2023 Task Analysis Survey (TAS):
Defining the Practice of Geology in the United States

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Introduction

The content or subject matter tested on licensing examinations is often determined through formal task analysis research studies that are designed to maximize the relevance of the examinations to the practice of the professions. The task analysis studies identify the tasks/activities that are performed by professionals and the underlying knowledge that is necessary to perform these tasks. The task analysis results form the basis for creating test blueprints that define the content and scope of the examinations. These studies are conducted on a regular basis to keep abreast of advances and/or changes in the practice of the profession.

The Association of State Boards of Geology (ASBOG®) conducted the 2023 task analysis survey (TAS) to update the content and scope of the Fundamentals of Geology (FG) and Practice of Geology (PG) Examinations. The 2023 TAS builds on earlier task analysis surveys completed in 1995, 2000, 2005, 2010, and 2015. The 2023 TAS results will be implemented with FG and PG Examinations in October 2023 (Forms 2310).

Procedures

The 2023 TAS members attended three meetings during 2022:

Atlanta, Georgia - January 14 - 15, 2022
Albany, New York - April 6, 2022
Wilmington, North Carolina – October 29, 2022

The 2023 TAS members, serving as Subject Matter Experts (SMEs), accomplished several major objectives during these meetings. The SMEs:

- Reviewed and finalized the 2023 TAS research design (i.e., methods for contacting licensees, survey format, statistical analyses, etc.).
- Examined guidelines for evaluating task and knowledge statements.
- Refined the 2015 TAS task statements to improve clarity in describing the practice of the geological profession.
- Reviewed and finalized the 2023 TAS format and email invitations.
- Evaluated the 2023 TAS results.
- Assigned task statements for the FG and/or PG Examinations based on whether the tasks are most accurately tested at the FG level (B.A. or B.S. with no requisite experience), the PG level (minimum of four years' experience), or both levels.

2023 Task Statements

The initial section of the survey included 43 tasks performed by professional geologists:

No.	**A. General Geology and Geological Investigations**
1	Plan and conduct geological investigations considering public health, safety, and welfare, the environment, regulations, and Quality Assurance/Quality Control (QA/QC).
2	Compile and organize available information to plan geological investigations.
3	Collect, describe, and record new geological and geophysical data.
4	Determine positions, scales, distances, and elevations from remote sensing, imagery, surveys, sections, maps, and GIS.
5	Prepare, analyze, and interpret logs, sections, maps, and other graphics derived from field and laboratory investigations.
	B. Mineralogy, Petrology, and Geochemistry
6	Plan and conduct mineralogic, petrologic, and geochemical investigations, including the use of field, laboratory, and analytical techniques.
7	Identify minerals and rocks and their characteristics.
8	Identify and interpret rock and mineral sequences and associations, and their genesis.
9	Evaluate geochemical and isotopic data and construct geochemical models related to rocks and minerals.
10	Determine type, degree, and effects of rock and mineral alteration.
	C. Sedimentology, Stratigraphy, and Paleontology
11	Plan and conduct sedimentologic, stratigraphic, or paleontologic investigations, including the use of field, laboratory, and analytical techniques.
12	Select and apply appropriate stratigraphic nomenclature and establish correlations.
13	Identify and interpret sedimentary processes and structures, depositional environments, sediment provenance, and geochemical and climatic cycles.
14	Identify sediment and/or rock sequences, positions, and ages, and interpret sequence stratigraphy.
15	Identify fossils and interpret fossil assemblages for age, paleoenvironmental interpretations, and/or stratigraphic correlations.
	D. Geomorphology and Surficial Processes
16	Plan and conduct geomorphic investigations, including the use of field, laboratory, and analytical techniques.
17	Identify, classify, and interpret landforms, surficial materials, and processes.
18	Determine relative or absolute age relationships of landforms, sediments, and soils.
19	Evaluate geomorphic processes and development of landforms, sediments, and soils, including watershed processes.
20	Apply remote sensing and GIS techniques to interpret geomorphic conditions and processes.
	E. Structure, Tectonics, and Seismology
21	Plan and conduct structural, tectonic, or seismic investigations, including the use of field, laboratory, and analytical techniques.
22	Identify and define structural features and relationships to construct and interpret cross sections and structural projections, and perform statistical analyses.
23	Interpret deformational history through structural and tectonic analyses.
24	Develop and apply tectonic models to identify geologic processes and history.
25	Evaluate earthquake mechanisms and paleoseismic history.
	F. Hydrogeology
26	Plan and conduct hydrogeological, geochemical, and contaminant investigations, including the use of field, laboratory, and analytical techniques.
27	Define and characterize hydraulic properties of vadose and saturated zones.
28	Design groundwater monitoring, observation, extraction, production, or injection wells.
29	Evaluate water resources, assess aquifer yield, and determine sustainability.
30	Characterize soil and water quality, and assess chemical fate and transport.
31	Manage, develop, protect, or remediate surface water or groundwater resources.
	G. Engineering Geology
32	Plan and conduct engineering geological investigations, including the use of field and laboratory methods.
33	Identify and characterize physical and index properties of earth materials.
34	Provide analysis and recommendations for engineering design, land use decisions, restoration, and watershed management.
35	Identify, map, and evaluate geologic hazards and processes.
36	Interpret land use, landforms, and geological site characteristics using remote sensing data, maps, records, and GIS.
37	Develop plans, interpretations, and recommendations for ground behavior during infrastructure development or hazard mitigation.
	H. Mineral and Energy Resources
38	Plan and conduct resource exploration, evaluation, and reclamation programs, including the use of conceptual models, and field, laboratory, and analytical techniques.
39	Collect and interpret data necessary to locate mineral or energy resources.
40	Determine the presence and distribution of resources based on surface and subsurface data.
41	Perform economic evaluation and reserve assessment.
42	Calculate quantity and quality of resources.
43	Conduct geological studies for design, abandonment, closure, waste management, and reclamation and restoration of energy development or mineral extraction operations.

Rating Scale

The survey contained one rating scale to assess the importance of each task to public protection:

Judgment of Importance – Rating Scale

Based on your knowledge and experience as a professional geologist/geoscientist, rate how important each task is to the practice of geology as it is applied to the protection of the public health, safety, and welfare using the scale below.

0 - Not important 1 – Somewhat important 2 – Very important 3 – Extremely important

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Participating Jurisdictions

The final portion of the 2023 TAS included questions about respondents' background characteristics and practice demographics, including the one jurisdiction where they perform most of their geological activities. Member Boards sent invitations to their active licensees during August 2022, inviting them to complete the TAS by clicking on a link contained in the email invitation. Member Boards sent their licensees a follow-up email approximately two weeks after the initial mailing that stressed the importance of the study. Thirty-two jurisdictions that license geologists participated in the 2023 TAS as listed below:

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1. Alabama
2. Arizona
3. Arkansas
4. California
5. Delaware
6. Florida
7. Georgia
8. Idaho
9. Illinois
10. Indiana
11. Kansas
12. Kentucky
13. Louisiana
14. Maine
15. Minnesota
16. Mississippi
17. Missouri
18. Nebraska
19. New Hampshire
20. New York
21. North Carolina
22. Oregon
23. Pennsylvania
24. Puerto Rico
25. South Carolina
26. Tennessee
27. Texas
28. Utah
29. Virginia
30. Washington
31. Wisconsin
32. Wyoming

Invitations to complete the 2023 TAS were also sent to academicians by the American Geological Institute (AGI). A total of 4,979 surveys from practicing geologists were completed while 303 academicians completed the survey.

Background Characteristics and Practice Demographics

Respondents were asked to specify in which one jurisdiction they conduct most of their geological activities, and the data indicate that the 2023 TAS includes practicing geologists from all 50 states (Figure 1). The same is true for academia where all 50 states are represented (Figure 2). The sample sizes in the figures do not match the number of completed surveys because some respondents did not respond to all survey questions.

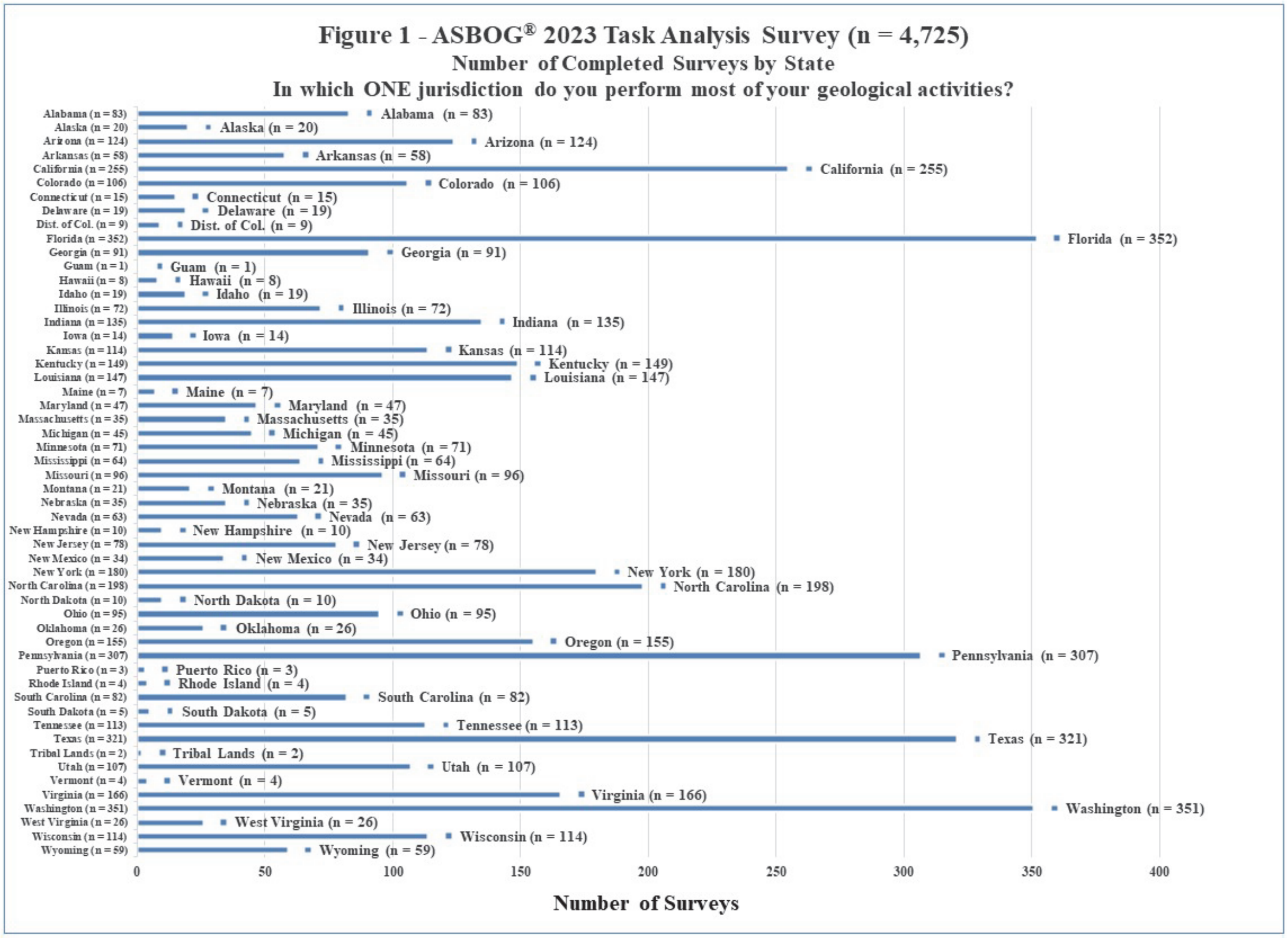


Figure 1 - ASBOG® 2023 Task Analysis Survey (n = 4,725)
Number of Completed Surveys by State
In which ONE jurisdiction do you perform most of your geological activities?
Alabama (n = 83)
Alaska (n = 20)
Arizona (n = 124)
Arkansas (n = 58)
California (n = 255)
Colorado (n = 106)
Connecticut (n = 15)
Delaware (n = 19)
Dist. of Col. (n = 9)
Florida (n = 352)
Georgia (n = 91)
Guam (n = 1)
Hawaii (n = 8)
Idaho (n = 19)
Illinois (n = 72)
Indiana (n = 135)
Iowa (n = 14)
Kansas (n = 114)
Kentucky (n = 149)
Louisiana (n = 147)
Maine (n = 7)
Maryland (n = 47)
Massachusetts (n = 35)
Michigan (n = 45)
Minnesota (n = 71)
Mississippi (n = 64)
Missouri (n = 96)
Montana (n = 21)
Nebraska (n = 35)
Nevada (n = 63)
New Hampshire (n = 10)
New Jersey (n = 78)
New Mexico (n = 34)
New York (n = 180)
North Carolina (n = 198)
North Dakota (n = 10)
Ohio (n = 95)
Oklahoma (n = 26)
Oregon (n = 155)
Pennsylvania (n = 307)
Puerto Rico (n = 3)
Rhode Island (n = 4)
South Carolina (n = 82)
South Dakota (n = 5)
Tennessee (n = 113)
Texas (n = 321)
Tribal Lands (n = 2)
Utah (n = 107)
Vermont (n = 4)
Virginia (n = 166)
Washington (n = 351)
West Virginia (n = 26)
Wisconsin (n = 114)
Wyoming (n = 59)
0
50
100
150
200
250
300
350
400
Number of Surveys

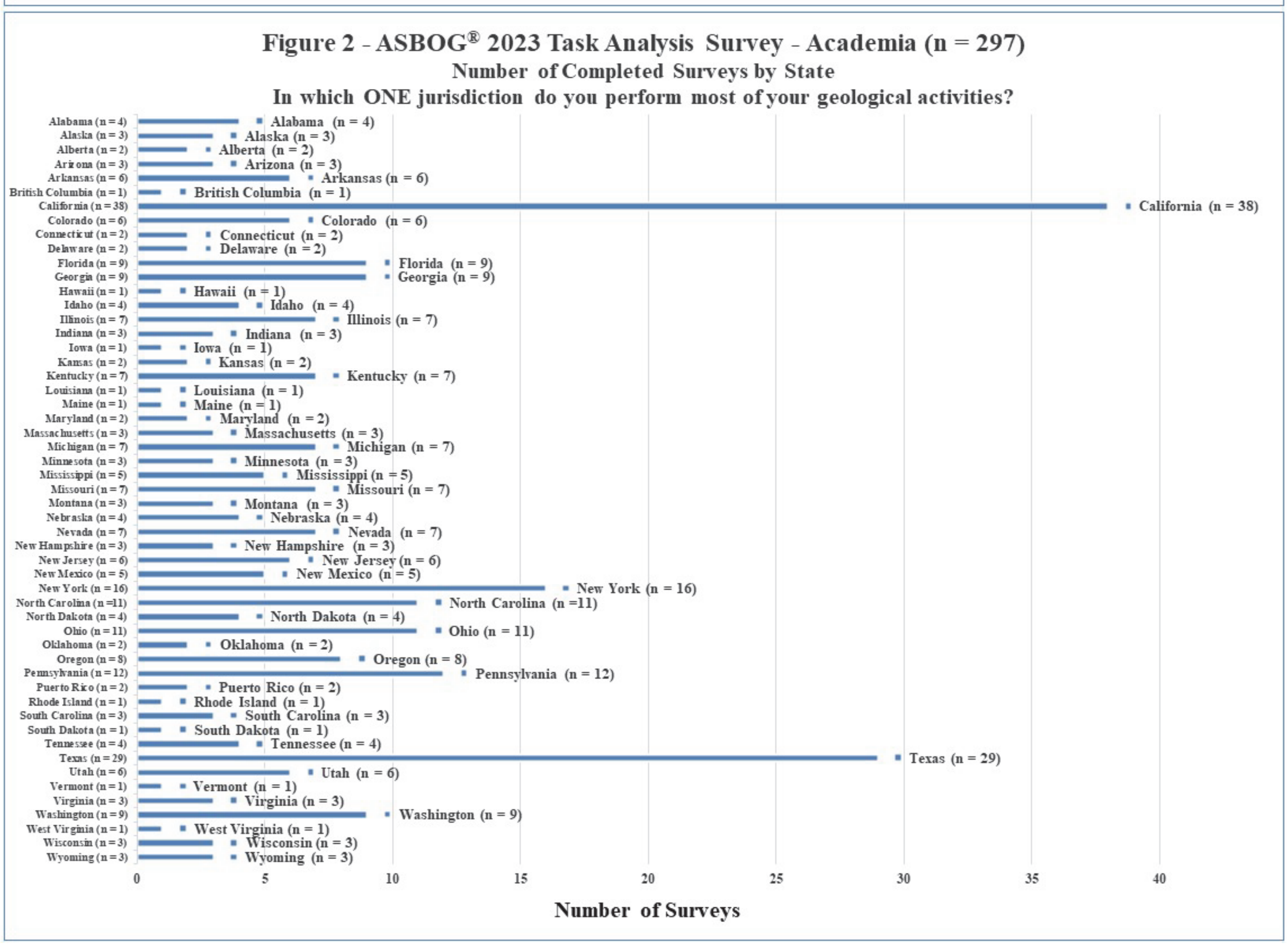


Figure 2 - ASBOG® 2023 Task Analysis Survey - Academia (n = 297)
Number of Completed Surveys by State
In which ONE jurisdiction do you perform most of your geological activities?
Alabama (n = 4)
Alaska (n = 3)
Alberta (n = 2)
Arizona (n = 3)
Arkansas (n = 6)
British Columbia (n = 1)
California (n = 38)
Colorado (n = 6)
Connecticut (n = 2)
Delaware (n = 2)
Florida (n = 9)
Georgia (n = 9)
Hawaii (n = 1)
Idaho (n = 4)
Illinois (n = 7)
Indiana (n = 3)
Iowa (n = 1)
Kansas (n = 2)
Kentucky (n = 7)
Louisiana (n = 1)
Maine (n = 1)
Maryland (n = 2)
Massachusetts (n = 3)
Michigan (n = 7)
Minnesota (n = 3)
Mississippi (n = 5)
Missouri (n = 7)
Montana (n = 3)
Nebraska (n = 4)
Nevada (n = 7)
New Hampshire (n = 3)
New Jersey (n = 6)
New Mexico (n = 5)
New York (n = 16)
North Carolina (n =11)
North Dakota (n = 4)
Ohio (n = 11)
Oklahoma (n = 2)
Oregon (n = 8)
Pennsylvania (n = 12)
Puerto Rico (n = 2)
Rhode Island (n = 1)
South Carolina (n = 3)
South Dakota (n = 1)
Tennessee (n = 4)
Texas (n = 29)
Utah (n = 6)
Vermont (n = 1)
Virginia (n = 3)
Washington (n = 9)
West Virginia (n = 1)
Wisconsin (n = 3)
Wyoming (n = 3)
0
5
10
15
20
25
30
35
40
Number of Surveys

Primary Area of Practice

The primary areas of practice for practicing geologists who responded to the survey are shown in Figure 3. The highest percentage of geologists indicated that their primary area of practice was in Environmental Geology (42%), the next highest percentage for primary area of practice was in Hydrogeology (23%).

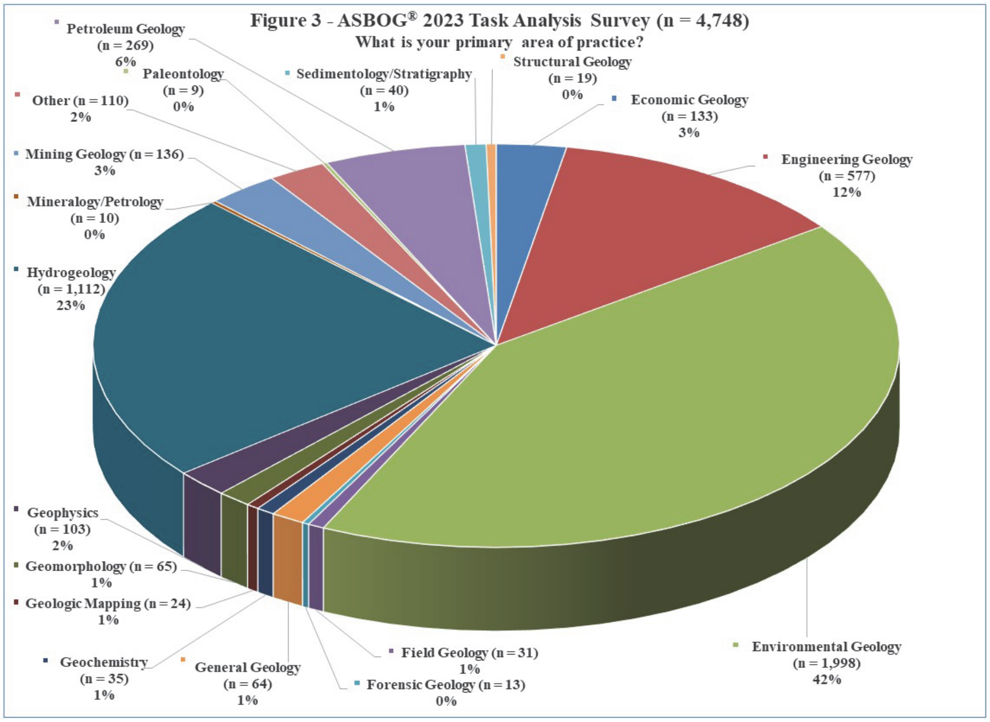
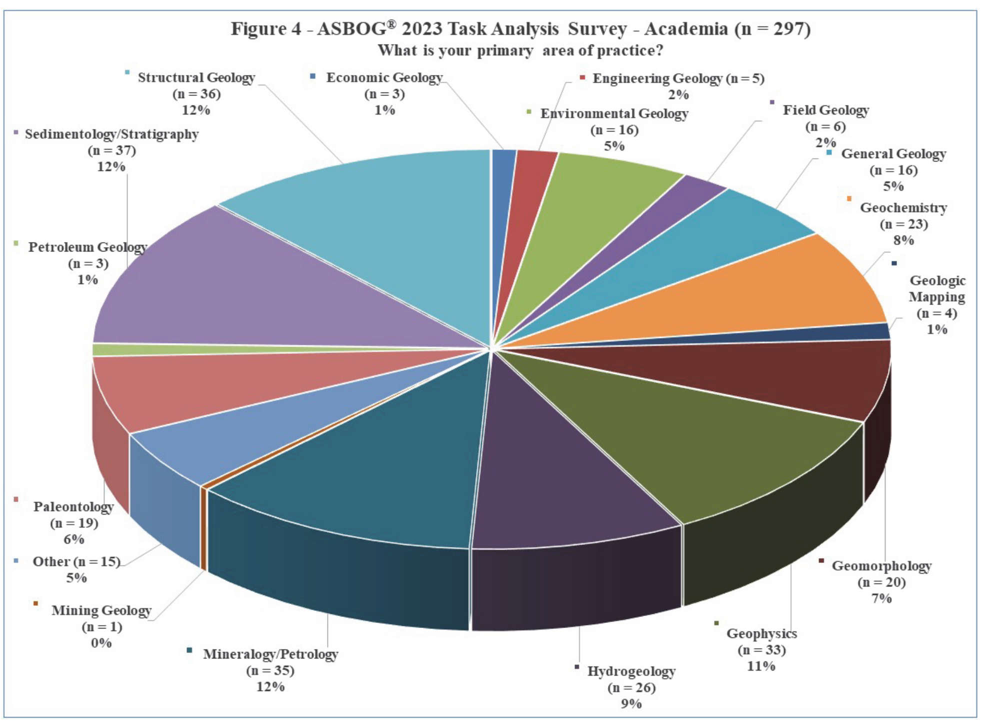
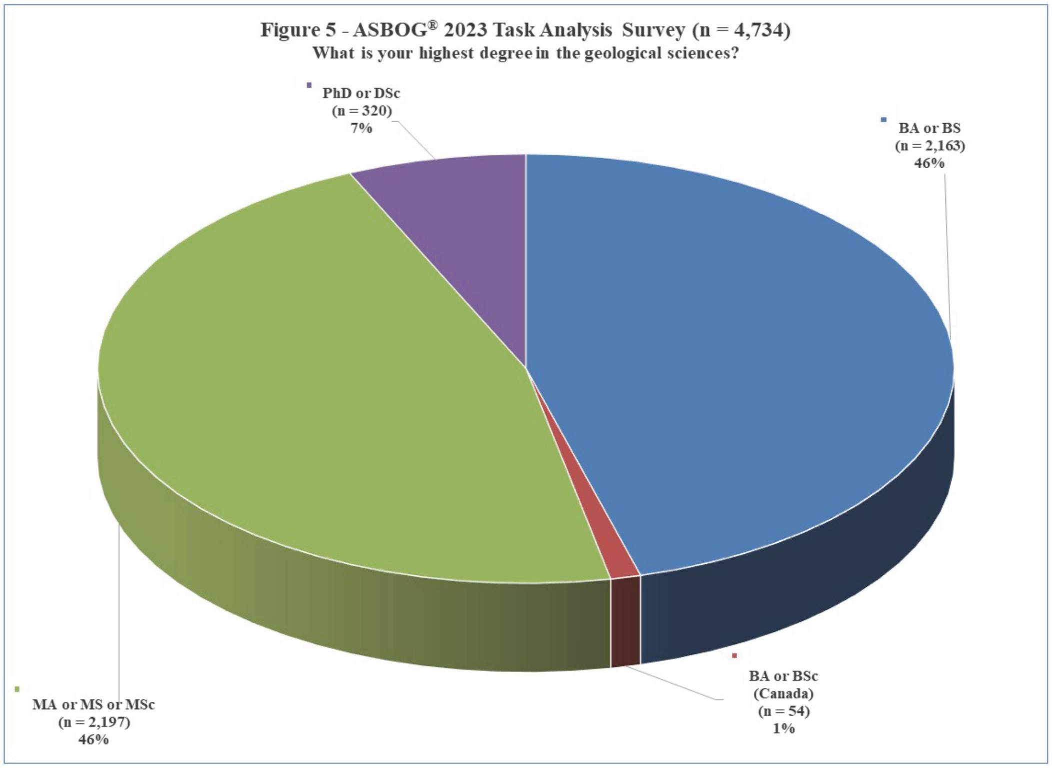


Figure 4 reveals the primary areas of practice for academia. The highest percentages of academicians indicated that their primary area of practice was Structural Geology (12%), Sedimentology/Stratigraphy (12%), Mineralogy/Petrology (12%), or Geophysics (11%). Relative to practicing geologists, academicians are more evenly spread across the practice areas.

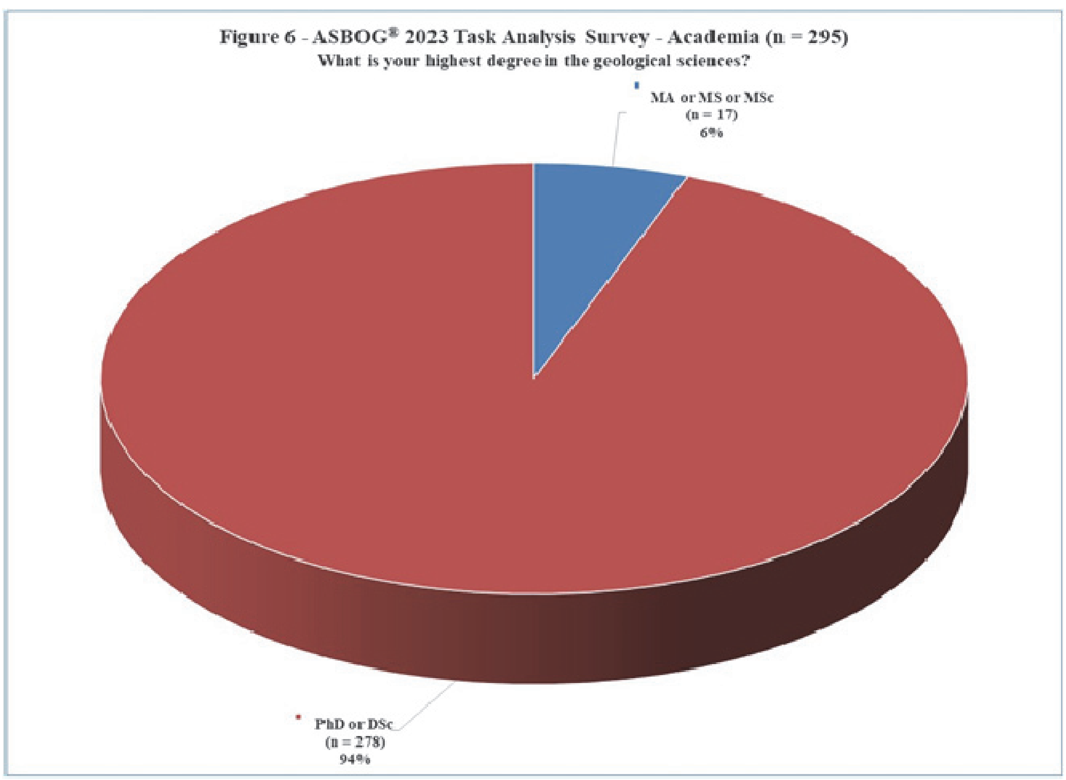


Highest Degree in the Geological Sciences

Respondents were asked to indicate their highest degree in the geological sciences. Forty-seven percent of the practicing geologists held a bachelor's degree (including one percent with a BA or BSc in Canada), 46% a master's degree, and seven percent a doctoral degree (Figure 5).

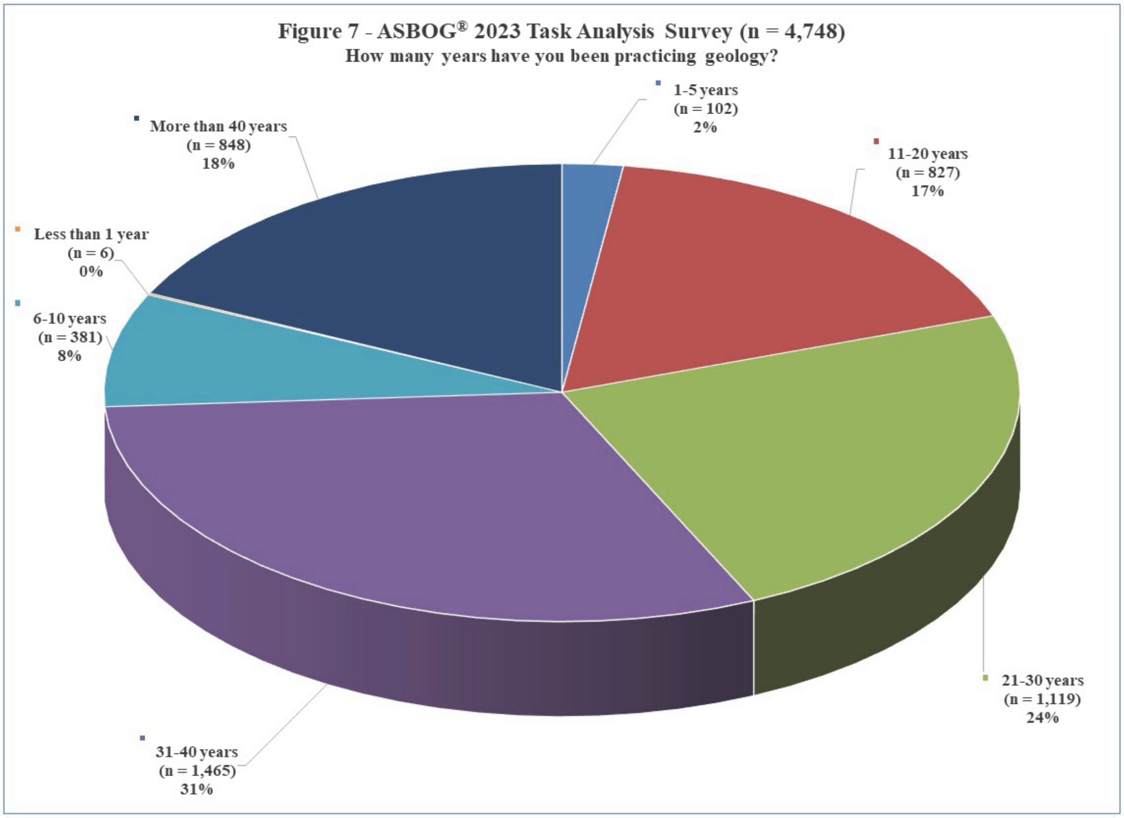


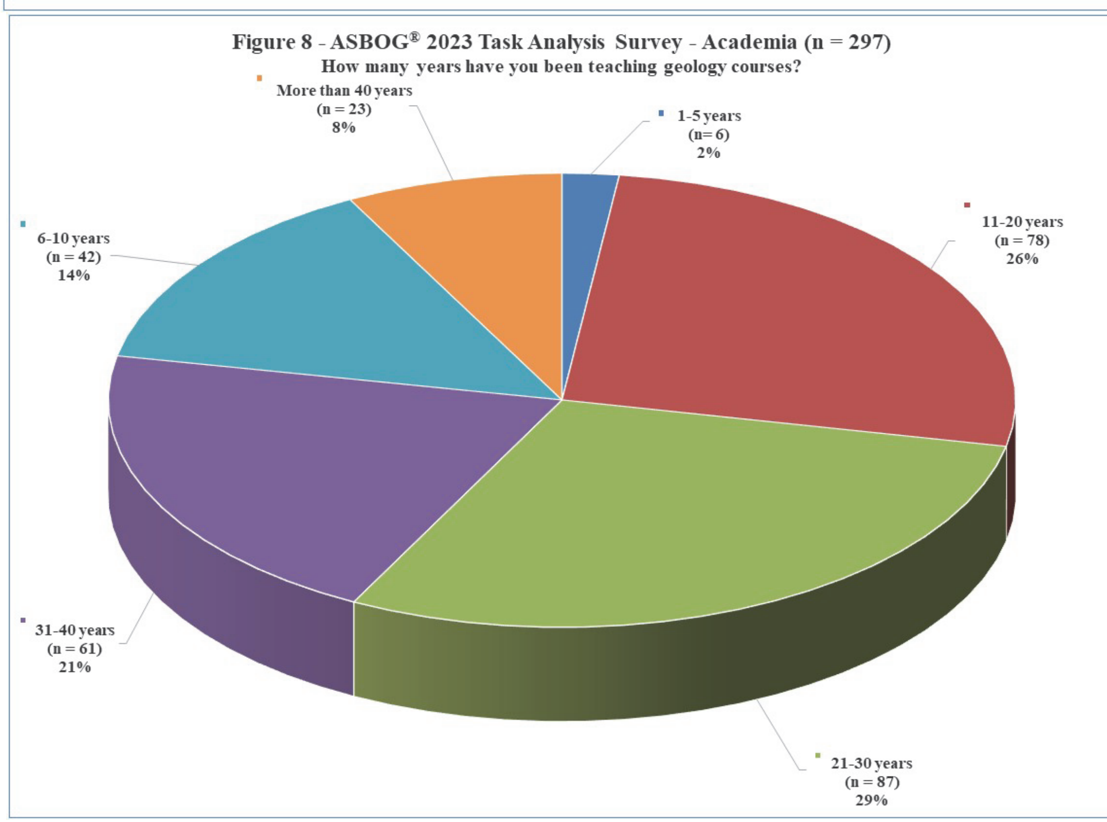
Ninety-four percent of the academicians held a doctoral degree and six percent held a master's degree (Figure 6).



Years Practicing/Teaching Geology

The number of years practicing or teaching geology are shown in Figures 7 and 8. Forty-nine percent of the practicing geologists indicated that they had been practicing 31 or more years, whereas only 29% of the academicians had been teaching for this length of time. The largest percentage of practicing geologists indicated they had been practicing between 31 – 40 years while the largest percentage of academicians indicated teaching 11 – 20 years.

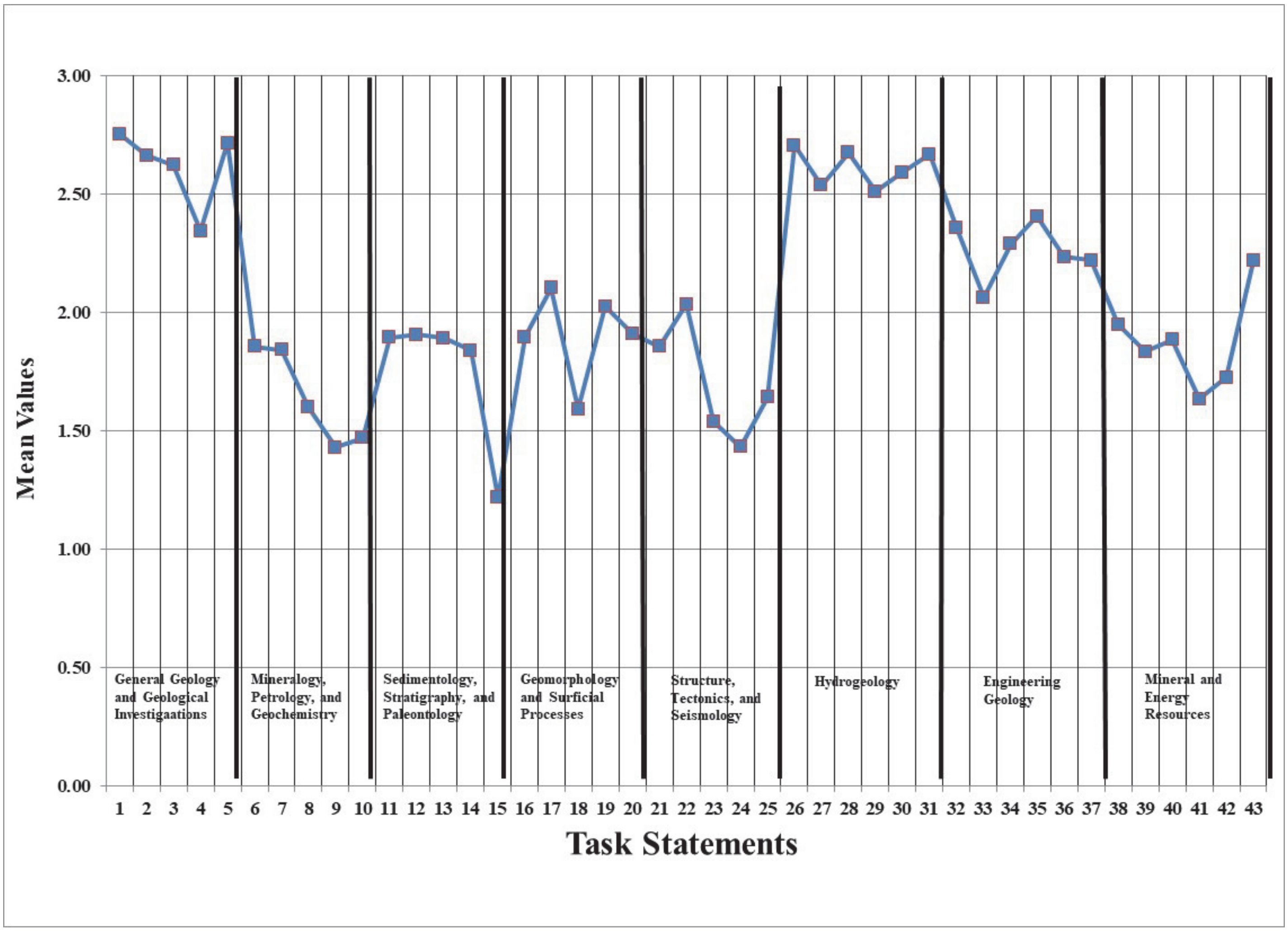




2023 TAS Results – Practicing Geologists

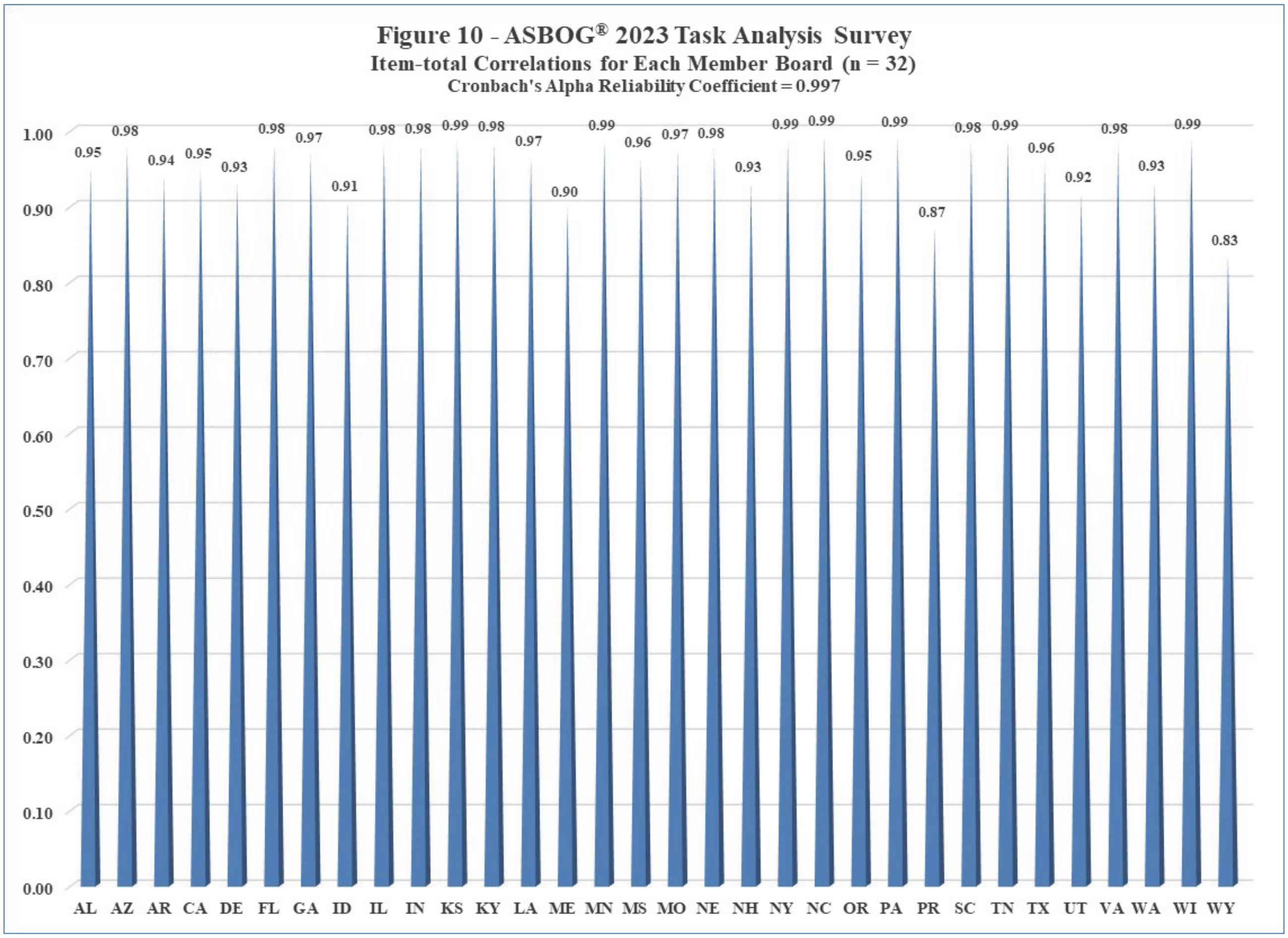
The mean values for practicing geologists across the 43 task statements are displayed in Figure 9. There is substantial variation in the mean values across the 43 task statements, with an average mean value of 2.06. Task 1 (Plan and conduct geological investigations considering public health, safety, and welfare, the environment, regulations, and Quality Assurance/Quality Control (QA/QC)) received the highest average rating (mean = 2.75), while Task 15 (Identify and interpret fossils and fossil assemblages for age, paleoenvironmental interpretations, and/or stratigraphic correlations) received the lowest average rating (mean = 1.22).

Figure 9 - ASBOG® 2023 Task Analysis
Mean Values for All Task Statements for Practicing Geologists (n = 4,744)



Consistency Among Jurisdictions

Figure 10 shows the relationships between the responses from each Member Board and the nation. The item-total correlations for each jurisdiction show the degree to which each jurisdiction mirrors the nation. Based on the high positive correlations shown in Figure 10, the practice in each jurisdiction is very similar to the practice nationwide. Cronbach's alpha coefficient is used to measure the consistency of responses among jurisdictions. The scale ranges from "0" meaning "no consistency" to "1" indicating "perfect consistency." Cronbach's alpha coefficient for this study is 0.997, indicating that the responses made by practicing geologists among jurisdictions are remarkably similar.



Practice of Geology Across Time

Figure 11 displays the task means for practicing geologists from the last three surveys (i.e., 2010 TAS, 2015 TAS, 2023 TAS). Comparisons across the three surveys are possible because the task statements in each survey were virtually identical, with only minor editorial changes made since 2010. Figure 11 reveals an extremely high degree of consistency in the practice of the profession across time. The correlations between surveys are remarkably high (2023 vs. 2015, r = +0.98; 2023 vs. 2010, r = +0.97; 2015 vs. 2010, r = +0.98). Practicing geologists in 2023 rated most of the tasks higher compared to the earlier surveys. The mean value across the 43 task statements was 2.06 in 2023 compared to 1.81 in 2015 and 1.87 in 2010.

2023 TAS Results – Academia

Figure 12 shows the mean values across the 43 tasks for academia for the 2010, 2015, and 2023 TAS. While the correlations between surveys are not as high as those for practicing geologists, they are nonetheless high (2023 vs. 2015, r = +0.93; 2023 vs. 2010, r = +0.88; 2015 vs. 2010, r = +0.91). The results indicate that the viewpoints of academicians have been quite stable from 2010 to 2023.

The mean values for practicing geologists and academia are presented in Figure 13. The correlation between these two groups is +0.87 which indicates that practicing geologists and academia view the profession similarly. The mean values for academia are higher than practicing geologists for *most* of the tasks in four content domains:

B - Mineralogy, Petrology, and Geochemistry
C - Sedimentology, Stratigraphy, and Paleontology
D - Geomorphology and Surficial Processes
E - Structure, Tectonics, and Seismology

Figure 11 - ASBOG® 2023 Task Analysis Survey
Mean Values for All Task Statements for Practicing Geologists
Across Time (2010 TAS, 2015 TAS, and 2023 TAS)

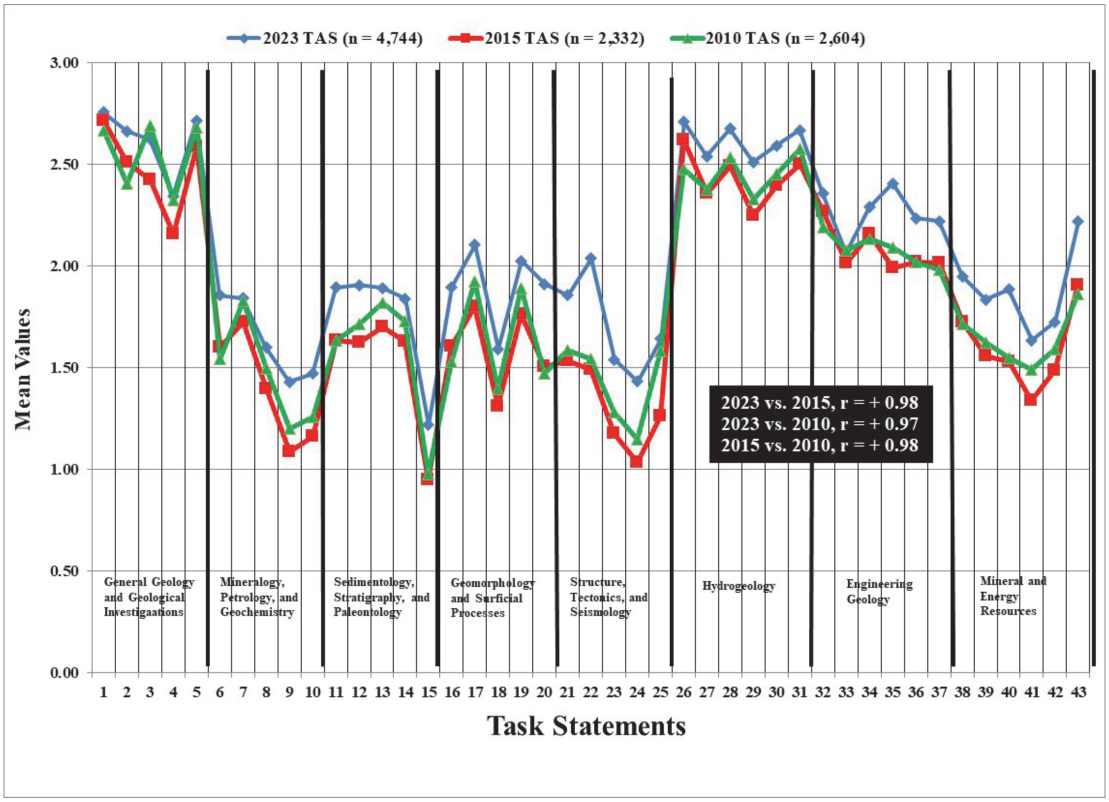


Figure 12 - ASBOG® 2023 Task Analysis Survey
Mean Values for All Task Statements for Academia
Across Time (2010 TAS, 2015 TAS, and 2023 TAS)

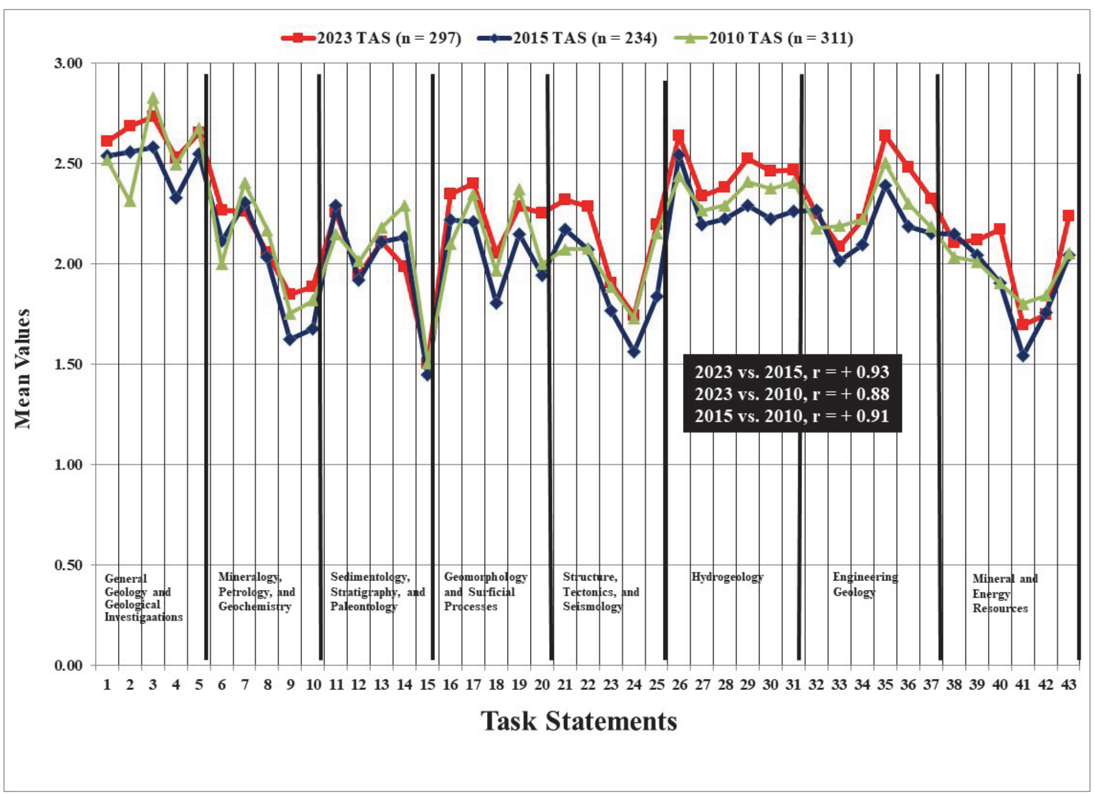
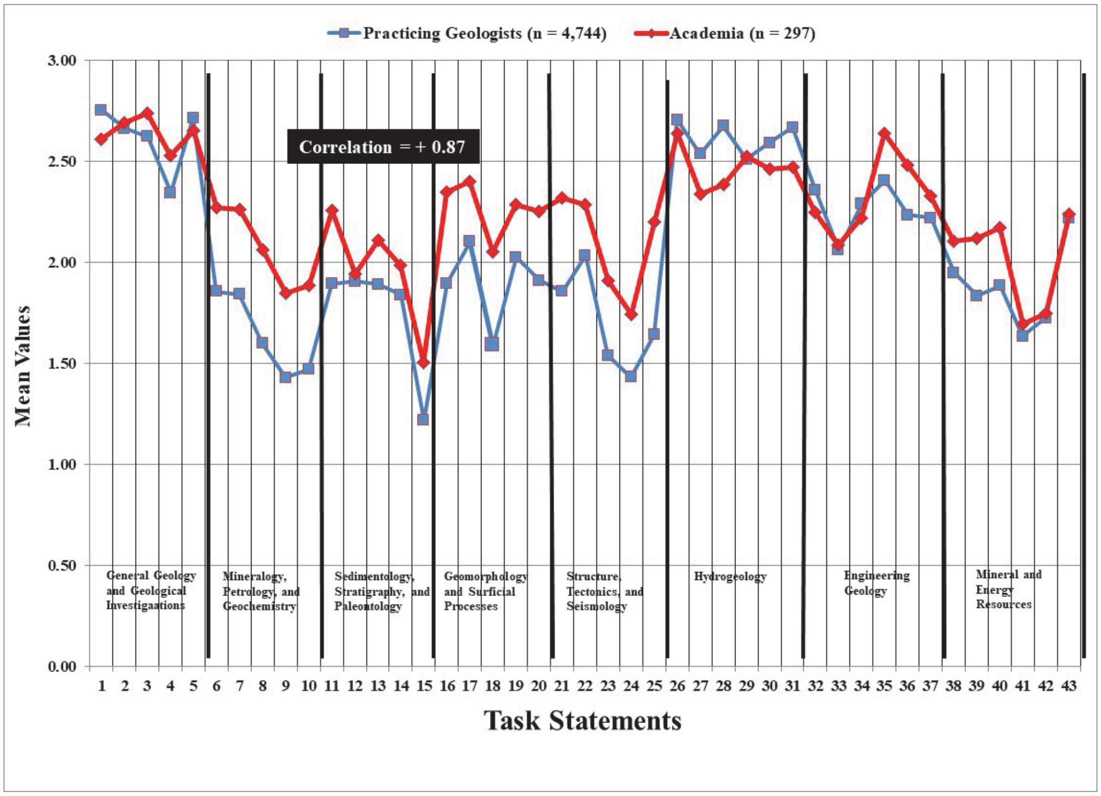


Figure 13 - ASBOG® 2023 Task Analysis Survey
Mean Values for All Task Statements
(Practicing Geologists vs. Academia)



Years of Experience

To investigate whether length of experience influences ratings, practicing geologists were divided into two groups, 1) ten or fewer years of experience and 2) 11 or more years of experience. Figure 14 shows the mean values for both groups across the 43 task statements. The correlation between experience groups is +0.99 which indicates that length of experience does not affect the ratings made by practicing geologists.

Education Level

The mean values for practicing geologists, comparing responses from those that possess a bachelor's as the highest degree in relation to those with advanced degrees is shown on Figure 15. The correlation between groups is +0.99 which indicates that education level does not influence the ratings made by practicing geologists.

Practice of Geology Outside of ASBOG States

The ratings made by geologists practicing in ASBOG states (n = 32) were compared to those made by geologists in non-ASBOG states (Figure 16). A remarkably high degree of consistency was observed between the two groups (r = + 0.99). This finding is very powerful because it demonstrates that the content of the FG and PG Examinations, driven by the task analysis results, will be relevant to the practice of geology for those states that join ASBOG in the coming years.

Figure 14 - ASBOG® 2023 Task Analysis Survey
Mean Values for All Task Statements
How many years have you been practicing geology?
(Ten or Fewer Years vs. Eleven or More Years)

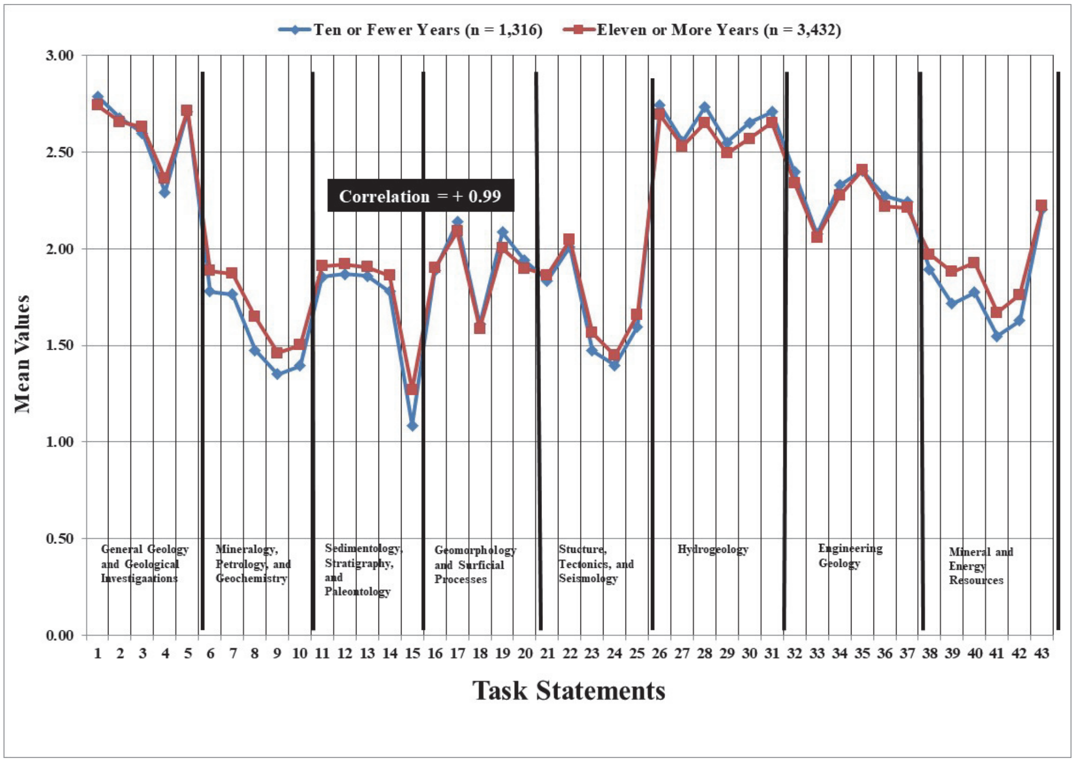


Figure 15 - ASBOG® 2023 Task Analysis Survey
Mean Values for All Task Statements
What is your highest degree in the geological sciences?
(BA/BS vs. MA/MS/PhD/DSc)

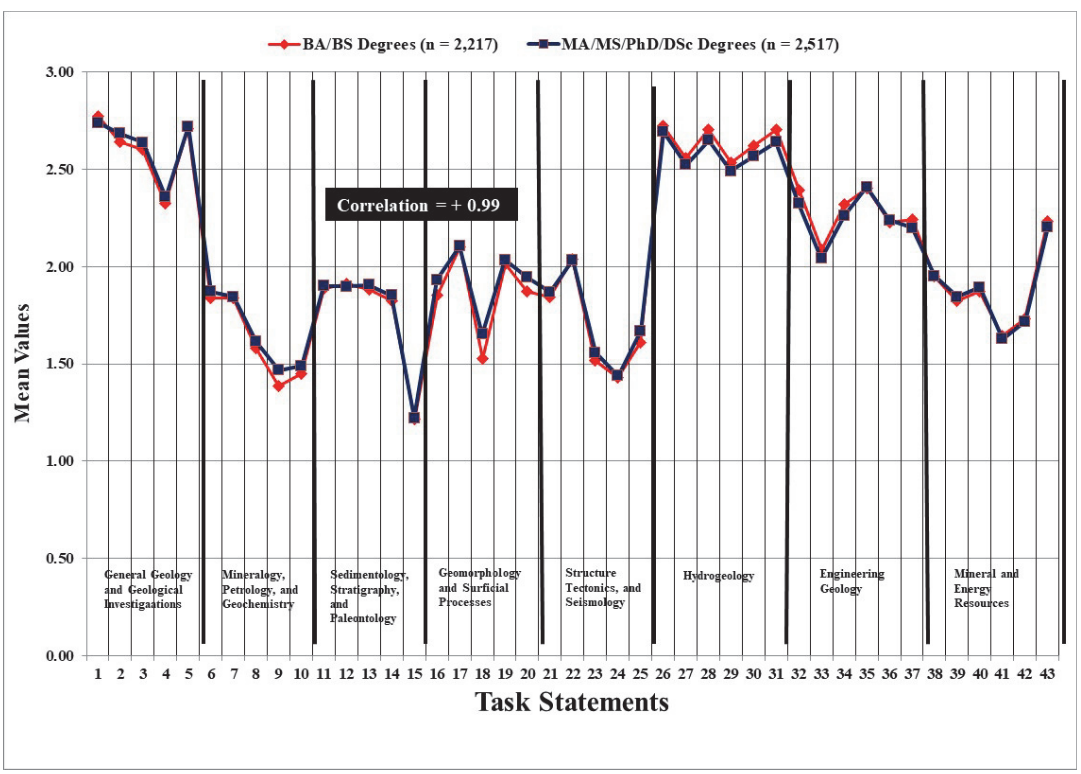
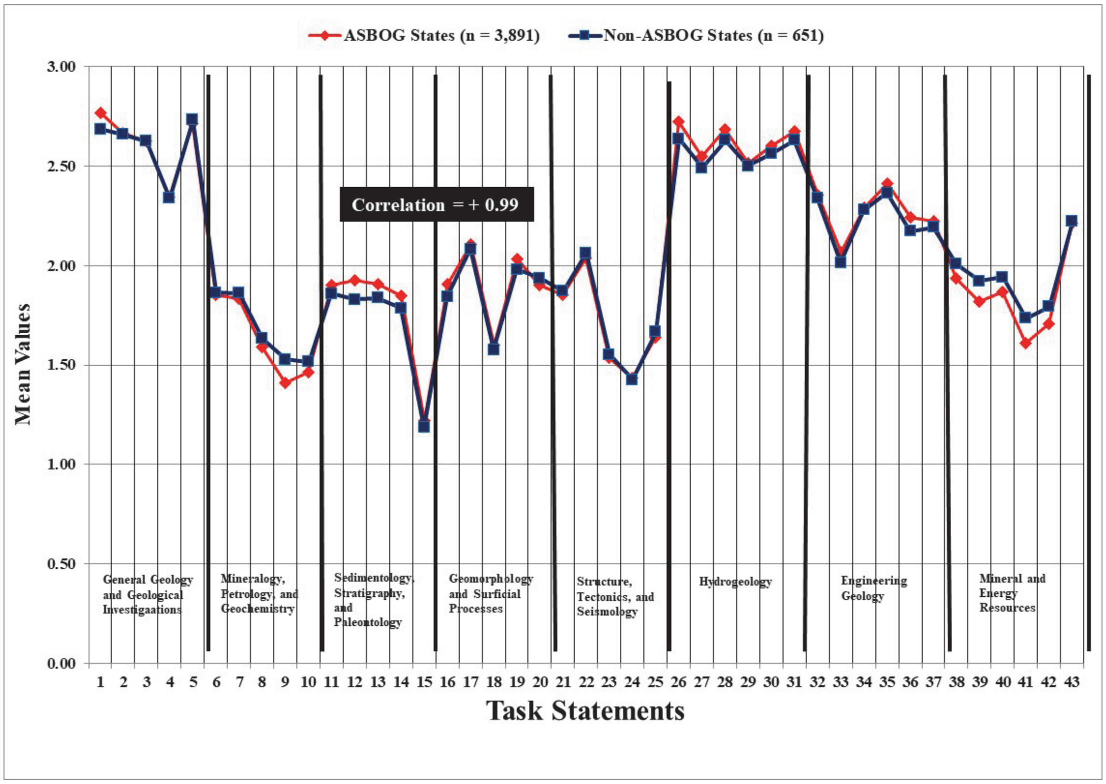


Figure 16 - ASBOG® 2023 Task Analysis Survey
Mean Values for All Task Statements
(ASBOG® States vs. Non-ASBOG® States)



FG and PG Test Blueprints

The 2023 TAS members reviewed and discussed the survey results during a workshop in Wilmington, North Carolina in October 2022. The primary goal of the workshop was to update the FG and PG Test Blueprints based on the 2023 TAS. The task means for all 43 task statements were sufficiently high to justify the continued testing of all tasks in either the FG or PG Examinations.

SMEs assigned each of the task statements to the FG and/or PG Examination based on whether the tasks are more accurately tested at the FG level (no requisite experience), the PG level (minimum of four years' experience requirement), or both. The FG Examination will focus on 29 (67%) of the 43 tasks included in the 2023 TAS. The PG Examination will focus on 34 (79%) of the 43 tasks. Twenty of the 43 tasks (47%) will be included in both the FG and PG Test Blueprints.

To determine the relative weight and, therefore, the number of questions necessary for each task in the examinations, the following formula was used:

Task Weight = Importance Mean

This formula places more emphasis on those tasks that are most important to public health, safety, and welfare. On the FG Examination, task weights were determined using the ratings made by practicing geologists <u>and</u> academia, giving equal weight to both groups. By contrast, the PG task weights were calculated using <u>only</u> those ratings made by practicing geologists.

The relative percent of items devoted to each task was determined by dividing each task weight by the sum of all task weights and then multiplying by 100:

Task Percent = (Task Weight/Sum of Task Weights) x 100

Effective with the October 2023 administration of the examinations (Forms 2310), the FG Test Blueprint will be based on 140 questions (Figure 17) while the PG Test Blueprint will contain 110 questions (Figure 18).

The 2023 TAS members also refined the Knowledge Base that is necessary to perform the tasks listed in the 2023 TAS. The Knowledge Base for each content domain is presented on pages 16 and 17. The eight domains collectively encompass the scientific and practical knowledge needed to become a licensed professional geologist. The Knowledge Base for Domain A (General Geology and Geological Investigations) encapsulates the general principles and knowledge of geology and field methods and provides the foundation for the other seven domains. Within each domain, the order in which the items are listed does not reflect their relative importance.

Summary

ASBOG® conducted the 2023 TAS to update the content and scope of the FG and PG Examinations. The consistency in the practice of the profession at three points in time (2010, 2015, 2023) is remarkable. The 2023 TAS results also reveal an extremely high degree of consistency in the practice of geology throughout the nation. Practicing geologists in different states view the importance of the geologic tasks very similarly. Furthermore, the importance of the tasks to public protection is not influenced by geologists' length of experience, education level, or whether they practice in a state that is a Member Board within the ASBOG® organization. These findings provide a sound basis for developing FG and PG Test Blueprints that are relevant to the practice of the profession throughout the nation.

Figure 17 - ASBOG® 2023 Task Analysis Survey
FG Test Blueprint - Domain Percentages
(Effective - October 2023)

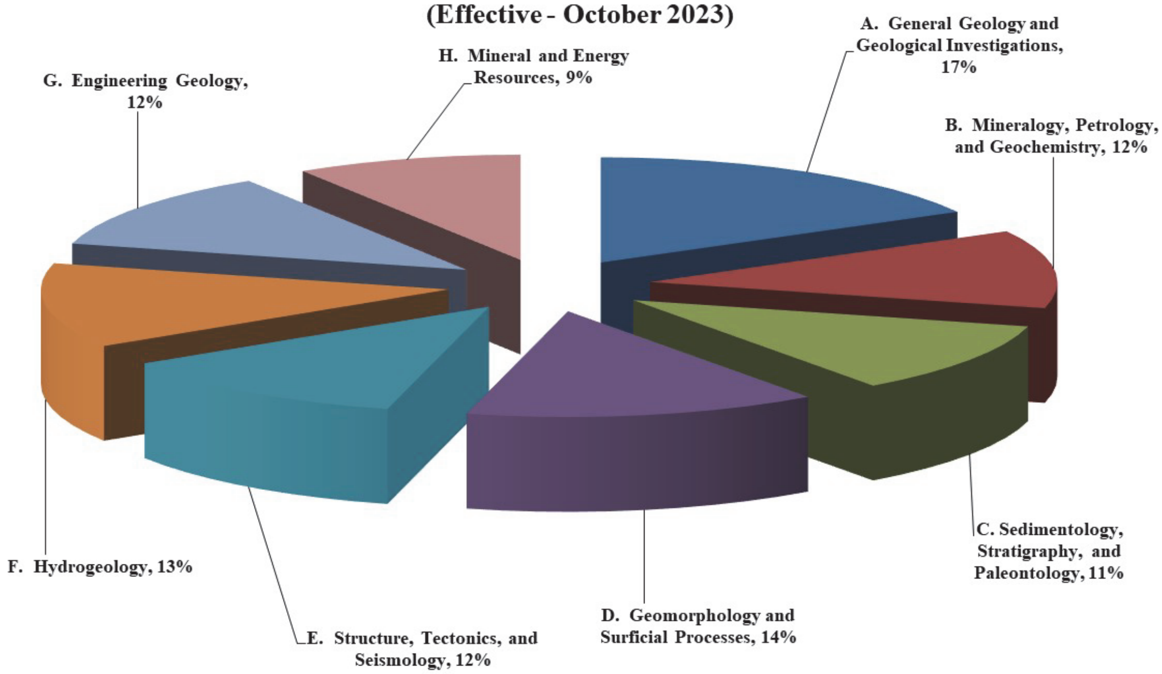
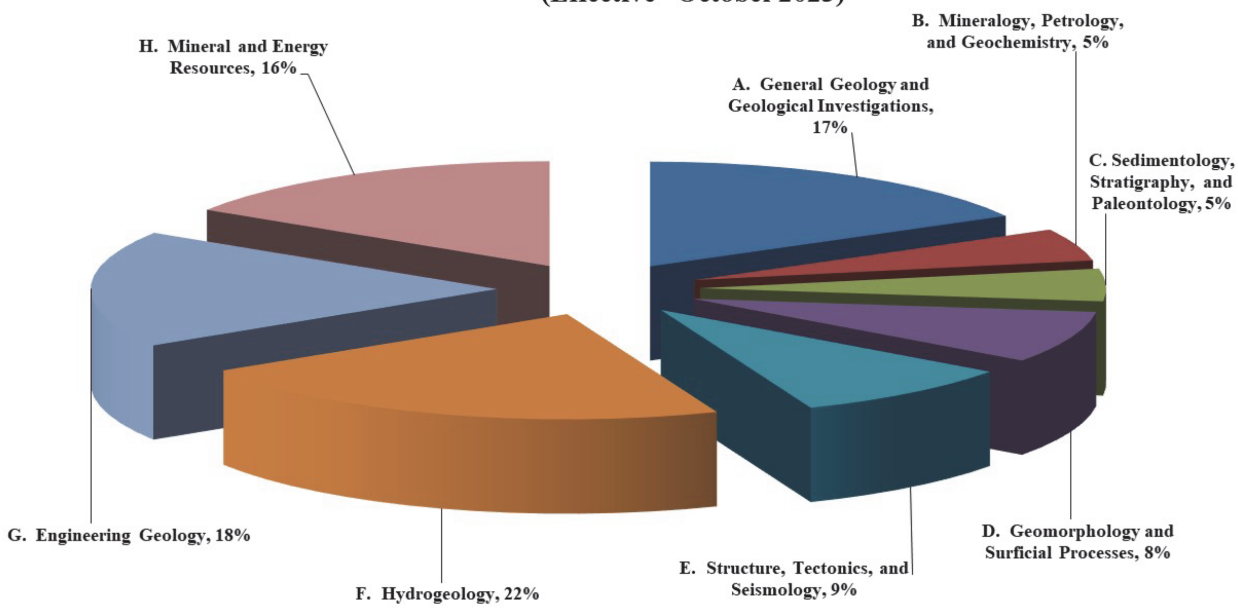


Figure 18 - ASBOG® 2023 Task Analysis Survey
PG Test Blueprint - Domain Percentages
(Effective - October 2023)



2023 TAS Knowledge Base

A. General Geology and Geological Investigations

A-1. Sources of Geologic Information
A-2. Surface and Subsurface Exploration Techniques and Interpretation
A-3. Geologic and Geophysical Tools, Application, and Interpretation
A-4. Field Notes, Documentation, and Record-keeping
A-5. Positioning
A-6. Scale and Scale Analysis
A-7. Surface and Subsurface Mapping and Map Applications
A-8. Remote Sensing, Image Analysis, and GIS
A-9. Geologic Sections
A-10. Project Planning, Management, Organization, and Economics (PG Only)

B. Mineralogy, Petrology, and Geochemistry

B-1. Mineralogy
B-2. Igneous Petrology
B-3. Sedimentary Petrology
B-4. Metamorphic Petrology
B-5. Geochemistry
B-6. Project Planning and Development (PG Only)

C. Sedimentology, Stratigraphy, and Paleontology

C-1. Stratigraphic Principles
C-2. Sedimentary Structures
C-3. Diagenesis
C-4. Facies Analysis
C-5. Depositional Environments
C-6. Fossil Record and Evolution
C-7. Basin Analysis
C-8. Project Planning and Development (PG Only)

D. Geomorphology and Surficial Processes

D-1. Basic Processes
D-2. Chemical Weathering and Soil Development
D-3. Physical Weathering, Mass Movements, and Slopes
D-4. Analysis of Surficial Materials
D-5. Fluvial Processes and Landforms
D-6. Wind Processes and Landforms
D-7. Glacial Processes and Landforms
D-8. Karst Processes and Landforms
D-9. Coastal Processes and Landforms
D-10. Visualization and Analysis
D-11. Project Planning and Development (PG Only)

E. Structure, Tectonics, and Seismology

E-1. Structural Interpretation
E-2. Deformation Styles
E-3. Structural Fabrics
E-4. Classifications
E-5. Mechanical Properties of Rock
E-6 Seismic/Paleoseismic History
E-7 Plate Tectonics/Tectonic Regimes/Earthquake Processes
E-8. Project Planning and Development (PG Only)

F. Hydrogeology

F-1. The Hydrologic Cycle
F-2. Aquifer Properties
F-3. Groundwater Flow
F-4. Aquifer Storage
F-5. Field Applications
F-6. Groundwater geochemistry
F-7. Contaminant Transport
F-8. Project Planning and Development (PG Only)

G. Engineering Geology

G-1. Geologic Properties, Formation of In-situ and Transported Soil Deposits, and Groundwater
G-2. Soil Mechanics
G-3. Rock Mechanics
G-4. Geologic Hazards
G-5. Site Investigation Methods, Tools, and Applications
G-6. In-Situ and Laboratory Testing
G-7. Project Planning and Development (PG Only)

H. Mineral and Energy Resources

H-1. Ore/Fossil Energy Systems and Principles
H-2. Ore Formation Processes
H-3. Fossil Energy
H-4. Prospecting/Exploration Techniques
H-5. Development Techniques
H-6. Environmental Health, Safety, and Security
H-7. Reclamation and Restoration
H-8. Project Planning and Development (PG Only)