Industrial Scholarships

A Partnership of Industry and Education

Circular 13

The School of Mineral Industries of the Pennsylvania State College

State College, Pennsylvania
INDUSTRIAL SCHOLARSHIPS
A Partnership of Industry and Education

Mineral Industries Experiment Station
Circular 13

The Pennsylvania State College
SCHOOL OF MINERAL INDUSTRIES
State College, Pennsylvania
1942
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THE NEED FOR TRAINED MEN

The Demands of War and the Postwar World

SPURRED BY THE DEMANDS OF WAR, the mineral industries are demanding more and more trained men. This has aggravated a condition which has been in existence for years. A serious deficiency exists in the number of men educated in the science of finding, producing, and processing the mineral wealth of the nation. The problems of a wartime economy with its demands for immediate production must be met now to insure victory. In a postwar world, problems of even greater magnitude and difficulty will surely exist in our mineral industries. They can be solved only through the application of better technologic practices by which costs may be reduced and through research by which new products and new markets can be developed.

The School of Mineral Industries has labored hard to fill the need for technically trained men. Graduates of the School are immediately absorbed into industry. Unfortunately the number of students entering mineral industries curricula is not great enough to keep pace with the demands for their services. The solution to this problem seems to lie in a closer bond between industry and education. Such a partnership will be mutually beneficial. Educational institutions will profit by the advice of industry. Industry will profit by insuring itself a supply of trained men, taken from its own ranks or communities. Advanced training can be supplied to its employees investigating specific problems of the industry itself. Investment for the future of a very small portion of wartime profits may well pay large dividends in the creation of technical skills, the development of good will, and lowered costs of operation. In spite of the great value of the School’s co-operative research program and of its in-service, upgrading extension services, the effective training of undergraduates is the primary function of The Pennsylvania State College.

In March 1942 a committee was appointed to investigate the industrial relations of the School and to make constructive recommendations upon which action could be taken. The following report is a summarization of a study dealing with plans of proved value by which industry and education can co-operate to their mutual advantage.

INDUSTRIAL RELATIONS COMMITTEE

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The Growth of the Mineral Industries

1881 $ 403,120,000
1891 600,849,000
1901 1,155,078,000
1911 1,924,081,000
1921 4,138,500,000
1931 3,166,600,000
1941 6,600,000,000
1951 ?? ?? ?? ??
1961 ?? ?? ?? ??
1971 ?? ?? ?? ??
2000 ?? ?? ?? ??

These figures represent essentially raw material production. The value of processed and manufactured articles is vastly greater. The true value as measured in terms of service to society cannot be measured.

What will it be in the working life of present graduates?

While the value of mineral production has increased other changes have taken place in the production of trained men. A diversification of skills has become necessary. The mining school and the mining engineering curriculum have been expanded and altered to schools of mineral engineering with curricula in many other types of technology.

Continued growth in mineral production and utilization will require new skills. It is inevitable that in the postwar years new industries will appear whose requirements of material and men cannot be estimated at present. One fact is apparent: the technical man will play a greater role than ever in creating new wealth and in reducing costs so that present industry can continue to exist. At the present one man is enrolled in mineral industries courses in Pennsylvania for each $4,000,000 annual value of mineral materials and primary mineral products.

A WAY IS OPENED

Development of Industrial Co-operative Scholarships

On account of a critical shortage of trained technical personnel and students in technical training for the mineral industries—ceramics, fuel technology, geology, mineralogy, mineral economics, geography, geophysics, metallurgy, meteorology, mineral preparation, mining, and petroleum and natural gas—several scholarship plans, described herein, have been developed to alleviate this condition.

This shortage is particularly noticeable in training mining engineers for the coal industry and for the nonmetallic mineral industries. Because of the lack of graduates, only a fraction of the requests for men for these industries have been filled during the past five years. Practically no mining engineers have been available for the nonmetallic industries.

The trend of young men away from the coal mining regions is particularly marked. One example which may be cited is that of a large industrial concern in the East operating coal, nonmetallic, and metallic ore mines, mills, and manufacturing plants, and recruiting from 100 to 200 technical graduates each year into the various divisions of the company. For several years this company has had difficulty in obtaining mining engineering graduates, particularly for its coal mines. A survey of the 1942 applications for the training program of this company included graduates from practically every scientific and technical curriculum and revealed that a large percentage of these applicants were from mining communities. These applicants were applying for eventual employment in divisions other than mining. It seems significant that in this single year 131 senior students whose homes were in the coal mining areas applied to this company for employment, but not one had specialized in mining engineering, which offered the greatest number of opportunities. The result of this survey follows:

Students from Coal Mining Regions Not Pursuing Mining Engineering—1942 Applicants

<table>
<thead>
<tr>
<th>College</th>
<th>Eastern Pennsylvania</th>
<th>Western Pennsylvania</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lehigh</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Lafayette</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Bucknell</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Syracuse</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Penn State</td>
<td>15</td>
<td>31</td>
</tr>
<tr>
<td>Carnegie Tech</td>
<td>3</td>
<td>39</td>
</tr>
<tr>
<td>Pittsburgh</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>Maryland</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Others</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>39</strong></td>
<td><strong>101</strong></td>
</tr>
</tbody>
</table>
It would seem that some of these young men should have the mental and physical qualities to enter into coal mining as a career. The yearly movement of young men away from coal mining in Pennsylvania must be extremely large as evidenced by the figures for this one year for this one company. That the coal mining industry must suffer from this outflow of youth away from mining, year after year, is apparent, for there is no counter flow of young technical men from other communities to the mines. Undoubtedly many capable high school graduates entering the mines are prevented from going on to college on account of lack of funds.

The Demands of the Growing Mineral Industries

The growth of the mineral industries has been one of the most outstanding features of the past century. Much of scientific advancement which has altered all manners of living while contributing to an increase in the actual standards of living has been based on a constantly increasing supply of mineral products. An increase in the production of technically educated men has accompanied this growth. However, the production of trained men has not been proportional to the increase in the production of minerals. A condition, now painfully apparent, is that there is a deficiency of trained men which may well increase in the immediate future.

Increased and rapidly changing technology, and competition from other industries, have created a need for men of specialized training for the mineral industries. It appears that the time has come for the mineral industries to subsidize qualified men in graduate study. This may be done by graduate fellowships supported by industry.

The cost of these plans is insignificant compared with the practical benefits obtained. It is a form of insurance providing for the co-operating companies a supply of young men carefully trained to solve the problems of the industry. Graduates who have followed one of these plans are capable of assuming managerial responsibilities at an early date, in many instances on graduation. The plans suggested herein may be modified to conform to special requirements or conditions of a particular mineral industry.

Details of the Scholarship Plans

Plan 1. Stipend Undergraduate Scholarships with Vacation Employment

1. General plan: Sufficient money to defray from ¼ to ⅓ of the recipient’s expenses is given. Summer and other vacation employment is provided by the co-operating company to enable the scholarship student to finance the remainder. Preferably these scholarships should be limited to nonofficial employees and sons
of nonofficial employees. In some cases it may be desirable to have the scholarships open to all high school graduates in the communities in which the company works are located.

2. **Semester stipend**: Minimum $150.

3. **Selection**: A scholarship committee is appointed by the president of the company to review the records of all candidates and select the winners. The suggested membership of this committee is: (1) the personnel manager of the company, (2) a representative of the employees, and (3) a high school principal.

4. **Requirements**: Students who rank high in their high school classes will normally find little difficulty in meeting the requirements for admission to the School of Mines Industries of The Pennsylvania State College. They must pass the physical examination and otherwise meet the requirements for employment by the sponsoring company. Recipients must make reasonably satisfactory grades to retain their scholarships.

5. **Maximum life of scholarships**: 4 years of two semesters each. The wartime accelerated program of the College provides for three semesters a year. If a student does not drop out of school every third semester to work, it is possible for him to finish in 2-⅔ years under the accelerated program.

This plan has been in very successful operation during the past four years. Although the sum of $150 per semester appears small, experience has shown that this attracts a serious type of student who is willing to earn the additional financing necessary to cover all expenses.

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**Plan 2. Nonstipend Undergraduate Scholarships with Vacation Employment**

1. **General plan**: This plan involves only a regularly scheduled arrangement for employment of worthy students by the sponsoring company. Every other or every third semester may be spent in the employment of the company. Since working every other semester usually involves some re-arrangement of curricula, it is necessary that three to five students be started on this plan at a time. This plan differs from former practice in that it will be organized on paper and under control, with a better organized procedure for charting progress of the recipient in school and in work for the co-operating company.

2. **Semester stipend**: None.

3. **Selection**: By the personnel manager or vice-president in charge of production of the co-operating company.

4. **Requirements**: Same as Plan 1.

5. **Maximum life of scholarship**: Until graduation. This will vary from four to five and one-half years depending on whether the student works for the co-operating company every second or every third semester.

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**Plan 3. Graduate Fellowships**

This plan provides an opportunity for advanced training of specialized personnel. It is assumed that applicants will have at least a Bachelor's degree and be eligible for advanced study on a graduate basis. The plan permits industry to enroll employees in the Graduate School for specialized training, directly related to the industry concerned. Research may be carried on in technical problems of special interest to the sponsor. The plan has proved to be successful in furthering industrial research at a minimum of cost.

1. **General plan**: Fellows are selected by the industries or by the faculty of the School of Mines Industries. Money for these fellowships is payable to The Pennsylvania State College at the beginning of the College year. All disbursements of the fund must be approved by the head of the department in charge of the fellowship.

2. **Recommended stipend**: First year—$500 to $1000.
   Second year—$750 to $1500.
   Third year—$1200 to $2000.
   Post-doctorate—minimum $2400 yearly.

3. **Requirements**: Candidates must satisfy the requirements for admission to the Graduate School of The Pennsylvania State College.
HOW THE PLANS HAVE WORKED

Companies Which Have Tried Them

Experience with various plans has produced a definite crystallization of ideas in regard to industrial co-operation in the selecting and training of technical men for the mineral industries. These plans are not new. They have been in use to a limited extent for some time. Part-time employment during vacations, summers, and alternate semesters has been carried on for years excepting during the bottom of the depression. Undergraduate stipend scholarships were established in Mining Engineering by the Pittsburgh Coal Company in 1939, and by the Lehigh Navigation Coal Company in 1940.

The Orton graduate fellowship in Ceramics has been operating since 1935. Fellowships were established in Fuel Technology by the J. H. Weaver Coal Company in 1935, and the Rochester and Pittsburgh Coal Company in 1936. Certain graduate fellowships in Metallurgy have been in force since 1937.

Successful companies in other industries have found the fellowship plan especially beneficial. The duPont Company has for some years been maintaining duPont fellowships in Chemistry at twenty or more graduate schools, without restrictions as to problems investigated or as to freedom of publication of results, but satisfied to ensure the production of a number of well trained men. The General Electric Company, through its Coffin fellowships, does similarly, although the applicants are restricted to sons of company employees.

Both the scholarship and fellowship plans have been so successful that it seemed desirable to make these plans available to mineral industry concerns in general, and the best features of the various plans now in use have been incorporated in the plans suggested in this booklet.

The two undergraduate plans provide for work with the cooperating company prior to graduation. This permits the student to see the practical application of the material he is learning in books and permits him to gain experience in getting along with people. A student under such a plan is much further along than the one who does not have the opportunity to gain work experience.

Experience with the undergraduate mining scholarship students, carefully selected from a number of candidates, shows that scholastically nearly all are in the upper three-fifths of their College class and that all are leaders in extracurricular activities. Approximately 30 per cent of the present class of senior mining
engineers, graduating December 1942, have been elected to Tau Beta Pi, honorary engineering fraternity. This is probably the highest percentage from any engineering department in the College. All of those elected are scholarship students in Plan 1 or Plan 2, attesting to the workability of preselection of students by these methods to obtain a superior type of individual for technical training. The class graduating in May 1942 contained a student under Plan 1 and one under Plan 2. These students ranked high scholastically and in addition had sufficient work time in so that they could take the State examinations for fire boss. One sophomore also took these examinations. The examining board reported that these students distinguished themselves in the examination. One sophomore student has his mine foreman's papers.

Objectives and Benefits of the Scholarships

Views expressed by several executives in regard to the possible objectives and benefits to be derived from a work-learn scholarship program may be briefly summarized.

Primary objective: To interest boys of keen minds in particular fields of the mineral industries as a profession and in particular to interest them in technical and operating phases of these industries.

Benefits: By limiting the scholarships to employees, sons of employees, or young men living in the communities adjacent to the works of the sponsoring company it is believed work-learn scholarships have accomplished certain benefits in mining. It is reasonable to assume that all of the benefits in modified form would hold for other branches of the mineral industries. Examples of benefits in mining are:

1. Scholarship students having the same environmental background as the men in the mines become adjusted easily and readily to the work and living conditions of these communities.

2. Most scholarship students live at home while working for the company during vacation periods and hence are able to save most of their earnings for their college expenses.

3. It is probable that an influx of these technically trained boys from a work-learn background into an organization tends to promote favorable employer-employee relationships.

4. Older officials probably benefit by the injection of young technical trained men into the organization.

5. Scholarship plans keep some of the best brains, the best of the youth, in the mining industry. At present, particularly in the coal and nonmetallic mineral industries, these boys are largely seeking a life work in other professions and vocations.

6. A program of work-learn scholarships providing for vacation work should produce a graduate with a much broader education than the usual college graduate since during vacations he is applying his theoretical knowledge while accumulating it.

7. Most companies give employment to a number of boys during vacation periods. In many of the mineral industries most of these boys are studying for some other profession or industry. Usually it is costly to give these boys work. That money might just as well be spent on boys interested in going into the industry. In other words, instead of helping to finance the training of boys for other industries, the company would be spending its money in training men for its own future benefit.

8. A few scholarships tend to get other boys interested. If shown by definite action of this kind that the mineral industries wants them and needs them the word gets around and other boys become interested in making some phase of our mineral industries a life career.

9. Provides the sponsoring company with a reservoir of trained men for supervisory and executive positions.

10. Presents a golden door of opportunity to boys unable to finance a college education and hence develops a sense of loyalty by recipients to the sponsoring company.

11. A special benefit for supervisory positions in the coal mining industry evolves from the State certification law. State certification for supervisory positions with its five-year experience requirement for eligibility to take examinations for competency deters many technical graduates from entering operating phases of the industry and tends to influence students away from coal mining engineering. However there are two exceptions to this five-year requirement. They are:

a. Men with four years of training in mining engineering but with no previous practical underground experience are eligible to take examinations after three years of experience. In other words, four years of training in mining engineering are counted as two years of practical experience.

b. Men with four years of training in mining engineering and three summer vacation periods of work in and about the mines are eligible to take examinations one year after graduation, provided the year of post-graduation work has been spent in practical experience in and about the mines. This means that four years of college work in mining engineering and three summer vacation periods of mining work are equal to four years of practical experience.

12. The problems of a postwar world are sure to be numerous and complex. The only insurance for existence in the future is the application of technologic principles by which costs may be lowered and quality improved. No better-paying investment of a very small portion of wartime profits can be made than to establish a reservoir of technical skill for future use.
OPPORTUNITIES FOR THE STUDENT

Fields That Are Open

EARTH SCIENCES: Geology, Mineralogy, Geography, Geophysics, Meteorology—these curricula are designed to give thorough preparation in the basic sciences and cultural subjects, and at the same time to provide fundamental training in the selected field of specialization. Graduates in geology obtain positions in survey work for oil and mining companies, prospecting, teaching, research, and, after considerable practical experience, as consulting geologists for corporations. The unusual wealth of Pennsylvania in mineral industries makes possible close contact with actual operating conditions. Many graduates who have specialized in geography have followed the teaching profession. However, a rapidly increasing number are entering public service and there are now geographers connected with most branches of the federal government and with regional, state, and municipal planning boards. Graduates specializing in meteorology may be employed by the various air lines, the U.S. Weather Bureau, Army and Navy Air Corps, and Signal Corps as observers or forecasters. There is also opportunity for research in long-range weather forecasting, instrument development, and related fields. Graduates in geophysics are trained for employment by oil and mineral prospecting companies, geological research, and for exploration work with State and Federal Surveys.

MINING ENGINEERING: Mining Engineering and Mineral Preparation—trains for professional activities in the art of extracting minerals from the earth and in preparing the mined product for the market or use. It provides a broad, fundamental training in science and engineering and permits specialization in many fields of endeavor open to the mining engineer—general mining engineering, mechanical mining, maintenance, safety, mining geology, mineral preparation, geophysical prospecting, valuation, and sales.

Graduates may enter operating or engineering work in the coal, metallic ore, and nonmetallic mineral extractive and mineral preparation industries, or with manufacturing or other service agencies to these industries. A survey of graduates in this curriculum shows: 37 per cent in operating positions having such titles as foreman, superintendent, manager, vice-president, and president; 34 per cent in engineering with titles of junior, safety, mining, valuation, preparation, chief, and consulting engineer; 9 per cent with manufacturing and service companies to the mining industry as technical sales engineers and executives; and the remainder in such varied activities as federal, state, and in-
surance company inspectors, mining geologists, tunnel and subway engineers, research, and teaching.

PETROLEUM AND NATURAL GAS ENGINEERING: The aim of the curriculum is to give a student interested in the oil and gas industries a broad as well as a fundamental course in order to equip him for his work as an engineer in the discovery, development, production, evaluation, transportation, refining, and marketing of petroleum and natural gas. Modern methods of oil production and recovery are especially emphasized, such as waterflooding, air and gas drive and repressuring. The proximity of the College to important regions in western and northwestern Pennsylvania where these methods are used extensively and intensively and the close relations maintained by members of the staff with these industries through personal contact and research activities give the Petroleum and Natural Gas staff members a decided advantage in the teaching of these modern methods of oil recovery.

The training offered enables the graduates of this curriculum to fill a wide variety of positions often leading to executive and research positions, a few of which may be mentioned as follows: oil geophysicist, oil geologist, drilling contractor, production engineer, oil-reservoir engineer, valuation engineer, refinery control and operation, advisor in oil and gas investments, marketer of oil products, equipment salesman, and research in all fields of oil and gas activity.

FUEL TECHNOLOGY: Our modern civilization is dependent upon power, which in turn is dependent upon fuels. The fuel technologist is concerned with the application of science and engineering to the preparation, processing, and utilization of fuels. Fuels serve not only as a source of energy but also as raw materials from which are made thousands of substances useful in everyday life. These range from medicinals, perfumes, and insecticides to plastics, fertilizers, explosives, and road building materials, to mention only a few. The fuel technologist is needed both by the fuel-producing and the fuel-using industries. The department endeavors to help its students prepare themselves for entrance into the industry of greatest interest, whether as plant operations men, sales engineers, or research and development men. The latter field, that of research and development, offers a particularly good opportunity for men who are interested in pioneering.

METALLURGY: Process and Physical Metallurgy—prepares for engineering, operating, administrative, or research positions in the metallurgical industries. Metallurgists are concerned with the extraction of metals from their ores and the various processes by which they are refined and fabricated and otherwise adapted to use.

Extractive or process metallurgy involves extensive applica-
tion of chemistry to the decomposition of naturally occurring ores and to separation and purification of the contained metals. It requires the study of fuels, fluxes, and slags and other exercessory materials.

Adaptive or physical metallurgy involves application of physics to the forming, working, and heat treatment of metals in preparing them for industrial use and to the exact control of all fabricating and treating procedures.

Engineers and architects designing machines and structures of all kinds are dependent upon the metallurgist for the quality and integrity of their most important materials of construction.

Graduates in metallurgy not only find ready employment in the vast iron and steel plants of Pennsylvania and adjoining states, as well as in the extensive aluminum, zinc, brass, and other non-ferrous industries that are so important to the State, but are also needed in the automobile, airplane, ordnance, and many other industries which use metals.

CERAMICS: The ceramic industries in the United States manufacture more than a billion dollars worth of products annually, and the value added by manufacture exceeds that of any other class of mineral product. This situation has created a large and rapidly growing demand for ceramic technologists, ceramic engineers, and men technically trained for ceramic sales work. Ceramic products include glass of every shape and kind, grinding wheels and abrasives, refractory firebrick for industrial furnaces, heat insulation, common building brick, floor and wall tile, sewer pipe, electrical porcelain insulators for power lines, stoneware and chemical porcelain for handling corrosive liquids, sanitary porcelain bathroom and hospital equipment, enamelled sheet steel and cast iron, dinnerware, pottery, and so forth. Pennsylvania leads all other states in the magnitude of its glass and its refractories industry, and is large in the other branches.

The College is the only institution in the Commonwealth giving a full eight-semester curriculum in ceramics. The student who has enjoyed chemistry and physics in high school will find in ceramics a very interesting and profitable career.

The Student's Place in the Military Picture
(At the Time of Going To Press)

The armed forces of the United States need graduates of the various mineral industries curricula. At present the armed forces assure themselves of a supply by various reserve enlistment plans leading to service after graduation in the Army, Navy, Marine Corps, and Coast Guard. Students, in the enlisted reserves, are expected to finish their technical training before being called to active duty. Enlisted reserves need not follow the accelerated academic program the year around, but may drop out of school every third semester to earn money to pay college expenses.

There is no comparable plan for industry. However, the intent of the Selective Service Act is to make the best use of the manpower of the nation and definite recommendations have been made to local boards to defer men in training for certain critical occupations. The war is as much a battle of production as it is of military conflict.

Most directions and recommendations to local boards in regard to critical occupations, such as Occupational Bulletin No. 10, effective June 18, 1942, specifically mention Mining and Metallurgical Engineers, including Mineral Technologists (broad, general coverage), Geophysicists, and Meteorologists, as critical with a marked shortage of trained technical men, and students in training for these professions.

Two significant extracts from Bulletin No. 10 follow:

"3. A registrant who is in training and preparation for one of these scientific and specialized fields may be considered for occupational deferment at the close, or approximately at the close, of his second or sophomore year in a recognized college or university if he is pursuing a course of study upon the successful completion of which he will have acquired the necessary training, qualification, or skill, and if he gives promise of continuing and will be acceptable for continuing such course of study and will undertake actual further classroom work within a period of not to exceed four months from the close of his second year."

"6. When a registrant has completed his training and preparation in a recognized college or university and has acquired a high degree of training, qualification, or skill in one of these scientific and specialized fields, such registrant should then be given the opportunity to become engaged in the practice of his profession in an activity necessary to war production or essential to the support of the war effort. In many instances following graduation from a recognized college or university, a certain period of time will be required in the placing of trained, qualified, or skilled personnel in an essential activity. When a registrant has been deferred as a necessary man in order to complete his training and preparation, it is only logical that his deferment should continue until he has an opportunity to use his scientific and specialized training to the best interest of the nation. Accordingly, following graduation from a recognized college or university in any of these scientific and specialized fields, a registrant should be considered for further occupational classification for a period of not to exceed 60 days in order that he may have an opportunity to engage in a critical occupation in an activity necessary to war production or essential to the support of the war effort, provided that during such period the registrant is making an honest and diligent effort to become so engaged.

LEWIS B. HERSHEY, Director