

The
PENNSYLVANIA STATE COLLEGE
BULLETIN



ECONOMIC OUTLOOK
FOR THE
BASIC INDUSTRIES
OF
PENNSYLVANIA

A message of facts vital to the people
of the Commonwealth concerning the
great economic importance of Penn-
sylvania's mining and mineral in-
dustries to the life and prosperity
of the State.

The School of Mines and Metallurgy
The Pennsylvania State College
State College, Pennsylvania

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STATE COLLEGE, PENNSYLVANIA

Economic Outlook
for the
Basic Industries
of
Pennsylvania



A message of facts vital to the people of the Commonwealth concerning the great economic importance of Pennsylvania's mining and mineral industries to the life and prosperity of the State.

Prepared by

The School of Mines and Metallurgy

of

The Pennsylvania State College

State College, Pennsylvania

Foreword

IF the mining and the mineral industries of Pennsylvania were removed, the industrial structure of the State would collapse and only the farmer would be left. Robbed of local markets, the farmer in turn could not prosper.

Material progress is directly dependent on the mining and the mineral industries, and, if they slacken or fail, armies and statesmen are helpless. In these Pennsylvania leads in the United States, and her industries include coal, iron, and non-metallic mining; quarrying, ceramics, oil and gas production and technology; and metallurgy. These together have determined the industrial growth and prosperity of the State.

As a component part of a state institution the School of Mines and Metallurgy of The Pennsylvania State College considers a portion of its normal functions to be the collection and dissemination of relevant facts concerning the economic and scientific problems of the mineral industries, and the relationship of higher technical education to the solution of those problems.

This booklet has been prepared to promote the mining and the mineral industries of Pennsylvania with a view of cultivating more favorable public opinion. The first part covers the great economic importance of the mining and the mineral industries of the State, and the urgent need for more technical application; the second part tells of the advisory board program which serves as a connecting link between state industry and state education; and the third part outlines the service that The Pennsylvania State College is rendering to the mining and the mineral industries and to the people of Pennsylvania.

The School of Mines and Metallurgy was established in 1891 by an appropriation act of the State Legislature. It is not only one of the oldest mining schools in the United States, but was the largest in 1927-'28, according to unpublished figures of the U. S. Bureau of Education, Washington, D. C. The program of the School is in keeping with the objectives of the State Legislative Act and embraces, first, fundamental education and extension courses that fit the requirements of the industries; and, second, applied research and investigation that will conserve and better utilize our natural mineral resources and help make for greater safety and efficiency in the industries.

In the preparation of this booklet, the valuable service of Professor H. W. Stover, of the College Department of Economics, is acknowledged; likewise the helpful suggestions and criticisms of F. G. Tryon, in charge of coal and coke statistics, U. S. Bureau of Mines, Washington, D. C., and George H. Ashley, state geologist, Harrisburg, Pennsylvania.

EDWARD STEIDLE, *Dean,*
School of Mines and Metallurgy

Mineral Industries of Pennsylvania

PENNSYLVANIA is the greatest mineral industrial commonwealth in the world. No single political unit can display such a firm grip upon resources and such a valuable use of mineral products. Its relative position as first in production places it as the trustee of that share of this nation's wealth which determines industrial progress or decline.

Because of its endowment of wealth and the utility of those resources which comprise that wealth, Pennsylvania has arrived at that stage in progress where state leadership must be preserved by the greatest effort and skill on the part of its industrial administrators. Other states have challenged Pennsylvania's position, and as new deposits of mineral resources are discovered in competitive states, Pennsylvania's technical skill and energy must be used as weapons of defense. The higher education of technical men and research applied to scientific development are the State's most powerful weapons of competition.

Pennsylvania Needs Mineral Technicians

The extraction of minerals from the ground, their conversion into power and energy or their fabrication into useful shapes and products, is being recognized more and more as a job for trained technicians. Wasteful rule of thumb methods have taken their toll. Every industry usually passes through a wasteful period of uneconomical methods and policies. A brilliant future must rest upon the pouring into those industries of scientifically trained men who have a foundation in pure science, pyramided with applied sciences, tempered with a cultural background, and a studious and keen appreciation of human nature, labor problems, and consumer demands.

Despite pessimistic opinion, coal remains as our primary source of steam power, in this age of great central stations. Water power, petroleum and other sources are competitors, but coal will retain its predominating lead. In 1900 the United States had 70 million horse power, in 1928, over one billion horse power. The use of power extends back through many centuries of slow, determined growth, yet authorities state that the installation of power has increased fourteen fold in the last 28 years. The mining engineer produces potential power. Industrialists assure us that the peak is not in sight. Coal furnishes 68 per cent. of industrial, railroad and house-heating energy; oil or petroleum, 24 per cent., and water power about 5 per cent.

Water power can not now furnish economic heat for the home, so with the maximum development of that form of energy it probably will not be a serious competitor. Coal and petroleum will remain. Pennsylvania is at a decided advantage, due to its location, and is now calling on technicians

to make the most effective use of her remaining coal and petroleum resources. The public knowledge of the essential facts concerning future power and energy will bring about a deep and wholesome respect for the mining engineer and the petroleum production engineer and geologist.

Mining sometimes has been called a hazardous undertaking. The ever-watchful women of the country have voiced serious objection to the participation in such industries by their husbands and sons. Modern mining education is laying great stress upon safety engineering. The well-trained mining engineer of the future will not worry concerning his own hazard or that of his men. Safety or accident prevention will be more than a slogan; it will be an established fact.

It is well to dispel any popular belief that the mining engineer spends all of his time in a quarry or in the interior of the earth; that the metallurgical engineer is constantly in a blast furnace atmosphere; that the geologist or oil and gas production engineer is always musing with fossils, oil smears or a dozen varieties of gas odors; or that the ceramic engineer is confined to a brick plant or glass works for life. On the contrary, the successful man in any one of these professions most likely finds himself in the chair of an executive, a skilled specialist directing forces that turn the wheels of big industries.

Leaders in industry, voters, administrators, in fact, the entire citizenry of Pennsylvania, to insure continued supremacy in the mineral industries, must develop a respect for technical skill and administration. The Pennsylvania State College can well be used as a laboratory by these industries, and they should co-operate with the institution by aiding it to turn out a product mutually beneficial.

Pennsylvania a Mineral Processing State

This commonwealth annually produces about one-fifth of the total value of the nation's mineral wealth. This advantage alone will not permit a relaxation of effort. The use of these resources, combined with those of other States, will insure a prosperous Commonwealth. The basic industries are woven into the fabric of the consumer's life. Such products as iron, steel, alloy metals, fuel, glass, tile and stone, are endowed with a perpetual demand. They are prime necessities of a modern life. With a definite limit to the existing supply of minerals, methods must be devised for more efficient recovery and use of them. Although mining only one-seventieth part of the iron ore in the country, Pennsylvania produces over one-third of all the pig iron. Countless similar examples display the tenacity with which Pennsylvania holds to the leadership in the mineral industries, and there are innumerable opportunities for college trained men to increase the proportion of processed mineral wealth over natural mineral wealth. Furthermore, a depletion of natural resources is amply counterbalanced by the processing of the minerals of other States and countries. Such tactics depend upon trained technicians. We must replace natural gifts with trained man-power.

TABLE I—PENNSYLVANIA'S MINERAL "FIRSTS"

Pennsylvania ranks first in the following mineral products:

- Cement
- Clay
- Coal (bituminous and anthracite)
- Coke
- Ferro alloys
- Pig iron
- Mineral Paints
- Sand and gravel
- Slate
- Natural gas (value)

Mineral Resources of the United States for 1927, U. S. Bureau of Mines (Preliminary Summary).

Products manufactured from minerals:

- Blast furnace products
- Steel work and rolling mills products
- Smelting and refining of zinc
- Glass
- Fire brick
- Mineral and earth (ground, etc.)
- Foundry supplies
- Enameled sanitary ware
- Steel springs
- Structural iron work
- Wrought iron pipe
- Railroad repair

Biennial Census of Manufacturers for 1925, U. S. Census Bureau.

Great Responsibility for Mining Graduates

The importance of Pennsylvania as a mineral territory may be stated tersely. Her mines and products derived from minerals account for about *two-thirds of the entire productive wealth of the State*. What an obligation The Pennsylvania State College must assume in helping to train key men for such a gigantic share of the State's activities! The State's own College must assume a full share of the entire burden and not wait for other states to pour trained man-power into Pennsylvania industries.

In the realm of geology, oil and gas production, mining, metallurgy and ceramics, this State boasted 413 students in 1928, enrolled in five colleges and universities. Of that number about 190 regular four-year degree men were being trained in the School of Mines and Metallurgy of The Pennsylvania State College. A survey of the industries in which a graduate of this State School of Mines and Metallurgy should be especially valuable, reveals the fact that those industries produce annually about \$1,700,000,000 worth of products. With the original \$1,000,000,000 worth of mineral resources, the \$700,000,000 has been annually added by the manufacturing processes in those primary industries which are in the most part dependent upon metallurgical engineers, geologists, oil and gas production engineers, and ceramic experts as well as mining engineers. In addition to this added annual value created by potential graduates of these courses, there is about one billion dollars more value created in the remaining metal industries, which, while based upon a definite degree of technical skill, may not necessarily employ metallurgists as key men.

TABLE II—PENNSYLVANIA'S IMPORTANCE IN MINERAL INTERESTS

The following data apply to those Pennsylvania industries which are dependent upon graduates in Mining, Geology, Oil and Gas Production, Metallurgy, and Ceramics courses of study:

I. PRIMARY MINERAL INDUSTRIES:

1. Mining, Quarrying, Oil and Gas Production	
Value of Products	\$1,055,766,077
Number of employees	342,000
Pay roll	541,452,000
2. Metallurgy	
a. Iron and Steel industries	
Value added by manufacture	\$ 464,160,200
Number of employees	177,400
Pay roll	332,500,000
b. Non-Ferrous industries	
Value added by manufacture	\$ 29,720,300
Number of employees	12,600
Pay roll	21,000,000
3. Ceramic and Non-Metallic industries	
Value added by manufacture	\$ 68,365,292
Number of employees	59,000
Pay roll	88,500,000
4. Coal Processing and Oil Refining	
Value added by manufacture	\$ 70,343,000
Number of employees	17,300
Pay roll	28,000,000
TOTAL, PRIMARY MINERAL INDUSTRIES:	
Value of mineral products and that added by manufacture	\$1,688,354,869
Number of employees	608,300
Pay roll	\$1,011,452,000

SOURCES OF DATA:

Biennial Census of Manufactures for 1925
 Productive Industries, Pennsylvania Department of Internal Affairs
 Mineral Resources of the United States for 1927, U. S. Bureau of Mines
 (Preliminary Summary).

II. OTHER INDUSTRIES FABRICATING MINERAL MATERIALS:

5. Metal-working industries	
Value added by manufacture	\$ 826,302,885
6. Industries working non-metallics	
Value added by manufacture	\$ 64,692,205
GRAND TOTAL—PRIMARY MINERAL INDUSTRIES and others fabricating mineral materials	
Total value of minerals and value added by manufacture	\$2,579,349,959

The primary mineral industries mentioned above, employ over six hundred thousand men or *43 per cent. of the total employed in productive industries of the State*. Those industries have capital invested to the extent of \$2,500,000,000 or *34 per cent. of the capital of the productive industries*. The total annual pay roll for the primary mineral industries is about \$1,000,000,000 or *48 per cent. of the total industrial pay roll*.

These specific industries which are served by potential graduates of The Pennsylvania State College School of Mines and Metallurgy, as meas-

ured by four methods, first, value added by manufacturing, second, number of employees, third, capital invested, and fourth, total payroll are much more important than any other single group of industries.

Demand for Mining Graduates

This question naturally arises: *Will Pennsylvania maintain the high standard in these basic industries when there are only 413 enrolled students in those courses which control more than one-third of the value of the State's productive industrial wealth?* About 60 students a year are being graduated with appropriate degrees. The industries have rapidly assimilated these few men. There is an urgent need for many times that number. The State as a whole must educate itself to a recognition of the dearth of technically trained men in the mineral industries.

These mineral industries are in a dynamic state. Invention, scientific discoveries and research, are hurling problems at the industries at a more rapid rate than ever before. Competitive conditions demand extensive research programs, conducted by trained technical men. The following vital problems illustrate the convincing fact that conditions are changing at a fast rate:

Until three or four years ago, coal went over bar or other screens into railroad cars and thence to the consumer. Due to recent developments in combustion engineering and processing practices, the consumer now specifies the character and the size of the coal he will buy. Consequently problems in coal cleaning and beneficiation are of outstanding importance. Electrification and mechanization of mines is another development in the industry which is calling for the highest degree of technical skill. There is a trend toward consolidation of mines, and the solution of many of the larger economic problems lies in this direction.

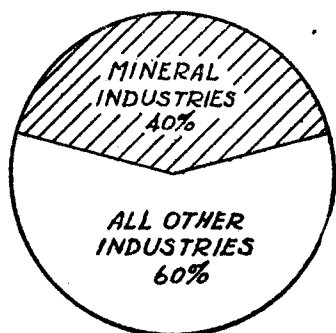
In the field of ceramic production, refractories industries are at present attempting to readjust themselves because of the discovery of mullite. The enameled iron industry is baffled by a popular demand for color. Shatter-proof glass has provided a knotty problem that will be solved by technical brains only.

The changing demands in the automobile and airplane industries, as well as the increased use of metals for all construction purposes and the higher strength and endurance demanded of them, are setting a fast pace for metallurgists. The heat treatment of steel is comparatively new, but the lack of trained men has a distinct throttling effect upon efforts in that direction.

As large supplies of natural gas have been wasted, the industry is reorganizing on a basis which will minimize the waste. A definite limitation in the petroleum supply and an appreciation of the superior quality of Pennsylvania crude has placed a strong demand upon the laboratory for improved and more effective recovery and refining methods.

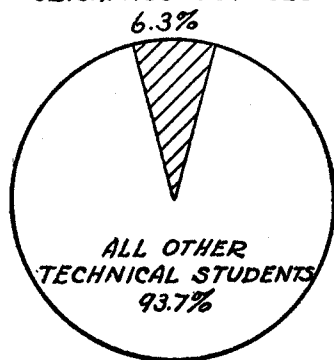
This constant state of flux of all mineral industries has emphasized the demand for properly trained men. Pennsylvania's early start as a

leader in the mineral industries has been somewhat of a handicap. Newer producing states have adopted the latest and most modern methods while Pennsylvania has been forced to change slowly because of the capital outlay and natural inertia. Obviously, more attention must be given to engineering practices in Pennsylvania, if this State is to compete with its neighbors.



VALUE OF PRODUCTS
CREATED

STUDENTS IN MINING
METALLURGY AND
CERAMICS SCHOOLS



NUMBER OF TECHNICAL
STUDENTS

CHART I—VALUE CREATED BY MINERAL AND OTHER INDUSTRIES IN PENNSYLVANIA COMPARED TO ENROLLMENT OF TECHNICAL STUDENTS

Figures of value created include all industries served by technical men, including manufacturing, agriculture, construction, forestry, and the mineral industries. Figures of technical students represent enrollment in approved Pennsylvania colleges in all engineering courses, and technical courses in agriculture, architecture, chemistry, and physics, as well as mining, metallurgy, and ceramics.

Note that out of 6,500 technical students in the State, the number enrolled for degrees in mining, metallurgy, geology, and ceramics was only 413, or 6.3 per cent.

Chart I illustrates strikingly the present lack of technical students in process of being trained for mineral industrial positions. The circle on the left represents the total annual productive value of all industries where technical men may be employed, such as agriculture, forestry, construction, mineral production, and all manufacturing. The figures for manufactured products are the value added by manufacture only. Thus, it may be said that technical men are more or less responsible for the creation of that value represented by the total area of the circle, approximately \$4,500,000,000. The shaded portion or 40 per cent., represents the \$1,700,000,000 of value created by the extraction of minerals and the preliminary processing of those minerals.

The circle on the right shows the proportion of mining school students to the other technical students. The circles taken in combination show that 6.3 per cent., or one-sixteenth of Pennsylvania's technical students, will be forced to maintain 40 per cent. of the industries.

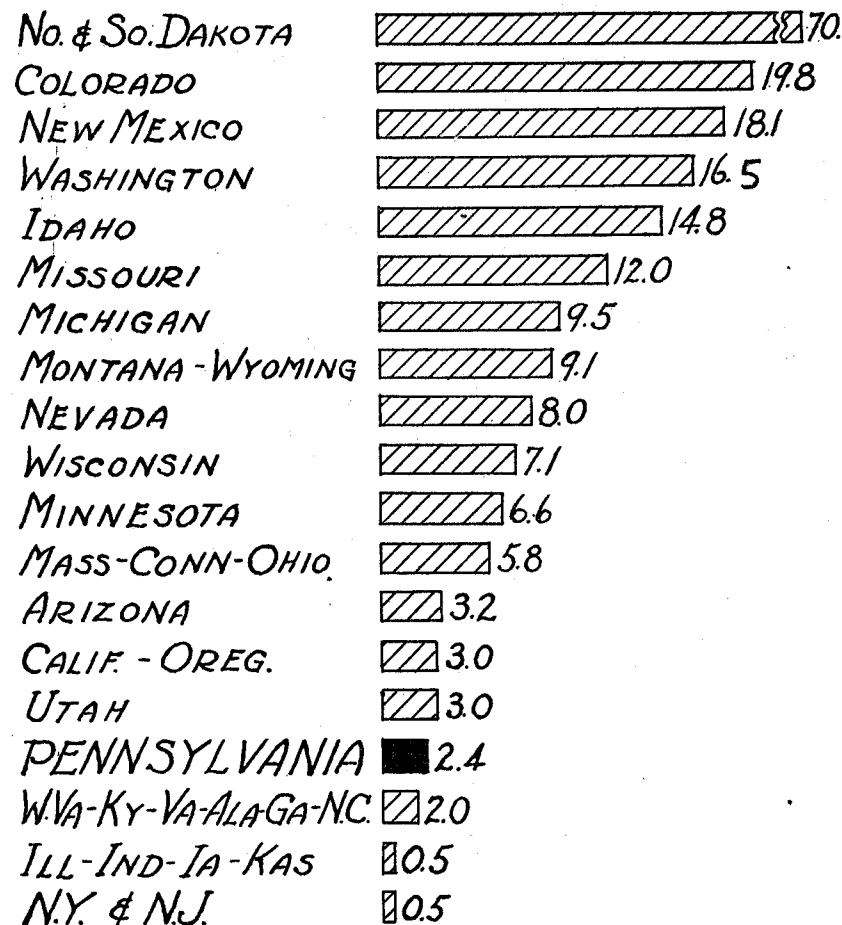


CHART II—STUDENTS IN MINING SCHOOLS IN RELATION TO VALUE OF MINERAL PRODUCTS IN 33 STATES

Figures represent the number of students enrolled in technical courses leading to degrees in mining engineering, metallurgy, and ceramics for each ten million dollars of value of primary mineral products in the same State. Value represents the value of the product at the mine plus the value added by manufacture. Metallurgy proper, ceramics, coal-processing and oil refining are included as well as mining, quarrying, and oil and gas production.

Data on value of production from reports of U. S. Bureau of Mines and the U. S. Census of Manufactures. Data on student enrollment from unpublished figures for 1927-1928 communicated by Bureau of Education, U. S. Department of the Interior.

In making a comparison of Pennsylvania with other states as to a dearth of students being trained along mineral industrial lines, Chart II illustrates the low rank of Pennsylvania. *This State has only 2.8 students for each \$10,000,000 worth of annual mineral product.* Although Pennsylvania has more students in schools of mines than any other state in the Union, when the demand for such students is considered, this State is decidedly under-supplied. The larger number of students in the western states is partly explained by the presence of the metal mines, which employ more engineers per unit of product. Even allowing for this factor, it is clear that the western and some of the eastern states support mining education more adequately than does Pennsylvania.

Due to a lack of uniformity in the organization of the various Schools of Mines, it is impossible to give accurate comparative maintenance figures. However, it is apparent that Pennsylvania's School of Mines is operating under a smaller unit cost per student than any of our leading mining schools. Pennsylvania, with one of the oldest and largest mining schools, and the greatest mineral wealth, is not receiving the public financial recognition that its position warrants. Leading western states are giving three and four times as much for maintenance, research and extension as Pennsylvania, yet their mineral wealth may be only ten per cent as much as that of this state.

Advisory Board Program for the School

OF first importance, and certainly the most logical function of the State School of Mines and Metallurgy, is the proper training of the undergraduate by classroom and laboratory instruction. Research constitutes a second function, while the third is that of extension service, which is becoming more popular. The efficient carrying out of these functions demands a wellknit connection with industry. Prospective employers of graduates may well be given a voice in the proper training of men. Industrial research projects must be offered to the College for solution and an effective extension service demands friends and advisors in industrial fields.

In line with these functions of the School, seven Advisory Boards have been created, and three more are to be formed in the near future. These Advisory Boards, as the name implies, are formed to act in an advisory capacity for the various departments. They are self-controlled, second-party units. Most of the business will be carried on by correspondence and personal interview, but one regular business meeting may be held each year at the College or at another convenient, centralized point. Eventually every phase of the School's program will be represented by a board of at least ten men. Those chosen are prominent executives and scientists, whose advice and counsel are of greatest value. There are many more outstanding men whose membership is very much desired, but the need for a wide geographic distribution of members largely governed the selection.

The President of the College, RALPH D. HETZEL, is an *ex-officio* member of each board. His connection crystallizes a valuable administration contact with industry. Another *ex-officio* member of each board is a public official. WALTER H. GLASGOW, Secretary of Mines, is an *ex-officio* member of all the Mining Advisory Boards, while GEORGE H. ASHLEY, State Geologist, acts in that capacity on the Petroleum and the Natural Gas Advisory Boards. CHARLES A. WATERS, Secretary of Labor and Industry, acts as an *ex-officio* member for the Iron and Steel and the Ceramics Advisory Boards. The Dean of the School is acting vice-chairman of each board, and the head of the particular department involved acts as secretary.

A series of lecture courses will be worked out, the advisory board members or their colleagues furnishing a background of knowledge and experience which will help to keep the School in the first rank.

In the promotion of a research program, the industries and State Departments at Harrisburg will be invited to send representatives to use the School's laboratories and equipment and receive the professional aid of the Faculty. The students, having been educated under suggestions and advice from the advisory boards, will be given preferential treatment in being placed after graduation.

An outline of the specific services that the advisory boards will render to the School include the following:

1. Encourage the education of employees, sons of employees, and friends in the mining and the mineral industries.
2. Aid in the placement of graduates.
3. Give aid and suggestions as to arrangements and plan of inspection trips for students.
4. Cooperate in lecture course plans.
5. Furnish or suggest possibility of summer employment for students.
6. Support in raising more State funds for School's program.
7. Advise and suggest type of education.
8. Advise on the research needs of industry.
9. Advise on the extension service needs of their respective industries.
10. Assist publicity program of the School through local high school contact.

The existing seven boards and their personnel follow:

Mining Advisory Board—Anthracite Field

- | | |
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| J. C. BRYDON, Vice-President
Pennsylvania Coal Company
Dunmore, Pennsylvania | HARRY W. MONTZ, Mining Engineer
Lehigh Valley Coal Company
Wilkes-Barre, Pennsylvania |
| CADWALLADER EVANS, JR., General Manager
The Hudson Coal Company
Scranton, Pennsylvania | F. C. NICHOLSON, Electrical Engineer
Lehigh & Wilkes-Barre Coal Co.
Wilkes-Barre, Pennsylvania |
| WILLIAM W. INGLIS, President
Glen Alden Coal Company
Scranton, Pennsylvania | D. V. RANDALL, General Manager
Susquehanna Collieries Co.
Wilkes-Barre, Pennsylvania |
| ALBERT B. JESSUP, Vice-President and General Manager
Jeddo-Highland Coal Company
Jeddo, Pennsylvania | E. H. SUENDER, Vice-President and General Manager
Maderia-Hill & Co.
Frackville, Pennsylvania |
| A. J. MALONEY, President
Philadelphia & Reading Coal and Iron Company
Philadelphia, Pennsylvania | JESSE B. WARRINER, Vice-President and General Manager
Lehigh Coal and Navigation Co.
Lansford, Pennsylvania |

Mining Advisory Board—Central Pennsylvania

- | | |
|---|--|
| B. M. CLARK, President
Rochester & Pittsburgh Coal Co.
Indiana, Pennsylvania | CHARLES O'NEILL, Secretary
Central Penna. Coal Producers Association
Altoona, Pennsylvania |
| JOHN C. COSGROVE, Chairman Board of Directors
Cosgrove-Meehan Coal Corp.
Johnstown, Pennsylvania | REMBRANDT PEALE, SR., President
Peale, Peacock & Kerr, Inc.
St. Benedict, Pennsylvania |
| T. R. JOHNS, General Manager
Bethlehem Mines Corporation
Johnstown, Pennsylvania | THE HONORABLE HARRY B. SCOTT
Phillipsburg, Pennsylvania |
| A. J. MUSSER, Vice-President and General Manager
Clearfield Bituminous Coal Corp.
Indiana, Pennsylvania | C. L. WATKINS, Vice-President
Pennsylvania Coal & Coke Co.
Cresson, Pennsylvania |
| E. J. NEWBAKER, General Manager
The Berwind-White Coal Company
Windber, Pennsylvania | J. W. WETTER, General Manager
Maderia-Hill Coal Mining Company
Phillipsburg, Pennsylvania |

Mining Advisory Board—Western Pennsylvania

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|--|---|
| W. L. AFFELDER, Vice-President
Hillman Coal & Coke Co.
Pittsburgh, Pennsylvania | HOWARD N. EAVENSON
Howard N. Eavenson & Associates
Pittsburgh, Pennsylvania |
| M. C. ANGLOCH, President
Vesta Coal Company
Pittsburgh, Pennsylvania | C. M. LINGLE, Vice-President
Buckeye Coal Company
Nemacolin, Pennsylvania |
| H. F. BOVARD, President
Keystone Coal and Coke Co.
Greensburg, Pennsylvania | G. ST. J. PERROTT, Superintendent
Pittsburgh Experimental Station
U. S. Bureau of Mines
Pittsburgh, Pennsylvania |
| THOMAS W. DAWSON, Vice-President
H. C. Frick Coke Company
Pittsburgh, Pennsylvania | J. P. WILLIAMS, JR., Vice-President
Koppers Coal Company
Pittsburgh, Pennsylvania |
| GEORGE H. DEIKE, President
Mine Safety Appliances Co.
Pittsburgh, Pennsylvania | L. E. YOUNG, Vice-President
Pittsburgh Coal Company
Pittsburgh, Pennsylvania |

Metallurgical Advisory Board—Iron and Steel

- | | |
|--|--|
| F. D. ANDREWS, General Superintendent
Harrisburg Pipe and Pipe Bending Co.
Harrisburg, Pennsylvania | CHARLES H. HERTY, JR., Supervising Metallurgist
U. S. Bureau of Mines
Pittsburgh, Pennsylvania |
| L. R. CUSTER, General Manager
Cambria Works
Bethlehem Steel Company
Johnstown, Pennsylvania | ROY C. MCKENNA, President
Vanadium-Alloys Steel Co.
Latrobe, Pennsylvania |
| A. N. DIEHL, Vice President
Carnegie Steel Company
Pittsburgh, Pennsylvania | E. J. POOLE, SR., Vice-President and General Manager
The Carpenter Steel Company
Reading, Pennsylvania |
| H. L. FREVERT, Vice-President in Charge of Operations
The Midvale Company
Nictown, Philadelphia, Pa. | O. C. SKINNER, Works Manager
Standard Steel Works Company
Burnham, Pennsylvania |
| H. W. GILLET, Chief Division of Metallurgy
U. S. Bureau of Standards
Washington, D. C. | H. C. THOMAS, President
Alan Wood Iron & Steel Co.
Philadelphia, Pennsylvania |
| T. M. GIRDLER, President
Jones & Laughlin Steel Corp.
Pittsburgh, Pennsylvania | F. M. WARING, Engineer of Tests
Pennsylvania Railroad
Altoona, Pennsylvania |
| C. W. HEPPENSTALL, President
Heppenstall Forge & Knife Co.
Pittsburgh, Pennsylvania | |

Ceramic Advisory Board—Refractories

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| C. W. BICKFORD, General Manager
Osceola Silica & Fire Brick Co.
Osceola Mills, Pennsylvania | W. B. COULLIE, Assistant General Sales Manager
Harbison Walker Refractories Co.
Pittsburgh, Pennsylvania |
| R. P. M. DAVIS, Chairman of the Board
U. S. Refractories Co.
Mount Union, Pennsylvania | EUGENE MCKELVEY, Vice-President
General Refractories Company
Philadelphia, Pennsylvania |
| GEORGE H. DIACK, General Manager
Queen's Run Refractories Co., Inc.
Lock Haven, Pennsylvania | J. M. MCKINLEY, Vice-President and General Manager
Crescent Refractories Co.
Curwensville, Pennsylvania |
| J. H. FRANCE, President
J. H. France Refractories Co.
Phillipsburg, Pennsylvania | RALPH SWANK, President
Hiram Swank Sons
Johnstown, Pennsylvania |
| S. M. KIER, President
Kier Fire Brick Co.
Pittsburgh, Pennsylvania | |

Petroleum Advisory Board—Western Pennsylvania

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| R. J. ALEXANDER, Secretary
Pennsylvania Grade Crude Oil Association
Oil City, Pennsylvania | R. M. HASKELL, General Manager
Associated Producers
Bradford, Pennsylvania |
| A. E. BOOTH, President
Northwestern Pennsylvania Oil Producers Association
Bradford, Pennsylvania | CORNELL N. PFOHL
Kendall Refining Co.
Bradford, Pennsylvania |
| FRANK BREWSTER, General Manager
Petroleum Reclamation Company
Bradford, Pennsylvania | W. T. PIPER, President
Piper and Lloyd Company
Bradford, Pennsylvania |
| W. J. BRUNDRED, President
Brundred Oil Corporation
Oil City, Pennsylvania | S. Y. RAMAGE, President
First National Bank
Oil City, Pennsylvania |
| | RALPH ZOOK, President
The Sloan and Zook Company
Bradford, Pennsylvania |

Natural Gas Advisory Board—Western Pennsylvania

- | | |
|--|---|
| SAMUEL W. MEALS, President
Carnegie Natural Gas Company
Pittsburgh, Pennsylvania | J. B. TONKIN, Vice-President
Peoples Natural Gas Company
Pittsburgh, Pennsylvania |
| GEORGE W. RATCLIFFE, President
Manufacturers Light & Heat Co.
Pittsburgh, Pennsylvania | L. W. YOUNG, JR., President
South Penn Oil Company
Pittsburgh, Pennsylvania |
| F. F. SCHAUER, General Manager
Equitable Gas Company
Pittsburgh, Pennsylvania | |

The advisory board program places the School in the position of a clearing-house for problems of mutual interest to industry and the public. It unites the College with the State departments in Harrisburg, and two important Federal Bureaus serving the mineral industries.

Heads of the departments are the key men of the School. Each department is responsible for its progress and the development of its respective field. The success of the Advisory Board program depends, first, on the initiative and energy of a well balanced School faculty, and, second, on the counsel and support of the Advisory Board members.

The State's School of Mines and Metallurgy

THE School of Mines and Metallurgy is distinctly a State school and feels a strong obligation to the State of Pennsylvania to assume a direct burden of mineral education. The School is composed of four departments, Geology, Mining, Metallurgy and Ceramics. The Department of Geology offers two instructional options, General Geology and Oil and Gas Production; likewise two optional courses, General Mining Engineering and Coal Mining, are offered in the Department of Mining. There is a minimum amount of undergraduate specialization in all of the courses.

The education of an engineer for the mineral industries is a complex matter. The responsibilities placed upon that profession are great. The ability of such an engineer to adjust himself to ever changing conditions is something that requires more than classroom contact. It demands several years of inspiring help and guidance on the part of the faculty, the ability to carry on independent research projects, and the capacity to explore, pioneer, and create new ideas. The faculty and administrators of the State School of Mines are personally interested in the welfare of every student; this contact is seldom broken by graduation.

There has been some discussion of the most effective type of institution which is charged with mineral industry education. The administration of the School of Mines and Metallurgy believes that the present organization is ideal from a pedagogical viewpoint. The Pennsylvania State College is composed of six units or Schools, each School having dependent problems with a common administrative overhead. As mineral education is based upon a strong foundation of pure science and engineering, the Schools of Chemistry and Physics, and of Engineering are charged with the responsibility of erecting that groundwork. The School of the Liberal Arts accepts the obligation of furnishing a cultural background. Each School contributes its share of the factors which make up an efficient curriculum for the various courses of study, leaving only the highly specialized technical instruction for the staff of the School of Mines and Metallurgy. The cost per student is considerably reduced, and a broader outlook for each student is obtained.

State biennium appropriations for Agriculture now amount to \$630,000 for extension, and \$270,000 for research, and those sums are practically doubled by Federal aid. Thus, the School of Agriculture is able to give direct, invaluable service to the farmers of the State. The State School of Mines and Metallurgy now receives \$4,000 for extension and \$50 for research. If the mineral industries would have required a more extensive and serviceable program for the School of Mines and Metallurgy when it

was first financed by the Legislature 38 years ago, many of the mineral industries of the State would now be in a healthier condition.

Achievements of Alumni

The record of the School merits recognition and honor. More than 750 students have been graduated, and 90 per cent. of these have remained in mineral or related industries. A vast majority of alumni are engaged in Pennsylvania industries. In the case of the Department of Mining, there are about as many graduates in the bituminous fields of Pennsylvania as the total graduates of all other colleges combined.

The graduates are outstanding men in the mineral industries and hold executive and administrative positions which control millions of dollars of invested capital. Some of these include three presidents, six vice-presidents and twenty-two general managers of the largest mining and steel companies, also nine high government and state officials, and ten consulting mining and metallurgical engineers and geologists. Scores of graduates hold prominent positions as engineers, geologists, and college instructors. The School rightfully claims a share in the Commonwealth's predominating position as the leading mineral state.

The Faculty

The faculty of the School of Mines and Metallurgy is composed of twenty well-trained engineers and scientists, diversified as to schools of training.

The Department of Geology, Mineralogy, and Oil and Gas Production, with C. A. BONINE as head, has seven members on its staff. Professor Bonine, a graduate of Lehigh University, took his post-graduate work at Johns Hopkins University and spent a number of years as a field geologist for the United States Geological Survey. He has specialized in economic geology and has had considerable experience as a consulting oil and gas geologist. GEORGE H. ASHLEY, a graduate of Cornell and Leland Stanford Universities, has recently been added to the staff as professorial lecturer in geology and oil and gas production. For the past forty years DR. ASHLEY has served with the United States Geological Survey and various state surveys and is now State Geologist for Pennsylvania. A. P. HONESS was graduated at Oberlin College and took his doctorate at Princeton University. He is a recognized authority and writer on mineralogy and precious stones. C. W. ROBINSON, a graduate of Acadia University, took his graduate work at Yale University, and specializes in physiography and geography. F. M. SWARTZ was educated at Johns Hopkins University and received his doctorate at the same institution. He specializes in stratigraphy and paleontology. C. K. GRAEBER was graduated at The Pennsylvania State College and took his Master's degree in Mineralogy and Petrography at Penn State and the University of Michigan. E. F. WILLIAMS, a graduate of The Pennsylvania State College, brings to the department excellent field experience in geology and is specializing in oil and gas production.

The Department of Mining is under the direction of WILLIAM R. CHEDSEY, an engineer trained in the Colorado School of Mines. His experience includes all phases of mining operations and brings to the School the viewpoint and knowledge of the western mining sections, from Costa Rica to Alaska, as well as eastern conditions. SION B. SMITH, a graduate of Allegheny College and an attorney of Pittsburgh, is a professorial lecturer in mining law. P. B. BUCKY was educated at the University of Illinois and holds a first grade mine foreman's certificate in West Virginia, and specializes in mechanical equipment. J. W. STEWART was graduated at the Universities of West Virginia and Illinois and specializes in coal preparation. Mining Extension is in charge of

W. G. DUNCAN, located at Connellsville. He is a graduate of the University of Michigan and possesses a first grade mine foreman's certificate for the bituminous fields of Pennsylvania. FRANK SLUZALIS is an assistant in extension and Summer School work, and is a certified first grade mine foreman for the anthracite region.

D. F. MCFARLAND, Head of the Department of Metallurgy, received his undergraduate training at the University of Kansas and his doctorate at Yale University. He has built up an enviable reputation as an educator of metallurgists and in carrying on fundamental research. O. A. KNIGHT is a graduate of Ohio University and The Pennsylvania State College and has done graduate work at Harvard. He has a brilliant record as a research metallurgist, particularly in metallography, while O. B. MALIN, a graduate of The Pennsylvania State College, has specialized in non-ferrous metals, especially brass alloys. J. R. LONG, a graduate of the University of Illinois, has had several years' experience in non-ferrous research.

J. B. SHAW, Head of the Department of Ceramics, is a product of Ohio State University. Ohio is the only State which exceeds Pennsylvania in the value of ceramic products. He has had extensive industrial experience in Ohio, Michigan, New York, and Pennsylvania. The Department of Ceramics is the youngest, less than six years old. Its need in such a State as Pennsylvania is great, and with proper equipment and support, it will be recognized by industry as a means of carrying the burden of increased prosperity in ceramic fields. PROFESSOR SHAW is ably assisted by G. J. BAIR, a graduate of The Pennsylvania State College, who has had considerable practical experience.

Humanized Technicians

A number of leaders in the mineral industries were interviewed recently on the general subject of higher education. There was a most remarkable agreement of opinion, and the name of HERBERT HOOVER, trained as a mining engineer, was invariably set forth as an example of the correct balance in technical education. Those interviewed placed great emphasis upon the need for more than proficiency and skill as technicians. The student should be trained to make a survey under varying conditions, and to submit a complete and interesting oral or written report of that survey to either his superior or to a layman. He should be "humanized" to the point that the mineral industries may assume their correct perspective in life, socially and economically. These attributes are not taught as such in the classroom. The faculty is charged with the duty of injecting into every class those intangible necessities of a well educated man. A cultural background is indispensable. In addition to the cultural inspiration of the faculty the student is compelled to take a well chosen list of subjects classed under Liberal Arts. Thus the ideal as set up by the administration of the School of Mines and Metallurgy produces a potential administrator and executive, with a knowledge of the technique of his field, and a keen recognition of the dynamic and changeable state of the industry.

Lecture Courses

A Mining and Metallurgical Society is maintained by the students registered in the School. Regular semi-technical meetings are held throughout the year. These give the students in the different courses an opportunity to broaden their vision and become acquainted with various closely allied problems. In addition, messages relative to modern developments in scientific and industrial problems are given by visiting lecturers

eminent in their specific field of study. These lectures are desirable from the standpoint of their educational value on the campus, as well as their indirect benefit to the industries.

Proposed New Plant

The School has extensive educational equipment, but thus far it has been housed in a frame shack with a tar-paper roof. The College administration has promised the School a new building and it should be constructed and in use before 1930. The new building will reflect the mining and the mineral industries of the State and will provide ample facilities for conventions and professional meetings. The State Departments in Harrisburg will be invited to make use of the building. Especial consideration will be made for research and a greatly enlarged extension program. The expanding physical plant will enable the School to act more as a service unit to the other Schools on the campus. The New Building and Advisory Board program are challenges to the School which must be met by well balanced and far-sighted policies.

Research Projects

In the field of research the School, with its projected new plant and equipment, expects to devote professional skill and laboratory facilities to the solution of Pennsylvania's great mineral problem. The possibilities of research are so great in the State that it will take years to cover the field thoroughly. The four department heads have outlined problems which, if properly investigated, will contribute much to the State's industrial leadership.

The Geology Department has grouped the proposed research project around six fields, economic geology, oil and gas production, mineralogy and petrography, stratigraphy and paleontology, glacial geology, and geography. The Mining Department has proposed a number of problems dealing with improvements in mining and quarrying, coal cleaning, economics of mining, safety, and mechanization of mines. The Department of Metallurgy has outlined about twenty-five fundamental and applied problems in iron and steel and non-ferrous metallurgy, all of which are of direct importance to Pennsylvania. In the field of ceramics the industries have hardly been scratched from the research angle. There is a startling lack of facts concerning this phase of Pennsylvania's front rank industry and the School could well be used as a clearing house for economic surveys and research.

Basic and applied research and investigations should be carried on by both faculty members and graduate students, thus giving undergraduates a better appreciation of how scientific knowledge is applied to industrial problems. This helps to reduce the length of apprenticeship or non-productive period following graduation.

Extension Service

It was once said, "Though it may be impossible to bring the masses requiring education to the University, may it not be possible to bring the University to them?" Thus began the extension idea, which has become

an important factor in American education. The Pennsylvania State College was a pioneer in that field, having begun its first extension work in 1906. The education of better mineral technicians offers a fertile field for "taking the University to the masses." A State institution, such as The Pennsylvania State College, with its obligation to the greatest mineral state, must open its service to all. The character of the mineral industries prevents a wholesale exodus into classrooms. The future plans of the School of Mines and Metallurgy embraces a strong recognition of the value of extension service. Some of the mining extension will be carried on under the Federal Smith-Hughes plan in cooperation with the Department of Public Instruction in Harrisburg.

Museum and Library

This School of Mines maintains the only comprehensive museum solely devoted to the mining and the mineral industries of the State. It is a center of interest on the campus and attracts many tourists to the College. The industries have largely provided the exhibition material, some of which is of great historical and educational value. Numerous relics of the mining and the mineral industries and other exhibition material are now on display, or in storage in various parts of the State for donation to the College when more suitable museum space is provided. In addition to the museum, space is required for various depositories such as drill cores and drill logs.

A library is an indispensable unit to any educational and research program. It will be developed for undergraduate and research reference work, and as an archive for valuable State records. The Capitol at Harrisburg provides the only library in Pennsylvania in which a complete set of State documents and manuscripts relating to the mining and mineral industries is filed for public use.

A Service School

The various departments of the School of Mines and Metallurgy offer many courses which may be called "service" courses and are designed to acquaint the students registered in other Schools of the College with useful phases of the fields covered by the departments in this School.

The Geology Department has a number of "service" courses, including general geology for science cultural training, taken by many students in the Schools of Liberal Arts and Education. Similar general courses are especially adapted to the needs of Agricultural students. Specialized geology and mineralogical courses have been given to various groups of engineering students. Advanced courses in crystallography are elected by certain groups from the School of Chemistry and Physics.

Similarly, a number of the elementary courses offered by the mining department are available for election by engineering and other students, especially principles of mining involving rock excavation, explosives, roof support, tunneling, and shaft sinking.

The Metallurgy department offers such courses to students from engineering departments, including a series especially designed for the needs of the students in electro-chemical engineering, a course in general metallurgy for students in civil and sanitary engineering, and a study of steel and iron alloys from the standpoint of a steel user given to the mechanical engineers. In addition, students in chemistry and chemical engineering frequently elect courses in metallurgy. The field for such "service" courses is capable of great expansion and it should

be possible to offer valuable metallurgical training supplementary to all of the engineering courses.

The ceramics department has courses in general ceramics which are open to election by students in engineering and other schools.

Where the Students Come From

It is apparent that the men engaged in the mining and the mineral industries of the State are not sending their sons into the State School of Mines and Metallurgy; an analysis of the occupation of the parents of the present student body of the College reveals this fact. Only ten miners send their sons to the School of Mines and Metallurgy, while 115 miners have sons in other Schools on the campus. Of 383 parents who are classified as superintendents, managers, and foremen, only 28 have sons enrolled in the School of Mines and Metallurgy. Chart III illustrates the source of the students of this School classified as to the parents' occupation.

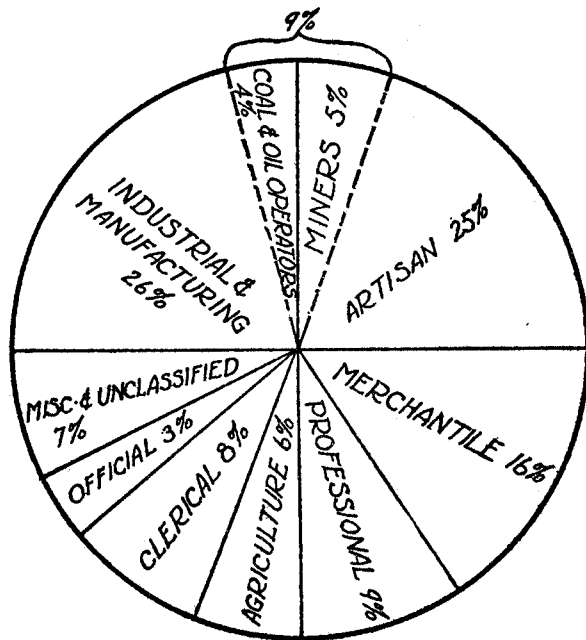
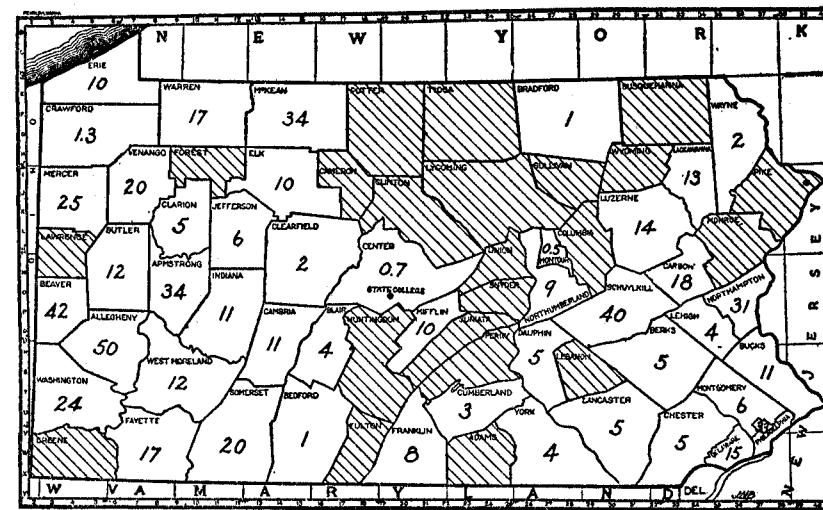


CHART III—OCCUPATION OF PARENTS OF STUDENTS ENROLLED IN THE SCHOOL OF MINES AND METALLURGY OF THE PENNSYLVANIA STATE COLLEGE, 1928-1929. Only 9 per cent. are directly traceable to occupations in the mineral industries.

Student distribution by counties, expressed as millions of dollars' production of mineral products, for each student from that county is illustrated by Chart IV. Those counties shaded have no students enrolled in the State School of Mines and Metallurgy; 45 of the 62 counties are represented.



Counties from which no student is enrolled

CHART IV—NUMBERS IN EACH COUNTY INDICATE MILLIONS OF DOLLARS OF ANNUAL MINERAL PRODUCTION FOR EACH STUDENT REGISTERED IN THE SCHOOL OF MINES AND METALLURGY OF THE PENNSYLVANIA STATE COLLEGE.

The following table indicates the estimated annual mineral production in those counties not represented in the School.

County	Approximate Annual Mineral Production Value (dollars)
Lawrence	20 millions
Greene	18 "
Lycoming	10 "
Lebanon	8 "
Huntingdon	6 "
Columbia	4 "
Clinton	3 "
Adams	2 "
Susquehanna	2 "
Wyoming	1 "
Monroe	1 "
Cameron	1 "
Tioga	1 "
Forest	Less than one million
Fulton	"
Juniata	"
Perry	"
Pike	"
Potter	"
Snyder	"
Sullivan	"
Union	"

An analysis of Chart IV in combination with this table gives the following conclusions: At least five counties, from the viewpoint of value of production of important minerals, are not represented by students—Lawrence, Greene, Lycoming, Lebanon, and Huntingdon. Over 57 million of production value is represented by these counties. In the counties that are represented by students, the following have a production of greater than 20 million per student: Allegheny, Beaver, Schuylkill, McKean, Armstrong, Philadelphia, Northampton, Mercer, Washington, Venango and Somerset. The securing of new students will be stressed especially in these counties.

The Future Outlook

Every phase of education has its rapid growth, inflation and deflation. Schools of Mines have reached the threshold of a healthy and dignified period of progress. Such a State as Pennsylvania owes its greatness to the pioneering class in the mineral industries. Once more these men are in great demand, for perhaps different purposes, to utilize limited resources better. The Pennsylvania State College School of Mines and Metallurgy has a constructive program of expansion and a hearty public approval is expected. There is no reason why mineral education in Pennsylvania should not command a much larger share of State funds. The School challenges the State as a whole to compare any industry to the mineral industry and refute the statement that proper state education of mineral technicians will pay the greatest dividends.

Mining Engineering has produced a president of the United States. His election has brought forth many press articles on the value of engineering education. President Coolidge in a George Washington anniversary address, declared that the country could use more technicians. High Schools in Pennsylvania should introduce the subject of mineral education, perhaps in connection with the popular science courses. Popular fallacies as to the character of coal mining should be refuted. The future of Pennsylvania demands that trained technicians in the mineral industries be elevated to dignified administrative or executive levels, trustees of the Commonwealth's greatest possessions.

The State School of Mines and Metallurgy has a bright future, and is recognized as a necessary part of the mining and the mineral industries of Pennsylvania. The main purpose of the new building is to accommodate undergraduate work, but the plans will make it possible to embrace the many other important features set forth in this bulletin. With the advisory board program in operation the School is closely linked with its related industries and is prepared to carry out a comprehensive program of service to the people of the Commonwealth.