

G L A S S B O R O S T A T E C O L L E G E

Proposal for a Geology Program

I. Introduction:

This proposal is sponsored by the Science Department and is initiated by the Department Chairman, Dr. Robert Renlund, and the geology teaching members of this department: Mr. Paul Dike, Mr. Joseph Waring, Mr. Donald Zalusky. The latter three members will act jointly as representatives of the Science Department in matters which pertain to this proposal.

II. Department Chairman's Statement:

A. Position of the program in the departmental curricular structure.

The Science Department plans a degree program in each of the following areas: biology, chemistry, geology and physics. This proposal is concerned only with the geology program.

B. Suggested time and scale of implementation of the plan.

In order to permit students entering Glassboro in the fall of 1971 to formally enter a degree program in geology, the description of the program should be included in the 1970 printing of the College catalog and the program should be approved prior to this printing.

Full scale implementation of the program could be initiated immediately. Many students will have completed the prerequisites for a number of the advanced courses which are not directly based on Geology I and II, and would be able to take advanced courses with the basic course.

C. Adequacy of staff and resources for implementation.

The Science Department has sufficient staffing for anticipated

enrollment in geology for the initial one or two years of the program. Additions to the staff would be made as the program and enrollment develop.

By 1972, if building developments as now projected are carried through, there will be sufficient teaching spaces if they are used judiciously. Equipment and supplies are now adequate for the initial presentation of courses beyond Geology I and II. As enrollment increases and the courses develop, additional equipment and supplies will be needed.

Use will be made of Marine Consortium facilities in Cape May in certain courses, while the libraries and museums in Philadelphia will be used by all the courses. Our library holdings will never be completely adequate. Older publications used for reference are not available or else are exorbitantly expensive. Gifts of old publications by retired scientists or by estates will slowly fill the gap. New materials are constantly being added to the library holdings.

Geologically, Glassboro is in a fortunate position. We are in one of the more interesting parts of the Atlantic Coastal Plains. Relatively short drives take us to the Piedmont Plateau, the Triassic Lowlands, the Highlands, and finally the Folded Appalachians. These are all classic areas of study which will be utilized in various courses.

III. Outline of the Proposed Geology Program

A. The Program

<u>First Semester</u>	<u>Freshman</u>	<u>Second Semester</u>
	(L.A. & S. - Secondary)	
Communications (comp.)	3 s.h.	Communications (comp.) 3 s.h.
Soc. Sci./Psych. (fund.)	3	Soc. Sci./Psych. (fund.) 3
Mathematics (fund.)	3	Art (comp.) 3
Free Elective	3	Free Elective 3
Inorganic Chemistry I (fund.)	4	Inorg. Chemistry II (deriv.) 4
OR		OR
Geology I (fund.)		Geology II (derived)
H.P. and E. (comp.)	1-1/2	H. P. and E. 1-1/2
	<u>17-1/2</u>	<u>17-1/2</u>

<u>Sophomore</u>	
(L. A. & S. - Secondary)	
Inorg. Chemistry I (fund.)	4
OR	
Geology I (fund.)	4
Calculus I (derived)	5
Geology (spec.)	3
Free Elective	<u>16</u>
Inorg. Chem. II (derived)	4
OR	
Geology II (derived)	4
Calculus II (derived)	4
Geology (spec.)	3
Free Elective	<u>18</u>

<u>Junior</u>	
(L. A. & S.)	
Restricted Elective	4
Geology (spec.)	3
Geology (spec.)	3
Restricted Elective	3
Humanities (fund.)	<u>3</u>
	<u>16</u>
Restricted Elective	4
Geology (spec.)	3
Geology (spec.)	4
Restricted Elective	3
Humanities (fund.)	<u>3</u>
	<u>17</u>

<u>Senior</u>	
(L. A. & S.)	
Geology (spec.)	4
Restricted Elective	3
Free Elective	3
Soc. Sci./Psych. (fund.)	3
Humanities (fund.)	<u>3</u>
	<u>16</u>
Geology (spec.)	4
Restricted Elective	3
Free Elective	3
Humanities (derived)	3
Free Elective	<u>3</u>
	<u>16</u>

First Semester

Second Semester

Junior
(Secondary)

Adol. & Learning (spec. prof.)	3 s.h.	Curric. & Method in Sec. Sch. (spec. prof.)	4 s.h.
Restricted Elective	4	Restricted Elective	4
Humanities (fund.)	3	Humanities (fund.)	3
Geology (spec.)	3	Geology (spec.)	3
Soc. Sci./Psych. (fund.)	3	Restricted Elective	3
	<u>16</u>		<u>17</u>

Senior
(Secondary)

Student Teaching (spec. prof.)	7	Issues in Foundation of Ed. (spec. Prof.)	3
Practicum (spec. prof.)	5	Humanities (fund.)	3
Reading in Sec. Sch. (spec. prof.)	<u>2</u>	Humanities (derived)	3
	14	Geology (spec)	3
		Restricted Elective	3
			<u>15</u>

The program as outlined for the Liberal Arts and Science degree must not be interpreted rigidly. As a student's program develops it might be advisable to shift some of the courses around. A student planning to go to graduate school should have a reading knowledge of at least one, preferably two, of the following foreign languages: French, German, Russian. Most schools offering graduate work in geology require at least one of the above languages, many require two for the Master of Arts in Geology. The restricted electives would be selected, with advisement, from biology, chemistry, physics, mathematics and basic drafting.

In the Secondary Earth Science Teaching program the restricted elective courses are selected with advisement from all the sciences.

The choice of courses in both programs would be guided by the future plans of the student. The requirements for immediate entry into industry are a little different to those for entry into graduate school or teaching.

If an undeclared or transfer student should decide on a geology major at the end of his Sophomore year, it would be

presumed that the student would have completed most of the general studies courses including Inorganic Chemistry I and II and possibly another basic science course. It would then be possible for that student to complete a geology major, even though he might still have to take Geology I and II in his Junior year. Such a student might find it necessary to complete some of the General Education courses in summer school.

The Secondary Science Teaching in Earth Sciences student should consider the requirements for teaching certification: The New Jersey Department of Education lists the following subject matter requirements for the several science teaching certificates:

1. Physical Science: 24 s.h. of science, including physics and chemistry.
2. Science: 30 s.h. of science including biology, chemistry, and physics
3. General Science: 24 s.h. of science.
4. Earth Science: 24 s.h. of science including geology, geography, astronomy, and physiography.

With proper use of the restricted and free electives all four certification areas can be readily satisfied with the program as outlined.

The minimum number of semester hours of geology required for entrance to graduate studies in geology varies widely. Admission to graduate studies in geology is based not only on the undergraduate geology courses completed, but on the breadth and depth of correlative work in all other areas of study, and, finally, the recommendations of his professors.

E. Credit Distribution

Liberal Arts and Science - Secondary

	Stipulated	Provided
1. General Education	60 s.h.	63 s. h.
A. Fundamental	30	32
(1) Social Science-Psychology	9	9
(2) Humanities	12	12
(3) Mathematics	3	3
(4) Science	6	8
E. Derived	18	19
(1) Science		8
(2) Mathematics		8
(3) Social Sciences-Psych.		0
(4) Humanities		3
(5) "Other choices"		0
C. Competence-Creativity	12	12
(1) Communications	6	6
(2) Creative Arts	3	3
(3) Art and P. E.	3	3

Liberal Arts and Science

2. Prescribed Specialization	30 max.	28
3. Supplementary Specialization (Restricted) Electives	12 min.	20
4. Free electives	18	21

Secondary

2. Specialization		
A. Science	15	18
B. Profession	24	24
C. Restricted Electives	15	14
3. Free Electives	12	12

C. Geology Offerings.

1. Introduction.

As stated earlier, in the projected development and growth of Glassboro State College a number of new major programs have been

proposed. Among these, Geology has been proposed as a major area of study in the Liberal Arts and Sciences as well as Secondary School Science teaching starting in 1971. It is vitally necessary that certain courses be initiated if such a major program is to exist, be of any value, and be acceptable to accrediting agencies and the professions.

2. a. Present undergraduate offerings in Geology:

55-100 Geology I - Physical Geology

55-101 Geology II- Introductory Historical Geology

55-110 Principles of Earth Science

55-220 Selected Topics in Geology

55-421 Historical Geology

55-423 Geology of New Jersey

b. Commentary on present offerings listed in the catalogue:

Geology I and II are basic introductory courses required of all geology majors in all colleges and universities. These are of great value and interest to the non-major, non-science student, also.

Principles of Earth Science is for Elementary Education Majors only. It is not open to geology majors.

Selected Topics in Geology was inserted in the catalogue at the same time that similarly entitled courses were inserted for the other sciences. This could be used, in spite of its low number as a Senior seminar or journal club, with lower classmen sitting in on the discussions.

Historical Geology is a good major subject, but not vital.

Geology of New Jersey is of vital interest to Secondary School Earth Science teachers in New Jersey. It is an unimportant major subject.

3. Background

The examination of a number of catalogues of schools offering a geology major of any consequence will reveal that the following courses are offered in addition to the introductory year course and Historical Geology:

1. Mineralogy
2. Crystallography
3. Optical Mineralogy
4. Petrography
5. Petrology
6. Invertebrate Paleontology
7. Structural Geology
8. Stratigraphy
9. Geomorphology
10. Marine Geology
11. Economic Geology
12. Introduction to Geophysics
13. Field Geology
14. Advanced Physical Geology
15. Rocks and Minerals

In Geology I and II a brief introduction to phases of all the above subjects and others, is presented in order to build a broad

foundation and to show the interrelationship of all the fields of Geology to each other, to other sciences and to Man.

4. Descriptions of New Courses:

No attempt will be made to present a detailed account of the presentation of each course. Nor will an apology for requesting each course be offered. Each course proposed is a valid, necessary, vital field of study in Geology. The instructors entrusted with the presentation of these courses will individually determine the precise manner of presentation. Each instructor will be bound by personal pride, reputation, and training to produce the best possible course. Each instructor will be aware of the critical inspection by accrediting agencies, the future development of his students and their assessment of his work as they progress, and the immediate evaluation of his fellow instructors.

1. Mineralogy: 5 s.h. laboratory and lecture

The rocks of the earth and the meteorites which plunge to Earth from outer space are made of minerals or matter which can become minerals. Hence, a knowledge of the more common rock-forming minerals as well as the minerals of economic importance is a basic need of any geologist. Mineralogy is a hobby of many laymen who find a course in mineralogy highly rewarding. In a course in mineralogy the student not only learns to recognize the common minerals, but becomes adept in the use of many techniques used in the identification of minerals. Prerequisite: Inorganic Chemistry.

2. Crystallography: 3 s.h. Laboratory and lecture (alternate years)

The vast majority of minerals are crystalline - possessed of an orderly internal atomic structure. This orderly internal atomic

structure is frequently reflected in characteristic external geometric forms called crystals. The study of these crystals - Crystallography - gives many clues concerning the minerals. Crystallography is the mathematical study of the morphology of crystals. The student who is fortunate enough to have this course before Mineralogy or Optical Mineralogy finds many of the problems encountered in these courses much simplified. At the present time crystallography is used in the study of various human physiological characteristics. The control of the quality and purity of drugs, sugar and other items of importance to man is controlled by the study of the crystallography of these materials. Prerequisites: Trigonometry, algebra, geometry (good high school courses are acceptable.)

3. Optical Mineralogy: 4 s.h. laboratory and lecture.

The orderly internal atomic structure of minerals brings about certain peculiar effects on transmitted polarized light. The study of these effects is Optical Mineralogy. Polarizing microscopes are used for this study. The study of Optical Mineralogy has the same "practical" applications to man and his endeavors as does crystallography. Prerequisites: Mineralogy, physics and a color sense capable of refined and exacting development.

4. Petrography: 3 s.h. laboratory

Rocks are what comprise the crust of our Earth and all the other planets, planetoids, meteors and satellites of our solar system. The basic study of rocks must be divided into two broad categories: (a) The description, classification and naming of rocks- Petrography. (b) The study of the theory of the origins of the rocks- Petrology. Petrography is highly technical, requiring careful study of physical features of hand specimens and ideally, of the field conditions. Prerequisites: Geology I and II, Mineralogy and Optical Mineralogy.

5. Petrology: 3 s.h. lecture

The study of how rocks have been formed is in part a theoretical study. Many laboratory physical-chemical studies of mineral systems have been conducted. From these empirical, controlled studies, backed by the study of field conditions, theories concerning the origins of rocks can be propounded. From these purely theoretical, frequently academic studies, many conclusions regarding the well being and economic development of man are derived.

Prerequisites: Geology I and II, Mineralogy. This is a case of which came first: the chicken or the egg! Having presented Petrography and Petrology on a rotating basis, I have had the interesting experience of students complaining that the Petrography made no sense without the Petrology first, and other students have complained that Petrology made no sense without the Petrography. The two should be a combined, in depth, year course.

6. Invertebrate Paleontology: 4 s.h. laboratory and lecture

Invertebrate Paleontology is the study of the animals without backbones which have lived in the past. The study of these organisms is vital to the understanding of the development of present day life. The remains, traces, and evidences of animals which have lived in the past (fossils) provide vital information concerning the distribution of past lands, seas, and climates, as well as the present day location of certain valuable economic deposits. The unravelling of the complexities of the history of the earth is largely based on fossils. Prerequisites: Geology I and II, Biology I and II or Zoology I and II or the equivalent. For a Biology major the first prerequisite could be waived, considering the importance of Paleontology to a fuller understanding of life today.

7. Structural Geology: 3 s.h. lecture

Few educated people are so totally unaware that in their travels they have failed to see massive bodies of rock seemingly jutting upward into the sky. Newspapers periodically display shocking headlines announcing devastation due to various phenomena of the Earth. These are only some of the topics of Structural Geology. Structural Geology is the study of the architecture of the continents and the forces which caused them to be the way they are. The smallest crack, the faintest lineation in a rock is of concern in the study of Structural Geology, along with the more spectacular things to be seen in such places as the Delaware Water Gap. For the geologist this is the study of the skeleton and articulation of the Earth. Prerequisites: Geology I and II.

8. Stratigraphy: 3 s.h. laboratory, lecture

In the study of the history of the Earth, the study of the sequence of events is, of course, paramount. Where the sequence of events can most clearly be seen is in the sedimentary strata. Careful study of the strata and their sequence is necessary to reach a correct interpretation of events. Rather startling inversions and contortions of the Earth's strata have taken place. These inversions and contortions can be unravelled only with a basic knowledge of stratigraphy. Prerequisite: Geology I and II.

9. Geomorphology: 3 s.h. laboratory and lecture

Geomorphology is the study of present day land forms, or landscapes, and their development in relation to the materials underlying the areas and the climatic conditions of the regions. This leads to a better understanding of what has happened in the past

and at the same time permits more exact projection into the future development of an area. With the urban sprawl becoming greater every year, it is necessary to know what the present characteristics of a given area are and how these will be affected by the works of man. Many communities are suffering physically today because of the disregard of the geomorphology of the region and what the community is going to do to the natural conditions. Prerequisite: Geology I and II.

10 Marine Geology: 3 s.h. laboratory and lecture

Oceanography is a field of study being approached from a wide variety of points of view. Marine Geology is the study of the physical features of the ocean bottoms and the line of contact between land and sea. It is also the study of the interaction between the seas and the lands. This is an area of great importance to any society living near and dependent upon a large body of water for an important part of its economy. Prerequisites: Geology I and II

11 Economic Geology: 3 s.h. laboratory and lecture

Economic Geology is the study of mineral deposits, their formation, their form, their location, and modes of exploitation. Our present civilization is using the mineral wealth of the Earth at an ever increasing unprecedented rate. New deposits must be searched for intelligently. No longer can we depend on the largely accidental finds of the half educated "sour-dough." Prerequisite: Geology I and II, Mineralogy.

12. Introduction to Geophysics: 3 s. h. laboratory and lecture.

An important arsenal of tools for the economic geologist, as well as the purely theoretical geologist, is supplied by geophysics. Geophysics permits us to explore, relatively cheaply, the invisible regions beneath the surface of the earth. The final analysis, of course, lies in drilling. Drilling is hideously expensive. Geophysical studies are being employed in trying to answer many questions concerning the interior of the earth. Geophysical studies are also proving to be valuable aids in defending man from some of the Earth's more violent actions. Prerequisite: Geology I and II, Physics I and II.

13. Field Geology: 3 s.h. laboratory

Field Geology is a purely technical study of the tools of the geologist and their use and application in the field. The geologist must be able to make field studies, record and report his findings for the use of other geologists. Prerequisite: Geology I and II, and any other courses available before this.

14. Advanced Physical Geology: 3 s. h. lecture and seminar.

Advanced Physical Geology would repeat many of the areas discussed in Geology I, but with greater depth, applying the knowledge gained in other advanced courses constructively. This would have to be a senior course using all immediately preceding courses as prerequisites.

15. Rocks and Minerals: 3 s. h. lecture and laboratory

This would be a non-major course designed primarily for the in-service elementary school teacher. Other non-majors would find this a very interesting and rewarding course giving them a broader

D. Rationale:

Classboro currently has no program for the training and accreditation of Earth Science teachers. We cannot recommend any of our graduates for certification in this area. However, a number of our graduates are presenting Earth Science programs in secondary schools, on the basis of one semester of General Geology (3 s.h.), Physical Geography (3 s.h.), one other geography course (at the most) devoted to the cultural aspects, Astronomy (3 s.h.) and a shallow spectrum of the other sciences. This is not an adequate background for the teaching of earth science in the secondary schools. It might be adequate for the lower elementary grades.

This represents a real gap in the training of teachers. Most public school systems are now offering a course in earth science as a preliminary, or even terminal science course. The teachers presenting these courses should have the opportunity to be adequately trained.

Aside from teaching, geology offers broad background of training for entering various areas of government work, law, business and construction.

E. Proposal:

It is not suggested or proposed that all these courses be presented immediately. We do not have the staff, students, space or equipment to make it possible.

The proposal is that this program and these courses be approved as a group so that they will be available for presentation as the number of students and the staff increase.

So far as equipment is concerned, we are now prepared to teach all the courses excepting the following:

Optical Mineralogy

Introduction to Geophysics

We are acquiring, gradually, the special microscopes needed for Optical Mineralogy. By student cooperation, Optical Mineralogy could be presented now. A course in Geophysics could be presented, demonstrating the principles with crude, home made instruments. Modern instruments are sophisticated and expensive.

The more advanced, specialized courses, as from Number 9 (Geomorphology, page 12) on, would be presented in alternate years. This would permit the student who selected Geology as a major early in his career the widest possible spectrum, while the late comer would still receive a broad selection of highly useful subjects permitting him to continue on into graduate school anywhere or into useful, rewarding positions in government and industry. Geology provides an excellent background for the junior and high school science teacher.

F. Appropriations:

Appropriations for equipment and supplies would not change appreciably from the present amounts in the regular college budget. Most of the materials used in geology are repeatedly usable over a period of years. The prime costs would be for expansion of the collections and specialized equipment which are included in the regular budget.

Salaries would be those of the present teaching staff with the regular increments and with the salaries of new personnel who would be needed with the normal growth of the student body.

G. Projected Enrollment:

With the continued development of earth science courses in the secondary schools, enrollment in the Secondary Education Geology program should develop rapidly. Large sections are undesirable in geology courses, inasmuch as a good deal of individual attention is required.

The prognostication would be for a total enrollment of 30 to 40 students in the advanced courses. Geology I and II may run as high as three or four hundred as other programs in the college develop.

H. Consultation:

The following have been consulted in the preparation of this proposal:

Mr. Paul A. Dike

Mr. C. Joseph Waring

Mr. Donald W. Zalusky

Respectfully submitted,

Robert N. Penlund, Chairman.