stratigraphy - 3 semester hours
  - Field Geology - 6 semester hours

Licensure Models Outside of California

Association of State Boards of Geology (ASBOG)

- Requirements from Model Rules and Regulations (2011)
  - Major in geology or geoscience specialty
  - Accredited college or university, or program accredited by an organization recognized by the Board
  - Designed to educate the student to engage in the practice of geology
  - Four (4) or more years
  - Includes at least 30 semester hours or 45 quarter hours in geologic course work deemed suitable by the Board

Licensure Models Outside of California

- Reviewed licensure requirements of other US States (29 including Louisiana) & the territory of Puerto Rico (1)
- List of states developed from the 2015 AAPG Division of Professional Affairs website and 2014 ASBOG state matrix
- Informal survey based on website review
- Arizona, Louisiana, and New York state licensing boards were contacted for additional information
- New York is in the process of developing their regulations

Licensure Models Outside of California

- 25 license boards require a degree in geoscience or related field: *"degree in geology"*, *"engineering geology"* or *"geosciences"*
- 5 states (Arizona, Louisiana, Maine, Oregon, and Texas) provide a path to licensure for applicants without a degree
- 29 license boards specify 30 semester hours/units geology coursework. Many specify 24 units in upper-division courses.
- 2 states (Indiana and Kentucky) allow for "*applied geoscience courses under departments other than geology*"
- 16 states provide lists of either mandatory courses, suggested courses, or broad topics that must be covered.
- Eight (8) licensing boards require some form of continuing education for license renewal. One (1) licensing board has a voluntary continuing education program.

Licensure Models Outside of California

- Canada
  - Practice is regulated in most provinces and territories similar to the individual state regulation in the US.
  - Practice is restricted to registered/licensed individuals.
  - Geoscience is self-regulated by the professional associations that register geoscientists.
  - There are 3 general practice areas: geology, environmental geoscience, geophysics.
  - Typical educational requirements are a BS degree with 30 units of science of which 20 units are geoscience.

Occupational Surveys and Competency Models

- ASBOG—2015 Task analysis survey used to update the content and scope of the national FG and PG exams.
- Occupational Analysis—California Specific Examination (CSE).
- 2016 Undergraduate Geoscience Education Summit.
- Geosciences Canada knowledge requirements.

Figure 17 - ASBOG® Task Analysis 2015
Mean Values for All Task Statements
ASBOG® States vs. Non-ASBOG® States

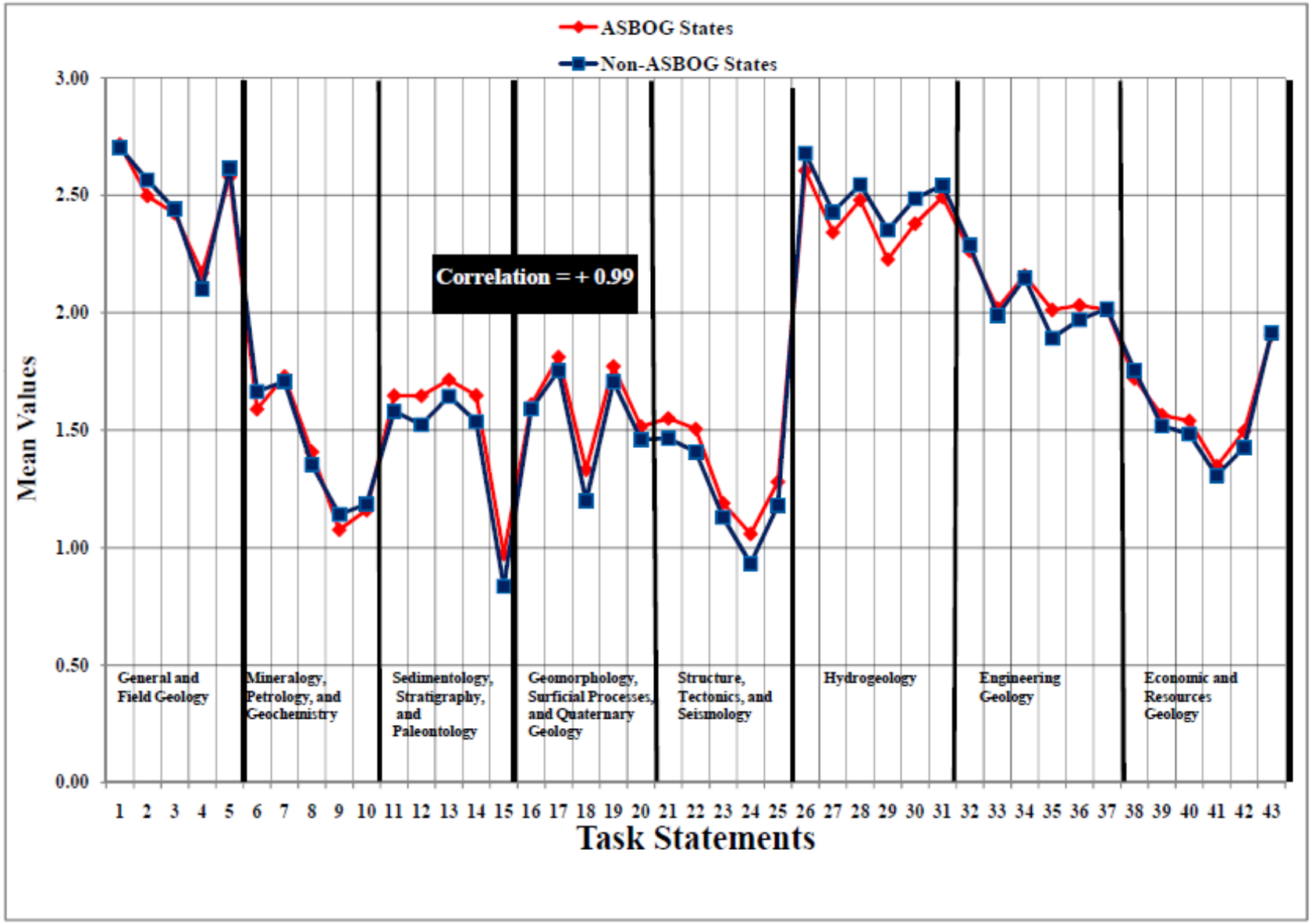


Figure 20 - ASBOG® Task Analysis 2015
FG Test Blueprint - Domain Percentages

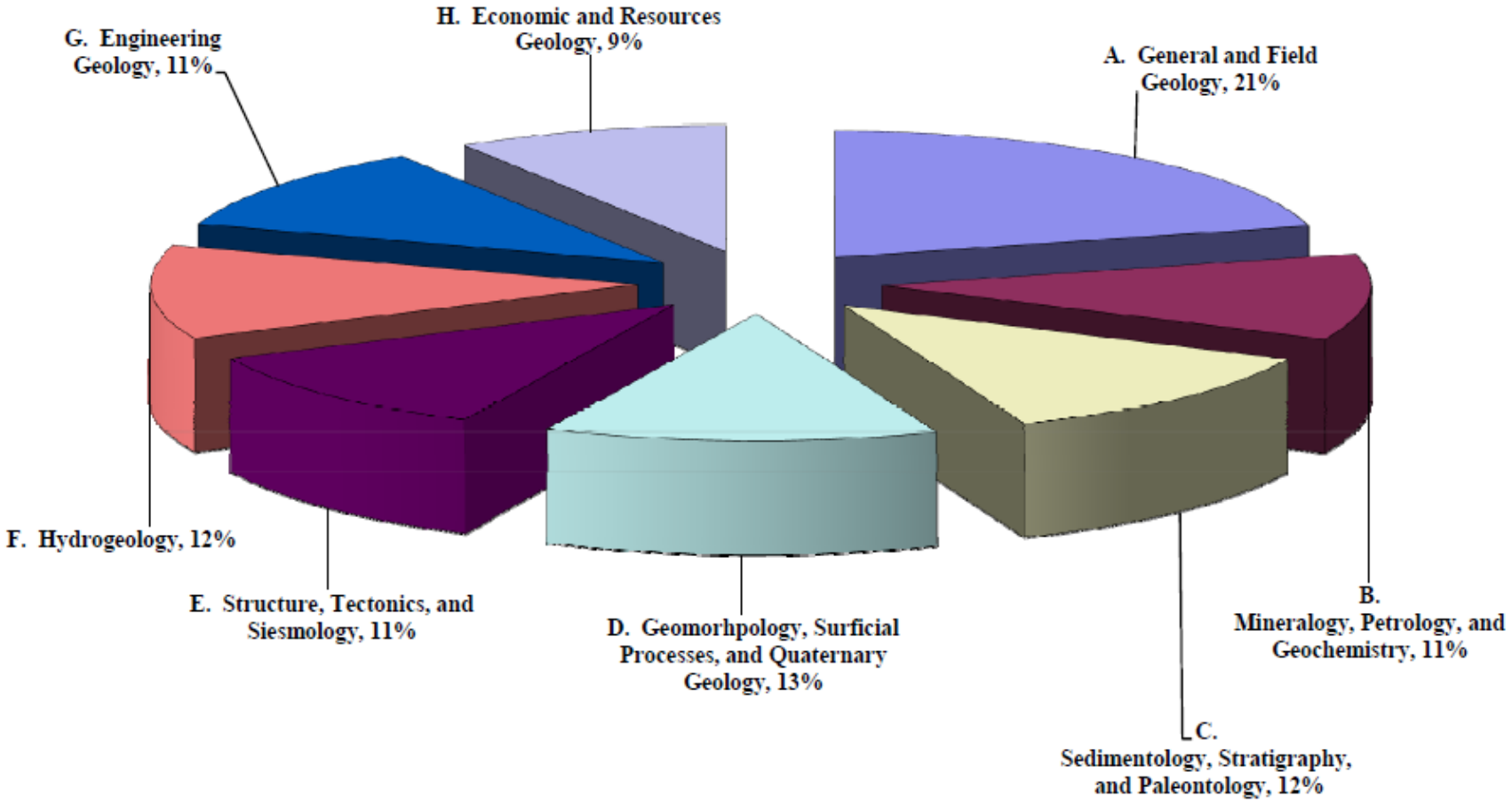
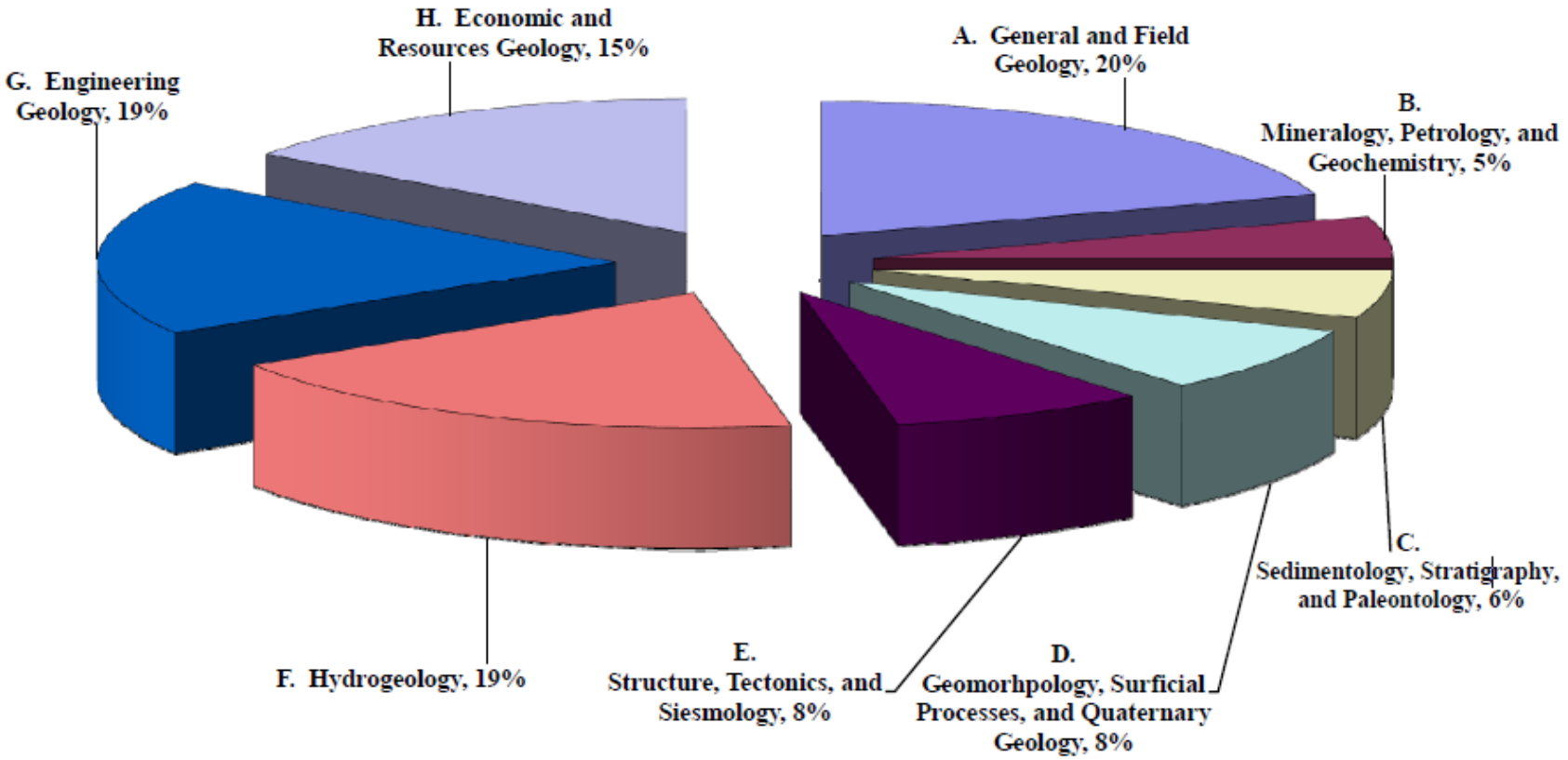
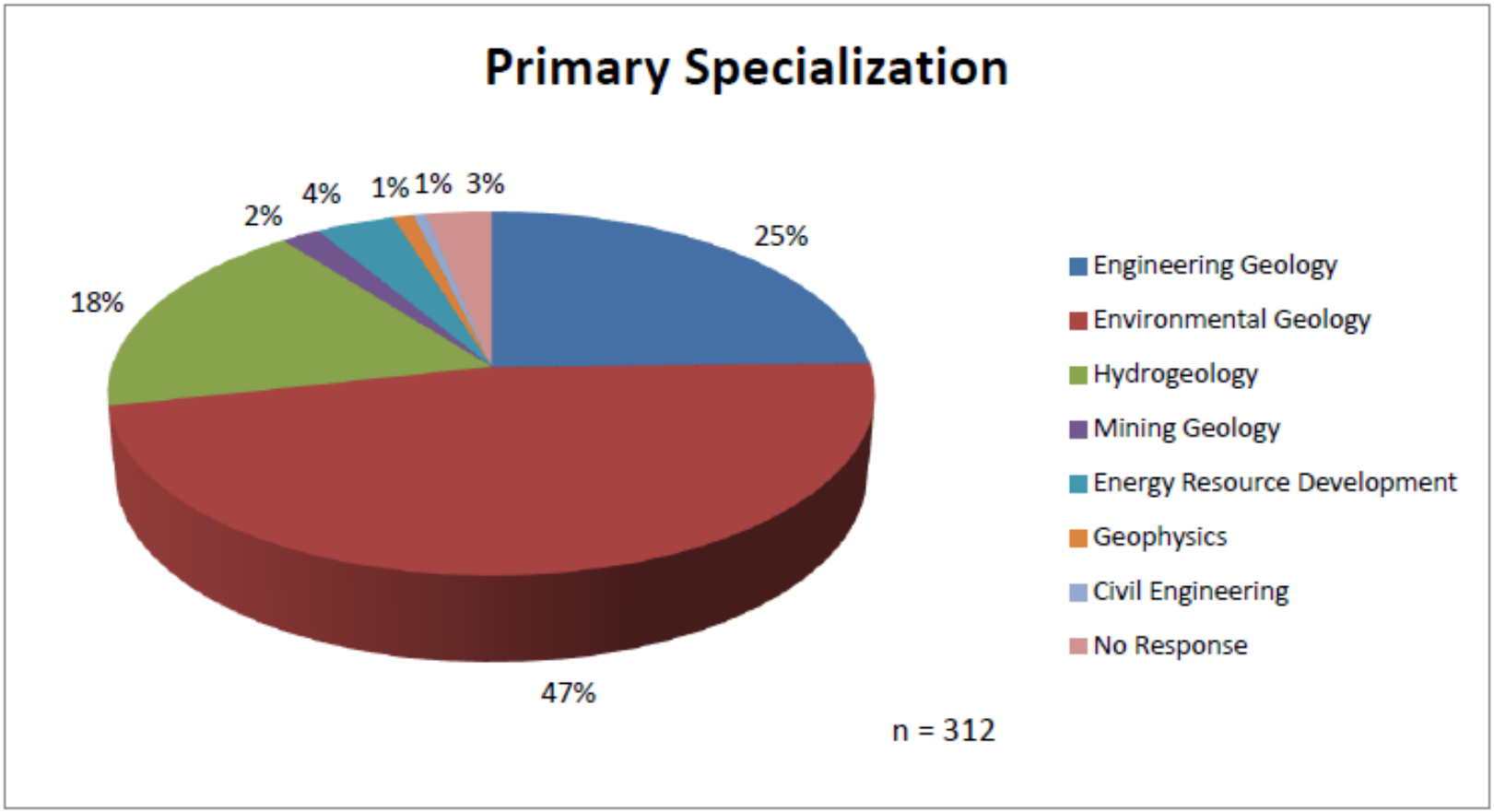


Figure 21 - ASBOG® Task Analysis 2015
PG Test Blueprint - Domain Percentages



Occupational Surveys-CSE

California Specific Examination (CSE) - Primary practice areas of respondents for occupational analysis



Occupational Surveys-CSE

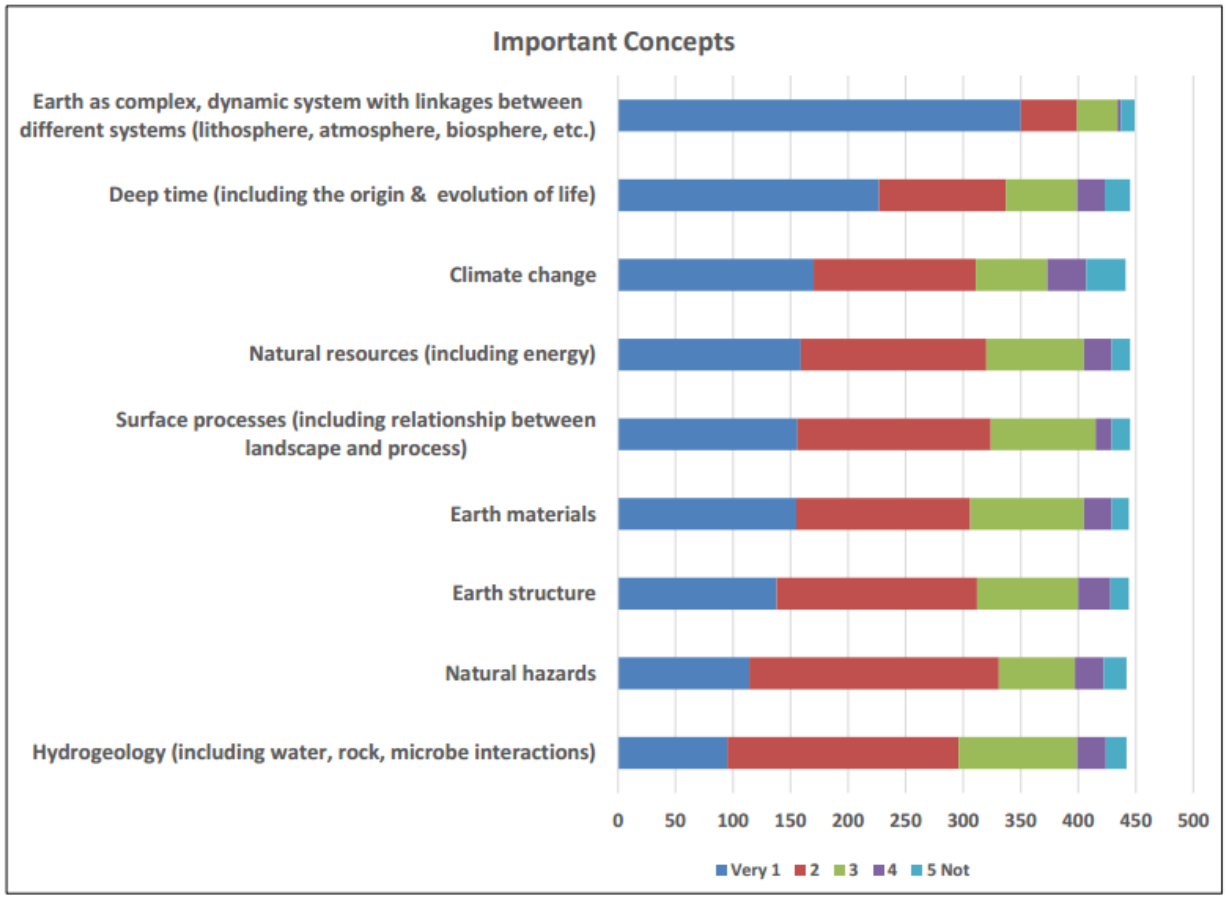
General knowledge areas required to pass the California Specific Exam based upon the 2013 occupational analysis.

GEOLOGIST – CALIFORNIA SPECIFIC EXAMINATION
Area I – General Geology Practice *This content area assesses the candidate's knowledge of geologic investigation techniques, field practice, feasibility studies, health and safety risk assessment, and ethical standards of practice.*
Area 2 – California Geology *This content area assesses the candidate's knowledge of the associations and distributions of rocks, faults, stratigraphic relations, tectonic features, and related hazards found in California.*
Area 3 – Applied Geology Practice *This content area assesses the candidate's knowledge of hydrogeology, environmental geology, engineering geology, mining geology, and energy resource development applied to California. It focuses on the major State issues in each subarea of geologic practice as well as State laws, regulations, and guidelines related to geology.*

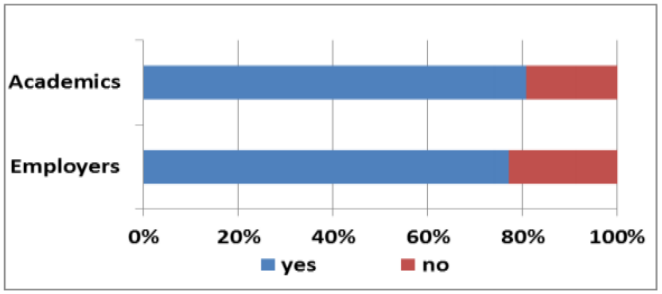
2016 Undergraduate Geoscience Education Summit 2014-15 Survey

Major conclusion of Summit:

Developing competencies, skills, and conceptual understanding is more important than taking specific courses



Survey Responses:



Geosciences Canada Knowledge Requirements

- Based on a typical BS in Geoscience from a Canadian university
- Defined for the 3 major Canadian practice areas of geology, environmental geoscience and geophysics
- Divided into compulsory foundation science, compulsory geoscience/additional foundation geoscience, and other geoscience/science

<u>Compulsory Foundation Geoscience (for all 3 practice areas)</u>

- Field Techniques
- Mineralogy/Petrology
- Sedimentation & Stratigraphy
- Structural Geology

Curriculum specialization for the 3 practice areas starts in the additional foundation geoscience coursework.

Major Elements of the Proposed Regulation

The following requirements are being considered for inclusion in the draft regulations language

- 4 year Bachelor's degree in geology, geosciences, or geoscience specialty
- Institution accredited by a regional accrediting commission recognized by the US Department of Education
- No "Life Experience Degrees"
- Applicant's burden to demonstrate that coursework meets requirements
- Applied geoscience courses taught in departments other than geology accepted at Board's discretion

Major Elements of the Proposed Regulation(cont.)

The following elements of the existing requirements will remain the same:

- No more than 3 years of education credit granted toward the 5 year experience requirement (in statute §7841).
  - 2 years of experience credit granted for an undergraduate degree meeting the Board's specifications
  - Up to 1 year of experience credit for graduate studies.
- Professional work experience credit is not counted until the educational requirements are fulfilled (in regulation §3031).

Defining a Geological Sciences Degree for Licensing

- Option 1:

  Adopt the 2011 ASBOG model regulation language for geology education.

Pros:

- Objective, easily understood by applicants.
- Facilitates comity applications by encouraging consistency with other states.

Cons:

- Somewhat general.
- Does not define what will be acceptable coursework to satisfy the 30 unit requirement.

These examples are for discussion purposes only. At this time, the Board has not selected a list of courses or decided on this approach.

Defining a Geological Sciences Degree for Licensing

- Option 2a:
  - Provide a fixed list of required core coursework:
    - Field Techniques
    - Mineralogy/Petrology
    - Sedimentation & Stratigraphy
    - Structural Geology
- Option 2b:
  - Provide a flexible list of required coursework
    - Coursework shall include four of the following:
      - Field Techniques
      - Mineralogy/Petrology
      - Sedimentation & Stratigraphy
      - Structural Geology
      - Hydrogeology
      - Engineering Geology

Pros:

- College transcripts are set up to provide a list of courses, so easily implementable.
- Objective, easily understood by applicants.

Cons:

- May discourage flexibility and variety in college curricula.
- University coursework has and will continue to evolve.
- May be difficult to match up newer course names with the intended subject areas on any list.

These examples are for discussion purposes only. At this time, the Board has not selected a list of courses or decided on this approach.

Defining a Geological Sciences Degree for Licensing

- Option 3:
  - Provide a fixed or flexible list of general subject areas or core competencies and require the applicant to demonstrate that their coursework meets the requirement.

Example from Pennsylvania:

The formal education required under this subsection must include field geology and structural geology coursework that is sufficient to demonstrate that the candidate has educational experience in tectonics and fractured bedrock geology and the field methods needed to measure, map and evaluate geologic data.

Pros:

- Adaptable to evolving university curricula.
- Skills based and easy to correlate with occupational surveys.

Cons:

- College transcripts are set up to provide a list of courses, so difficult to implement.
- Places a burden on the applicant to document content of completed university coursework.
- Likely to be somewhat subjective.

These examples are for discussion purposes only. At this time, the Board has not selected a list of courses or decided on this approach.

Defining a Geological Sciences Degree for Licensing

- Option 4:
  - Provide a fixed or flexible list of required coursework (or equivalent), and include statement describing the expected skills or competency for each course.

Example :

Senior Thesis/Senior Field – 6 semester units: The Senior Thesis/Senior Field course shall consist of a culminating academic experience or capstone project that is based on the knowledge and skills acquired in earlier course work, and includes the completion of a project report. The project report must be based upon a field investigation that demonstrates the candidate has educational experience in the field methods needed to measure, map and evaluate geologic data. For the purposes of this section, the "Senior Thesis/Senior Field" project must be functionally equivalent to a traditional geology summer field class, and must not include the introduction of new skills.

Pros:

- Combines best of Option 2 and Option 3.
- Reasonable to implement by comparing college transcripts with supporting documentation.
- Easily adapted to evolving university curricula.
- Skills based and measurable against occupational surveys.

Cons:

- Places a burden on the applicant to document content of completed university coursework.

These examples are for discussion purposes only. At this time, the Board has not selected a list of courses or decided on this approach.

Next Steps

- Written comments are requested by March 31, 2016
  - **By E-mail:** Laurie.Racca@dca.ca.gov
  - **U.S. Mail:** (Attn: Laurie Racca, 2535 Capitol Oaks Drive, Suite 300, Sacramento, CA 95833)
- Proposed Amendments to §3031 of the regulations will be presented at a future Board meeting. The Board may:
  - Approve the proposed language and begin formal rulemaking
  - Ask for further study or more information before proceeding with formal rulemaking

Comments Received as of 2/29/2016 fall into the following general categories

- **Practicing geologists reporting a perceived lack of field skills with recent graduates**
- **Recent graduates indicating that traditional summer field courses are expensive**
- **Members of non-licensed professions seeking a pathway to geology licensure**
- **Frustration from some non-licensed professionals that they were not made aware of licensing requirements when choosing a college major**
- **Lists of specific courses that should be included in the requirements**
- **Positive feedback from college and university geology departments indicating a willingness to provide students with help documenting their educational qualifications for a license application**

Stay Informed and Be Involved

- Subscribe to the Board's e-mail list, Facebook page, or Twitter feed.
- www.bpelsg.ca.gov
- Updates will be announced via e-mail and social media.

Bibliography

Abbott, David M. Jr. CPG. Consulting Geologist. 2015. *Email Communication*. October 22.

Abbott, David M. Jr. CPG. Consulting Geologist. 2015. *Email Communication.* October 23.

Abbott, D., Wallace, R., Nutter, K., Jarvis, S., and Austin, L. 2015. *The Certification Experience Requirement.* American Institute of Professional Geologists, The Professional Geologist. July/August/September.

ABET, 2016-2017. *Criteria for Accrediting Applied Science Programs.* http://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting-applied-science-programs-2016-2017/

American Association of Petroleum Geologists (AAPG). 2015. *State Registration and Licensing.* http://dpa.aapg.org/state_registration.cfm

American Geological Institute. 1984. Bates, Robert L., and Julia A. Jackson, editors. *Dictionary of Geological Terms, Third Edition*. New York: Anchor Books.

American Geosciences Institute. 2013. *Final Report of the American Geosciences Institute ad hoc Committee on Academic Geoscience Program Classification*. http://www.americangeosciences.org/sites/default/files/AGIClassificationCommitteeReport.pdf.

American Geosciences Institute. 2015. Wilson, Carolyn, editor. *Directory of Geoscience Departments and Other Geoscience Organizations, 50th Edition*.

American Institute of Professional Geologists (AIPG). 2007. *Education for Professional Practice.* Report with Recommendations of the Ad Hoc Committee on Curriculum.

American Institute of Professional Geologists (AIPG). 2015. *What is AIPG?* http://www.aipg.org/about/index.htm.

American Institute of Professional Geologists (AIPG). 2015a. *AIPG Membership: Guidelines.* http://www.aipg.org/Membership/guidelines.htm

AB 600, 1968 Reg. Sess. Ketchum. Chapter 942 1968 Cal. Stat.

AB 20, 2009 4th Ex. Sess. Strickland. Chapter 18 2009 Cal. Stat.

AB 1431, 2010 Reg. Sess. Hill. Chapter 696 2010 Cal. Stat.

Association of Engineering Geologists. 1996. *Issue Analysis: How California Citizens Benefit From a Geology Practice Licensure Act.*

Blair, Jane W. PE, Executive Secretary, New York State Board for Engineering, Land Surveying and Geology. 2016. *Personal Communication*. January 21.

Board for Geologists and Geophysicists (BGG). 1969. *Minutes of the Public Meeting of the State Board of Registration for Geologists.* May 19.

Board for Geologists and Geophysicists (BGG). 1969a. *Minutes of the Public Meeting of the State Board of Registration for Geologists.* June 9.

Board for Geologists and Geophysicists (BGG). 1969b. *Minutes of the Public Meeting of the State Board of Registration for Geologists.* July 1.

Board for Geologists and Geophysicists (BGG). 2003. *Request for Approval of Proposed Legislation, Licensure Requirements for Registered Geologists*.

Board for Professional Engineers, Land Surveyors and Geologists (BPELSG). 2012. *Minutes of the May 1, 2012 Geologist and Geophysicist Technical Advisory Committee.* http://www.bpelsg.ca.gov/about_us/meetings/minutes/20120501_ggtac.pdf.

Board for Professional Engineers, Land Surveyors and Geologists (BPELSG). 2012a. *Minutes of the July 31, 2012 Geologist and Geophysicist Technical Advisory Committee.* http://www.bpelsg.ca.gov/about_us/meetings/minutes/20120731_ggtacmn.pdf.

Board for Professional Engineers, Land Surveyors and Geologists (BPELSG). 2014. *2015-2018 Strategic Plan.* http://www.bpelsg.ca.gov/pubs/2015-2018_bpelsg_strategic_plan.pdf.

Brady, Roland H. III, PhD, PG 5721. Professor Emeritus of Earth and Environmental Sciences, California State University Fresno. 2016. *Personal Communication*. January 28.

Brady, Roland H. III, PhD, PG 5721. Professor Emeritus of Earth and Environmental Sciences, California State University Fresno. 2016. *Academic Preparation for PG Licensure.* Memorandum to Laurie Racca, Senior Registrar Geology and Geophysics, Board for Professional Engineers, Land Surveyors, and Geologists (BPELSG). February 7.

Bralower, T., Easterling, W, Geissman, J., Savina, M., Tewksbury, B., Feiss, G., Macdonald, H., and Rhodes, D. 2008. *Accreditation: Wrong Path for the Geosciences*. GSA Today, v. 18, no. 10. p. 52-53. http://www.geosociety.org/gsatoday/archive/18/10/pdf/i1052-5173-18-10-52.pdf.

California Business and Professions Code §§6700-6799. (includes amendments made during the 2015 legislative session). Effective January 1, 2016. *Professional Engineers Act.* http://www.bpelsg.ca.gov/laws/pe_act.pdf.

California Business and Professions Code §§7800-7887. (includes amendments made during the 2015 legislative session). Effective January 1, 2016. *Geologist and Geophysicist Act.* http://www.bpelsg.ca.gov/laws/gg_act.pdf.

California Business and Professions Code §§8700-8805. (includes amendments made during the 2015 legislative session). Effective January 1, 2016. *Professional Land Surveyors' Act.* http://www.bpelsg.ca.gov/laws/pls_act.pdf.

California Code of Regulations. Title 16, Division 5 §§400-476. *Board Rules and Regulations Relating to the Practices of Professional Engineer and Professional Land Surveying.* http://www.bpelsg.ca.gov/laws/boardrules.pdf.

California Code of Regulations. Title 16, Division 29 §§3000-3067. *Regulations Relating to the Practices of Geology and Geophysics.* http://www.bpelsg.ca.gov/laws/gg_regs.pdf.

California Courts Webpage. Accessed September 25, 2015. http://www.courts.ca.gov/1098.htm

California Legislative Information. 2015. Cross-Reference Chaptered Bills. http://leginfo.legislature.ca.gov/faces/displayCodeAndBill.xhtml?sectionNum=7841.&billVersionSectionId=3349090&lawCode=BPC

California State University. Search CSU Degrees. http://www.bpelsg.ca.gov/about_us/meetings/minutes/20120731_ggtacmn.pdf. Accessed August 12, 2015.

California State University, San Bernardino, Department of Geological Sciences. 1997. *Goals and Objectives for Geology Majors.* February 14.

Corbett, Robert G. and Corbett, Erica A. 2001. *Geology Programs and Disciplinary Accreditation. Journal of Geoscience Education*. v. 49, no. 2, p. 130-134.

Davidson, Wendy J. AIPG Assistant Director. 2015. *Email Communication*. October 15.

Department of Consumer Affairs. 2013. *Occupational Analysis of the Geology Profession for the California Specific Examination (CSE)*. Office of Professional Examination Services. Lincer-Hill, H., and Riedel, L. July.

Dictionary.com. Accessed on September 25, 2015. http://dictionary.reference.com/browse/license?s=t

Dictionary.com. Accessed on September 25, 2015a. http://dictionary.reference.com/browse/licensure?s=t

Drummond, Carl N. and Markin, Jane M. 2008. *An Analysis of the Bachelor of Science in Geology Degree as Offered in the United States*. Journal of Geoscience Education. v. 56, no. 2, p. 113-119.

Duke, Gary. Senior Staff Counsel, Department of Consumer Affairs. 2015. *Personal Communication*. November 5.

Elifritis, C. Dale. PhD. Professor Emeritus, Geological Engineering, Missouri University of Science and Technology. 2016. *Email Communication*. January 22 and 25.

Ericksen, Rick L., RPG, CPG. Executive Director, Mississippi Board of Registered Professional Geologists. 2015. *Email Communication*. October 26.

Franks, Alvin L. PhD, PG 152, CEG 88, CHG 1. 2016. *Personal Communication*. January 13.

Geological Society of America. 1957. *Teaching Aids and Allied Material in Engineering Geology.* Special Report. Committee on Teaching Aids. Mann, J. F., McGill, J.T. and Kiersch, G.A., Chairman. http://www.geoscilibrary.org/wp-content/uploads/2014/08/kiersch_g-teaching_aids_engineering_geology-4-academic_preparation-ocr.pdf

Geoscientists Canada. 2014. *Geoscience Knowledge and Experience Requirements for Professional Registration in Canada*. http://geoscientistscanada.ca/wp-content/uploads/2014/11/GC-Knowledge-Requ.BKLT-.REV-.EN-.web-.final-.pdf

Gonzales, Leila M., and Keane, Christoper K. 2010. *Who Will Fill the Geoscience Workforce Supply Gap?* Environmental Science & Technology. v. 44, no. 2, p. 550-555.

Head, William D., Alexander, Susan. E., Moore, Steven W., and Melton, Forrest S. 2006. *From the Ground Up: Building and Undergraduate Earth Systems Curriculum. Journal of Geoscience Education*. v. 54, no. 3, p. 240-248.

Joint Legislative Sunset Review Committee (JLSRC), Senator Ruben S. Ayala, Chairman. 1996. *Review and Evaluation of the Board for Geologists and Geophysicists.* Report to the Department of Consumer Affairs.

Legal-dictionary.thefreedictionary.com. Accessed on September 25, 2015. http://legal-dictionary.thefreedictionary.com/code

Legal-dictionary.thefreedictionary.com. Accessed on September 25, 2015a. http://legal-dictionary.thefreedictionary.com/statute

Lindberg, David N., PG 5581, CEG 1895. 2015. *Email Communication*. November 19.

Livingston, Chris. Research Librarian, California State University Bakersfield Walter Stiern Library. 2015. *Personal Communication*. September 24.

McEachrin, Shelly. Evaluator. Arizona State Board of Technical Registration. 2015. *Personal Communication.* September 22.

Moore, Ric PLS, Executive Officer BPELSG. 2015. *Personal Communication*. September 10.

National Association of State Boards of Geology (ASBOG). 2005. *The Professional Geologist Model Licensure Law.* http://asbog.org/documents/Model%20Law%2012-2-05.pdf.

National Association of State Boards of Geology (ASBOG). 2011. *Model Rules and Regulations.* http://asbog.org/documents/ASBOG%20Rules-Regs%202011.pdf.

National Association of State Boards of Geology (ASBOG). 2014. *Geology Registration Standards Matrix*. November.

National Association of State Boards of Geology (ASBOG). 2015. *Home Page*.

National Association of State Boards of Geology (ASBOG). 2016. *Professional Geologists Candidate Handbook*. January.

National Association of State Boards of Geology (ASBOG). 2015. Task Analysis Survey 2015: A Study of the Practice of Geology in the United States and Canada. TEST, Inc. Warner, J.L., April.

Nicholas, Georgina. Louisiana Board of Professional Geoscientists. 2015. *Personal Communication.* September 28.

Oxforddictionaries.com. Accessed on September 25, 2015. http://www.oxforddictionaries.com/us/definition/american_english/law

Proctor, Richard J. 2004. *A History of AIPG 1963-2003*. American Institute of Professional Geologists.

Proctor, Richard J., PG 247, CEG 134 (Emeritus). 2015. *Personal Communication.* December 17.

Renshaw, Carl E. 2014. *Design and Assessment of a Skills-based Geoscience Curriculum.* Journal of Geoscience Education. v. 62, p. 668-678.

Rogers, David J. PhD., 2015. *Threadlines of Geotechnical and Engineering Geology Firms in the Greater Los Angeles Metro-Southern California Area: 108-109*. Evolution of Geotechnical Practice Blog. September 2. http://web.mst.edu/~rogersda/Geotechnical-Practice/

Rogers, David J. PhD., 2015a. Karl F. Hasselmann Chair in Geological Engineering, Missouri University of Science & Technology. *Email Communication.* September 17.

Santi, Paul M. PhD., 2015. Professor and Department Head, Department of Geology and Geological Engineering, Colorado School of Mines. *Personal Communication.* October 15.

Santi, Paul M., and Higgins, Jerry D. 2005. *Preparing Geologists for Careers in Engineering Geology and Hydrogeology.* Journal of Geoscience Education. v. 53, no. 5, p. 512-521. http://inside.mines.edu/~psanti/paper_pdfs/Preparing%20Geologists%20for%20EG%20and%20Hydro.pdf

Santi, Paul M., and Kowalski, Ryan J. 2004. *The Role of Education and Experience in Developing Site Investigation Skills.* Environmental & Engineering Geoscience. v. 10, no. 1, p. 45-55.

Schmidt, P.L. and Conrad, J.M. 2012. *Capstone 101: A Framework for Implementation of an ABET-compliant Capstone Sequence*. Paper presented at 2012 ASEE Annual Conference, San Antonio, Texas. June.

Schmitz, Darrel. American Association of Petroleum Geologists (AAPG). *Curriculum Accreditation Needed.* Commentary. http://www.aapg.org/Publications/News/Explorer/Details/ArticleID/672/Curriculum%ADAccreditation%ADNeeded1/3. Accessed August 5, 2015.

Shapiro, Russell S. PhD., Chair Geological and Environmental Sciences Department, CSU Chico. 2015. *Personal Communication.* September 1.

Snyed, Deana, PG, Executive Director ASBOG. 2015. *Email Communication*. October 23.

Soil Science Society of America. *Glossary of Soil Science Terms.* https://www.soils.org/publications/soils-glossary/#. Accessed February 8, 2016

Sydnor, Robert H., PG 3267, CHG 6, CEG 968, 2016. *Email Communication*. January 29.

Tepel, Robert E., PG 1706, CEG 547, 2015. *Email Communications*. October 8 and 19.

Troxel, Bennie W., PG 937, CEG 370 (Emeritus). 2015. *Personal Communication*. October 22.

Turner, A.K., 2008. *Education and Professional Recognition of Engineering Geologists and Geological Engineers in Canada and the United States*, in: Proceedings, 1st International Conference on Education and Training in Geo-Engineering Sciences, Constantaz, Romania, 2-4 June 2008, (I. Manoliu & N. Radulescu, Eds), CRC Press, Taylor & Francis Group, London, p. 111-118.

Turner, A.K., 2011. *The Role of Competency-Oriented Descriptions in Geo-Engineering*. Paper presented at the Pan-Am CGS Geotechnical Conference – Geo-Innovation Addressing Global Challenges, Toronto, Canada.

University of California. Campus Majors. http://admission.universityofcalifornia.edu/counselors/files/undergraduate_majors_list.pdf. Accessed on August 12, 2015.

University of Texas at Austin. *2016 Heads/Chairs on the Future of Undergraduate Geoscience Education Summit.* http://www.jsg.utexas.edu/events/future-of-geoscience-undergraduate-education/. Accessed September 24, 2015 and February 2, 2016.

Williams, John. PhD., PG 3219, CHG 3, CEG 937, Professor Emeritus of Geology, San Jose State University. *Personal Communication*. December 4.

Wisconsin Statutes. 2015. Chapter 470. *Examining Board of Professional Geologists, Hydrologists and Soil Scientists.* https://docs.legis.wisconsin.gov/statutes/statutes/470.pdf.

Wuebbles, Donald J., Asplen, Lisa, and Brewer, Joseph, 2006. *Earth Systems, Environment and Society: A New Interdisciplinary Undergraduate Major at the University of Illinois*. Journal of Geoscience Education. v. 54, no. 3, p. 230-239.

Definitions

Accreditation: An authorization indicating that some entity (university, department, or program), meets the standards of an external, organization. All serious universities and colleges receive general accreditation under some regional authority. Specific degree programs may also receive accreditation. For example, engineering degree programs are accredited under ABET (American Geosciences Institute, 2013).

Code: A collection or compilation of laws, rules, or regulations that are consolidated and classified according to subject matter (Legal-dictionary.thefreedictionary.com, 2015). The Geologist and Geophysicist Act is in the Business and Professions Code.

Department: An institutional component or unit that may administer one or more degree programs (American Geosciences Institute, 2013).

Earth Science: An all-embracing term for sciences related to the earth. It is occasionally used as a synonym for geology, geoscience, or geological sciences, but this usage is misleading because in its broadest scope, earth science includes such subjects as meteorology, physical oceanography, soil chemistry, and agronomy (American Geological Institute, 1984).

Engineering Geology: The application of geologic data, principles, and interpretation so that geologic factors and processes affecting planning, design, construction, maintenance, and vulnerability of civil engineering works are properly recognized and utilized (CCR Title 16 §3003).

Geology: That science that treats of the earth in general; investigation of the earth's crust and the rocks and other materials which compose it; and the applied science of utilizing knowledge of the earth and its constituent rocks, minerals, liquids, gases and other materials for the benefit of mankind (Cal. Bus. and Prof. Code §7802)

Geological: Pertaining to geology (American Geological Institute, 1984).

Geoscience: Synonym for geology (American Geological Institute, 1984).

Hydrogeology: The application of the science of geology to the study of the occurrence, distribution, quantity, and movement of water below the surface of the earth, as it relates to the interrelationships of geologic materials and processes with water, with particular emphasis given to groundwater quality (CCR Title 16 §3003).

Hydrology: The science that deals with global water (both liquid and solid), its properties, circulation, and distribution, on and under the earth's surface and in the atmosphere, from the

moment of its precipitation until it is returned to the atmosphere through evapotranspiration or is discharged into the ocean (American Geological Institute, 1984).

Law: The system of rules that a particular country or community recognizes as regulating the actions of its members and may enforce by the imposition of penalties (Oxforddictionaries.com, 2015).

License: Formal permission from a governmental or other constituted authority to do something, such as to carry on some business or profession (Dictionary.com, 2015).

Licensure: The granting of licenses, especially to engage in professional practice (Dictionary.com, 2015).

Program: An academic program in a given discipline, such as "geology" (American Geosciences Institute, 2013).

Regulation: Rules issued by government departments or agencies to carry out laws (Legal-dictionary.thefreedictionary.com, 2015). The regulations relating to the practices of geology and geophysics are in the California Code of Regulations, Title 16, Division 29 §§ 3000-3067

Statute: A specific law, expressed in writing (Legal-dictionary.thefreedictionary.com, 2015). The Geologist and Geophysicist Act is the specific law for geologists and geophysicists in California. (Cal. Bus. And Prof. Code §§7800-7887)

Soil: (i) The unconsolidated mineral or organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants. (ii) The unconsolidated mineral or organic matter on the surface of the earth that has been subjected to and shows effects of genetic and environmental factors of: climate (including water and temperature effects), and macro- and microorganisms, conditioned by relief, acting on parent material over a period of time. A product-soil differs from the material from which it is derived in many physical, chemical, biological, and morphological properties and characteristics. (Soil Science Society of America, 2016).

Soil Science: Soil Science is the science dealing with soils as a natural resource on the surface of the Earth including soil formation, classification, and mapping; physical, chemical, biological, and fertility properties of soils; and these properties in relation to the use and management of soil. (Soil Science Society of America, 2016).

California Universities and Degrees Reviewed

Bachelor Degrees	Department Name	Degree Type	Subject Area
California Institute of Technology	Division of Geological & Planetary Sciences	BS	Geobiology
		BS	Geochemistry
		BS	Geology
		BS	Geophysics
		BS	Planetary Science
California Luthern University	Department of Geology	BS	Geology
California Polytechnic State University, San Luis Obispo	Earth & Soil Sciences Department	BS	Environmental Earth and Soil Sciences w/Geology concentration
California Polytechnic State University, Pomona	Department of Geological Sciences	BS	Geology
CSU Bakersfield	Department of Geological Sciences	BA	Geology
		BS	Geology
CSU Chico	Dept of Geological & Environmental Sciences	BS	Geology
		BS	Geosciences
		BS	Environmental Science-Energy and Earth Resources
		BS	Environmental Science-Hydrology concentration
CSU Dominguez Hills	Dept of Earth Science & Geography	BS	Earth Science
CSU East Bay	Dept of Earth & Environmental Sciences	BA	Geology
		BS	Geology
CSU Fresno	Dept of Earth & Environmental Sciences	BS	Geology
CSU Fullerton	Department of Geological Sciences	BA	Earth Science
		BS	Geological Sciences

CSU Long Beach	Department of Geological Sciences	BA	Earth Science
		BS	Geology
CSU Los Angeles	Department of Geosciences and the Environment	BS	Environmental Geoscience Option
		BS	Geology Option
CSU Northridge	Department of Geological Sciences	BS	Geology Option
		BS	Geophysics Option
CSU Sacramento	Department of Geology	BA	Earth Science
		BA	Geology
		BS	Geology
CSU San Bernardino	Department of Geological Sciences	BA	Geology
		BS	Geology
		BS	Environmental Geology Option
CSU Stanislaus	Dept of Physics and Geology	BA	Earth Science-Liberal Studies
		BS	Geology
Humbolt State University	Dept of Geology	BA	Geosciences
		BA	Geology
		BS	Geology
Loma Linda University	Dept of Earth and Biological Sciences	BS	Environmental Science/Geology Concentration
		BS	Geology
Occidental College	Dept of Geology	BS	Environmental Science/Geology Concentration
		BS	Geology
Pomona College	Geology Department	BS	General Geology
		BS	Environmental Earth Science
		BS	Earth, Planetary & Space Science
		BS	Geochemistry
San Diego State University	Dept of Geological Sciences	BA	General Geology
		BS	General Geology
		BS	emphasis in Engineering Geology

San Diego State University (cont.)		BS	emphasis in Geochemistry
		BS	emphasis in Geophysics
		BS	emphasis in Hydrogeology
		BS	emphais in Marine Geology
		BS	emphasis in Paleontology
San Francisco State University	Department of Earth & Climate Sciences	BA	Earth Sciences
		BS	Earth Sciences w/Hydrology Emphasis
		BS	Earth Sciences w/Geology Emphasis
San Jose State University	Dept of Geology	BA	Earth Science
		BS	Geology
Sonoma State University	Department of Geology	BA	Earth Science
		BS	Geology
Stanford University	Dept of Geological and Environmental Sciences	BS	Geological Sciences
		BS	Geological Sciences (options for concentration in engineering geology or hydrogeology)
UC Berkeley	Dept of Earth & Planetary Science	BA	Environmental Earth Science
		BA	Geology
UC Davis	Department of Earth and Planetary Sciences	BA	Geology
		BS	Geology
UC Irvine	Department of Earth System Science	BS	Earth System Science (options for specialization in hydrology & ecosystems)
UC Los Angeles	Dept of Earth, Planetary and Space Sciences	BA	Earth and Environmental Science
		BS	Geology
		BS	Engineering Geology
		BS	Geology/Paleobiology
UC Riverside	Dept of Earth Sciences	BS	General Geology
		BS	Geology w/Global Climate Change Option
		BS	Geology w/Geobiology Option
		BS	Geology w/Geophysics Option

UC San Diego	Scripps Institution of Oceanography	BS	Earth Science - Geology
		BS	Earth Science - Geophysics
		BS	Earth Science - Environmental Geochemistry
		BS	Earth Science-Solid Earth Geochemistry
UC Santa Barbara	Dept of Earth Science	BA	Earth Science
		BS	Earth Science - geology, or Engineering ES based on electives
		BS	Earth Science - climate & environment
		BS	Earth Science - geohydrology
		BS	Earth Science - Geophysics
		BS	Earth Science - Paleobiology
UC Santa Cruz	Earth & Planetary Sciences	BA	Earth Sciences/Anthropology BA
		BS	Earth Sciences
		BS	Earth Sciences w/Environmental Geology
		BS	Earth Sciences w/Ocean Sciences
		BS	Earth Sciences w/Planetary Sciences
		BS	Earth Sciences w/Science Education
University of Southern California	Dept of Earth Sciences	BS	Geological Sciences
		BA	Earth Sciences
University of the Pacific	Dept of Earth & Environmental Sciences	BA	Geology
		BS	Geology
		new BS	Geological & Environmental Science w/Geology Concentration