

# Mineral Industries

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College of Mineral Industries



*The*  
*Pennsylvania State University*

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## The Mineral Industries Undergraduates Speak

In this issue the students of the College of Mineral Industries tell you not only about student life at Penn State, but also about the different careers in which you as a college-bound individual, may find an interest and ultimately your life's work. Because of the vital importance of the mineral industries to the welfare of the entire economy of Pennsylvania, students in this College are preparing themselves, not only for well-paid positions, but also for the task of solving some of the most pressing problems affecting the general welfare and prosperity of every individual in the Commonwealth.

As you read about the hopes and plans of some of our present student body, it is possible that you would like to have these same experiences and train yourself for similar work. The thoughts and opinions expressed by the students in this issue represent a good cross-section of all Mineral Industries undergraduates. Our students come from all parts of Pennsylvania, and some from neighboring states. We believe that you, as a high school student, will gain a greater understanding of the opportunities that an education in the mineral industries can offer if you know the views of the present undergraduates.

For those of you who would like to know more about this type of training, a cordial invitation is extended to write to the Dean, College of Mineral Industries, and information concerning our programs will be provided. Even better, you and your parents are invited to visit the College of Mineral Industries and discuss with the faculty the type of study program which can provide you with the most satisfying career. Toward this end we are scheduling a Counseling Day for May 1, 1954. There will be exhibits showing the varied nature of the work done by both undergraduates and graduates, and members of the teaching staff will be available for conferences. High school students are welcome to visit us at any time, of course, but we plan to be especially well prepared for such visits May 1. We hope to have the opportunity of talking to many high school students, and their parents and advisers also, at that time.

Before going into the student section, we have a brief message from Dean Osborn of the College of Mineral Industries.

### Comments from Dean Osborn

This message is directed toward those boys and girls who are seriously thinking of a professional career. Men and women trained in any of the mineral fields are vitally, even desperately, needed in industrial, governmental, and educational positions.

Minerals and mineral products are the basis of our diversified and constantly expanding industries. Without this primary wealth, our high standard of living would drop and we would lose our position of leadership in world affairs. Unless we continually find new sources and kinds of raw materials and develop new technologies to process and fabricate them, we cannot expect long to survive as a nation. High-ranking high school students are needed for training in the mineral industries to provide the leadership and know-how necessary to meet these basic needs for minerals and mineral products. Any good student making a career in these fields can expect to contribute much to his country's welfare, while doing an interesting and rewarding job.

In the high schools of the State, students have little chance of studying in, or even hearing of, such exciting fields as geology, geochemistry, metallurgy, fuel technology, mineral economics, or mineral preparation. The field of ceramics is probably thought of as pottery-making, whereas it is an enormous and critical industry using huge tonnages of raw materials in the manufacture of such products as glass, high temperature refractory materials, insulating and fireproof products, electronic components, special bodies for use in rockets and atomic energy plants. Research and engineering in such a field have unlimited possibilities.

In this issue we present a brief look into the student program in each of the 13 fields of study represented in the College of Mineral Industries. We suggest to promising high school graduates that they well may find the work in one of these fields so fascinating and so full of opportunity that they will wish to make it their life work. A careful look at the descriptions of the College's curriculums will be very helpful in finding out more about the careers that are possible for men and women in the mineral industries



Dean E. F. Osborn

tries and will aid anyone in choosing the one best suited to his interests and abilities.

In the College of Mineral Industries, the courses taken during the freshman year are the same for all curriculums. Chemistry, geology, mathematics, and English must be studied by all to lay the necessary foundation for the following years in which the specialized technical courses of each curriculum become increasingly important. An advantage of this common freshman year is that students in effect have a full year at the University for observation, orientation, and counseling before their programs become definitely fixed in a particular curriculum.

We want to encourage especially the good students—those who delight in the science studies and are eager to make a good record. If university training appears to be out of the question for financial reasons it is possible that some financial assistance may be provided through scholarships—and summer vacation jobs are available in the various mineral industries for our students.

# Mineral Industries

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### DIVISIONS OF SERVICE

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## The Petroleum and Natural Gas Engineer

"So you want to know why I chose PNG as my major?" asked Jim Brannigan, a seventh semester student. "Well, I'll tell you why, with a few extra thoughts for your consideration, and after I'm through maybe Gordon Thomas can fill in the gaps where what I've said doesn't apply to him or some of the other students.

"Like any high school graduate whose grades are good enough to assure him that he could take on college work," said Jim, "I wanted to continue my education if I could secure the necessary funds. Where to go and what to take were big problems also. Since Penn State is one of the largest universities in the country, the right answers to all my problems were found in this institution.

"First of all," continued Jim, "Penn State is recognized as tops academically; yet the fees are low because it is a State-supported university. Then it provides a wide variety of engineering curriculums, at least a dozen, and since my aptitudes indicated my preference for engineering work, I was sure that somewhere in that group I would find the particular engineering field I would most enjoy."

Jim paused for a moment to marshal his thoughts.

"What finally led me to petroleum engineering," he said, "was strictly a matter of elimination, for up to that time I hadn't even seen a drilling rig. When I began to analyze the various engineering curriculums, it seemed to me that petroleum engineering



James Brannigan

embodied all of the features I wanted in a life-time job. The work is for the most part outdoors, and there is ample opportunity to travel. In the field the petroleum engineer has a chance to use his own ideas to a great extent, and he is also given a great deal of responsibility. Looking at the whole picture, it's a fast growing industry with a constant demand for graduate engineers, and that spells plenty of opportunity for advancement.

"One of the advantages of taking petroleum engineering at Penn State," Jim added, "is that it is taught in the College of Mineral Industries, and I didn't realize the peculiar value of this arrangement until now. Petroleum engineering, while it embraces fundamentals of other branches of engineering, is principally the science of extracting an irreplaceable natural resource from the earth. We must be exceptionally well grounded in the essentials of geology, mineralogy, and geophysics. Since these are all part of the Mineral Industries College program, you can see the advantage we have in being trained in a school where these subjects are emphasized.

"Looking back now, I am convinced that, for Jim Brannigan anyway, my choice was right. And if I were a freshman again, and knew what I know now, I would be first in line to register for the petroleum engineering work at Penn State."

"Jim is pretty much right," said Gordon



Gordon Thomas

Thomas, "and most of what he said fits my ideas exactly. I, too, chose Penn State because of its well-rounded technical education program in the mineral industries field. My choice of petroleum engineering, like Jim's, has been a happy one, so naturally I am glad to pass on some of my enthusiasm for the work. One point that Jim didn't mention, however, was the close coordination between industry and school that we have in the Mineral Industries College, and this is especially true of the petroleum industry. We know what the industry wants, and they know what we are doing. Some of the research projects that are carried on in the department give those of us who are involved a better idea of the problems encountered in the field work.

"Since coming to Penn State I have found that we can get experience which would not be available at many other universities. Our labs are really spacious, and they are well equipped for all types of study and investigative work.

"Perhaps the thing I appreciate most," said Gordon in conclusion, "is the democratic spirit that prevails at Penn State and attracts students from all parts of Pennsylvania, and other states also. It is particularly evident in the informal discussions we have with our profs, and in the personal attention they give us in the classes and labs."

## The Mineralogist

When anyone asks what a mineralogist does, the professor usually clears his mind of other matters, reaches mentally for his prepared talk, and then goes into a long-winded discussion of proper preparation, tools of the trade, and variety of jobs open to the graduate. This time we're going to by-pass the professor and ask the mineralogy student some questions, such as why he chose mineralogy, why he came to Penn State, what his mineralogy courses are like, and what he expects to do when he graduates. Instead of setting down similar answers from many students, we have chosen the experience of Eugene White, a junior in geology and mineralogy, as typical.

Gene grew up on a farm not far from Punxsutawney. There were several small mines on the farm, and the lumps of coal and occasionally of rock that were loaded into trucks at the drift mouth of a mine interested Gene because of the variety of materials associated with the coal. A limestone quarry on the farm provided additional rocks to be examined, and a summer trucking job led him farther afield in his search for interesting specimens of rocks and minerals.

During his senior year in high school Gene visited the Penn State Center at nearby DuBois and discussed with some of the professors the possibilities of a college education. Encouragement by his high school instructors, and the offer of a senatorial scholarship which would partially solve the financial problem, convinced Gene that he was on the right track, so he applied for entrance to Penn State. This decision was largely influenced by the availability of earth science



The Student Body of the College of Mineral Industries

courses in the College of Mineral Industries, for by this time he was convinced that working with rocks and minerals presented a most attractive future.

Following his freshman year at the Du-Bois Center where he was able to fulfill some of the basic physical science, mathematics, and English requirements for his curriculum, Gene transferred to the Penn State campus where he received his first glimpse of the broad field of study in mineralogy and geology. Additional financial aid was gained through a technical labor job on a mineralogy research project. At the same time this work gave him a chance to learn various laboratory techniques, such as grinding thin sections of rocks for microscopic study (illustrated in one of the accompanying photographs), heavy mineral separations, radioactivity measurements, and spectrophotometry. Besides the pay and experience, Gene feels that this job gave him a more concrete pic-

ture of actual mineralogical work, and has influenced his decision to specialize in mineralogy.

Married a year ago, Gene finds the responsibilities of family life when added to the



Gene using the microscope

demands of his course work and part-time job mean fewer leisure hours. In high school he enjoyed glee club activities and track events, but there just isn't sufficient time now for these extracurricular activities.

As a junior, Gene finds his courses are becoming increasingly technical and specialized. In optical mineralogy (illustrated in the second photograph), he is learning to use the polarizing microscope in the study of optical properties of minerals. Later, this technique will be used to identify minerals in various kinds of rocks and thus aid in learning how they were formed.

Although graduation is still a year away, thoughts of a job are becoming more important each day. Gene hasn't made up his mind definitely, but indicates that mineralogical work with the U. S. Geological Survey or with one of the oil companies is a distinct possibility.

### The Geologist

If you have glanced at the accompanying picture of a man apparently squeezed between two slanting layers of rock, and have been trying to figure out what it means, let me assure you that the individual is not caught between the rocks, that he is having a most enjoyable time, and that his name is Arthur M. Hussey, a senior geology student at Penn State.

When the picture was taken, Art was crawling out of a cave in central Pennsylvania, one of the many in this area which the local cave-explorers club have located. Like many geologists, Art has chosen to make a hobby out of his profession. Some like to hunt for and collect fossils or rare minerals; others take great delight in emulating the mountain goat in scaling peaks, in search of geologic specimens or perhaps to solve a geologic mystery. Art's hobby is exploring caves, and of course what he finds during these underground trips may add up to something important geologically.

Where did his interest in geology start?



Gene White at the grinding wheel



Art Hussey spelunking (cave-exploring)





Art Hussey at work on outcropping

According to Art, a former resident of Aliquippa who moved to Wells, Maine, during his high school days, it developed from the interesting rocks and minerals which he picked up along rocky beaches and sheer cliffs of the Atlantic Coast near his Maine home. When it came time for him to go to college, his Pennsylvania background led him to choose Penn State, and his interest in minerals made him decide on the geology-mineralogy curriculum.

Now that he is in his senior year, Art has a few opinions on Penn State and geology. In fact, he becomes quite enthusiastic in talking about the friendly town and townspeople, the comfort of his living quarters, the sport of give-and-take among his fellow students, the countryside which is so picturesque and near, the student activities, and those other items that are part and parcel of a full student life. Yes, these are important, but it is really his work in geology that is the focal point of his living.

More than any other single item, Art likes to talk about cave exploring. He joined the local exploration club, "Nittany Grotto," in 1951, and has taken an active part in its operations ever since. Members of the club go out during evenings and week-ends to learn about cave exploring. On each successive trip they are guided through more difficult caves, narrower passages, slimier muds, and deeper and colder pools of water. Finally, when they have literally "learned the ropes," they go on trips through newly discovered caves to help survey the networks of rooms and tunnels, and view new subterranean sights by the glow of their torch lights. Art is president of "Nittany Grotto" this year, and the club has more than 100 members—about a quarter of them girls.

In addition to his outdoor, or should we say underground, activities, Art is corresponding secretary of Sigma Gamma Epsilon, honorary fraternity of geology students, and a member of the Mineral Industries Student Council. That he pays attention to his studies also is shown by the regularity with which his name appears on the Dean's Honor Roll.

For his senior thesis Art plans to present the story of the geologic past as recorded in the rocks near his home in Maine. Material for this topic was gathered during his visit

there last summer. Following graduation Art would like to continue with his geological studies in graduate school, and later apply his training to geological field mapping and the search for ores in the far corners of the world. We're willing to bet that it won't be as thrilling as cave exploring in central Pennsylvania.

### The Mining Engineer

The classic picture of the mining engineer is that of a tall young fellow, dressed in work clothes, wearing high top boots and a slouch hat, sighting through a transit at some distant point, and perhaps waving or giving a signal to "move it to the right a bit." Mining engineers are inclined to smile at such a picture, for while it may represent a picturesque task, it certainly does not indicate the extent of the interesting jobs that the engineer of today finds in the mining field. The majority of the young men in colleges and universities who are in training for mining engineering degrees come from mining areas, and they know from intimate contact the many opportunities that are open in this field. Recent inquiries among the undergraduates in the mining engineering curriculum as to why they chose this field brought forth some interesting replies.

Tom Falkie, a third semester miner from the hard coal region, says it was the most

natural choice in the world for him because mining is the predominant industry around his home. Tom holds the Taggart scholarship which he won in competitive examination. Each summer he works in the coal industry, and this experience has been quite valuable to him in his studies. It has also shown him that acquiring a good background in math, chemistry, physics, mechanics and other sciences is essential for success in his chosen profession. Tom, who appears with Bob Curran, also a third semester student, in an accompanying photograph, believes that anyone who expects to become a mining engineer should visit mines, talk with mining people, and learn first hand of the many opportunities in not only production and management but also research and sales in the mining industry.

Bob Curran, who was discharged recently from the Air Force, prefers the active life that a mining engineer leads. Coming from a mining community, he is well acquainted with the varied type of work that a mining engineer does, and that suits him just fine.



Tom Falkie at the transit and Bob Curran taking notes

After graduation he would like to get into hard rock mining, but that is still a few years away, and in the meantime he is developing mental skills, learning how to find sources of information, and acquiring factual engineering information.

Some of the work that Tom and Bob will encounter in their future studies is illustrated in a second photograph which shows



A class in mining systems

some fifth semester mining engineers studying the various mining systems. Such technical courses in the mining fields are supplemented with broad engineering studies in structural design, mechanics, hydraulics, and electrical engineering. Elective studies in other fields, which help make the engineer more aware of his social and economic responsibilities, and on-the-job training in nearby coal and limestone mines during the summer are examples of the broad training provided the mining engineer.

George Trevorrow, who comes from a western Pennsylvania mining family, has also worked in a mine during the summer; he enjoys the advanced mining courses, and finds their application to practical mining work extremely interesting. George Schneider, whose father is a graduate engineer with the State Department of Mines, and Jim Reilly, whose father is engaged in production work in central Pennsylvania, were both influenced, no doubt, in choosing mining because of their familiarity with the work. Jim feels that surface mining operations may be his choice when he graduates. Bob Smudzin, another hard coal miner, has no particular choice of future jobs, but he knows that there are plenty of opportunities in the industry for the graduate engineer. Phil Muron, one of the older students who has had several years of mining experience as well as four years in the Army, is convinced that formal training is essential for administrative work in the mining industry, and Phil is well on his way to reaching his goal of becoming a mining official.

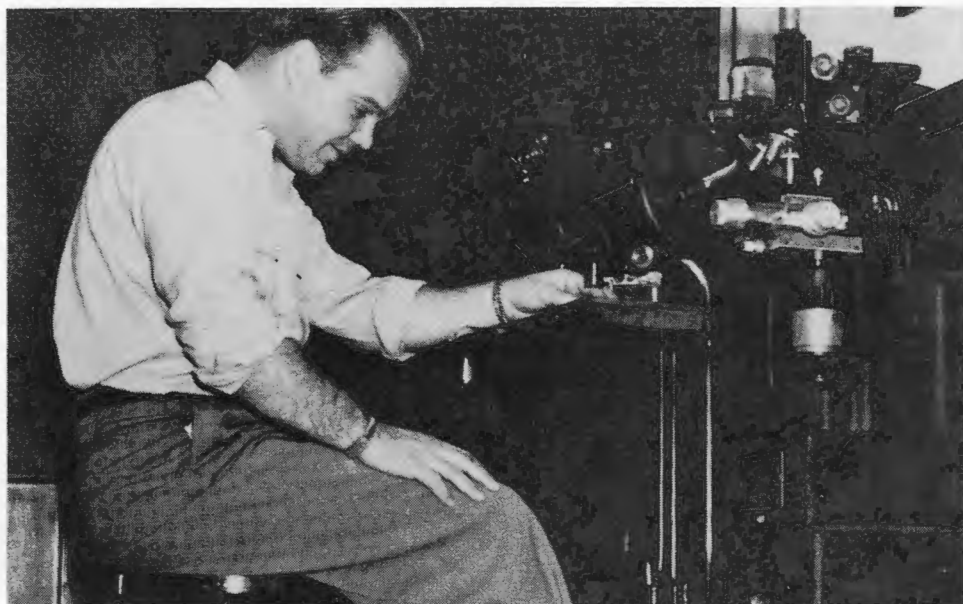
Some of the best known figures in the American mining world are Penn State graduates. If the attitude of the undergraduates is any indication, they expect to carry on this tradition.

### ***The Metallurgist***

Young men undertake the study of metallurgy for a variety of reasons and with various purposes. Having diverse backgrounds and a multiplicity of attitudes on most subjects, they nevertheless possess two characteristics in common: an interest in the physical sciences and a curiosity about metals. Below are brief accounts of the progress and objectives of three undergraduates who are studying metallurgy at Penn State.

Hal Lee Harman, a third semester student in metallurgy, based his choice of metallurgy as a profession upon four considerations: (1) so long as our present civilization persists, metals will have to be won from their ores, refined, and shaped; (2) the current expansion of the metals industry is creating new opportunities; (3) he was interested in metals; and (4) he thought his capabilities suited the profession.

Most of Hal's courses as a sophomore are not in metallurgy itself but are intended to give him the firm background in physics, chemistry, mathematics, and certain other branches that every metallurgist needs. Along with general physics, calculus, and quantitative chemical analysis, he studies also mineralogy and mineral preparation to learn



**J. Richard Kirn, a senior in metallurgy, determining metal hardness**

about ore minerals and methods of ore concentration.

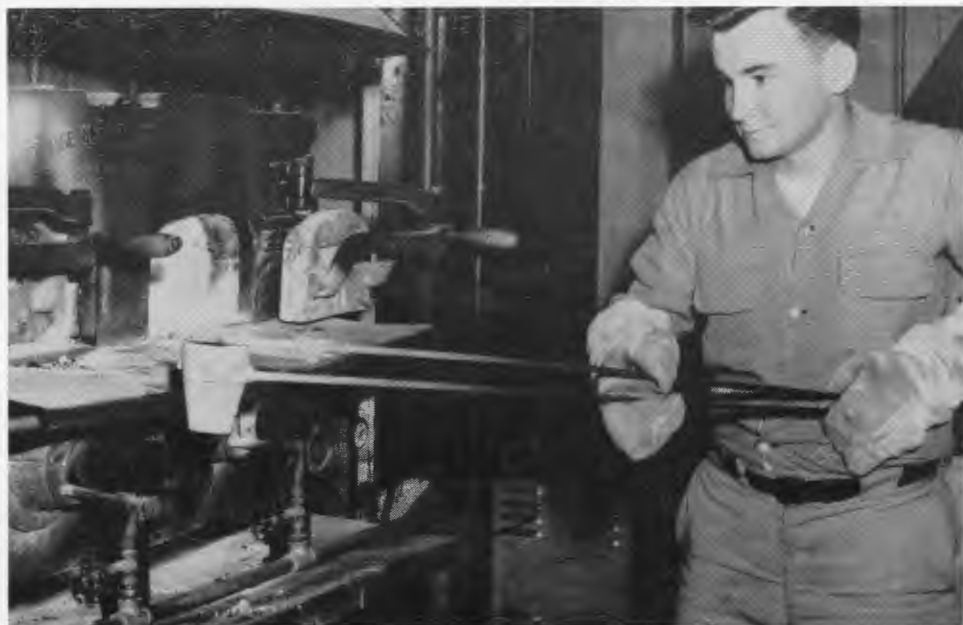
Recognizing that he has only begun to learn what he wants to know as a qualified metallurgist, Hal is already planning to work toward an advanced degree in metallurgy. He is convinced that postgraduate study "will serve to broaden my knowledge of metallurgy, thereby increasing my potential for scientific accomplishment." Not yet ready to select a particular type of job, he plans to make that decision at the end of his formal education, choosing the work he most enjoys and for which he then seems best qualified.

At the time of his graduation from high school, Charles McHugh, a fifth semester student in metallurgy, like many men of his age was quite undecided about what profession to pursue. On the basis of his high-school experience, however, he recognized his strong interest in chemistry and that sundry group of technologies which are often lumped together as "engineering."

It was that interest which influenced him to choose Penn State and to enroll in the College of Mineral Industries. Because he lives in a coal-mining community not far from the steel-producing city of Johnstown, Charles narrowed his choice to metallurgy or fuel technology. He enrolled in the latter curriculum, knowing that, because the two curriculums were almost identical in the first four semesters, he would have another two years in which to make his final selection.

During his sophomore year, Charles lost all interest in fuels, whereas his interest in metals was intensified. One fact which attracted him to metallurgy was the current demand for metallurgical graduates in the many different branches of the metals industry. He still is uncertain whether to go into the ferrous or the nonferrous field, but he is sure that he would like a career in research. He wisely plans to defer a definite decision until he is nearer graduation.

J. Richard Kirn, an eighth semester student, lives in the Philadelphia area where



**Charles O. McHugh working on junior metallurgy problem**

his father operates a small nonferrous foundry. On numerous occasions during his childhood, Richard roamed about the foundry, watching the many interesting operations. Later, he became fascinated by electricity and, for a time, that was his primary interest.

At the time of his high school graduation, Richard was faced with two problems: what profession to prepare for in college, and what college to attend. After much thought on the first questions, he decided to major in metallurgy. He concluded that the field of metallurgy was expanding at such a pace that, even if a serious recession occurred, positions would still be available for trained metallurgists. In some other engineering fields, in which the supply of trained personnel was more nearly adequate, a business cut-back could result in the availability of more engineers than positions.

After deciding on a curriculum, Richard had next to choose a school. This problem was easy, as he was primarily interested in the nonferrous field and Penn State was one of the few schools in the East offering a wide variety of courses in nonferrous metallurgy.

It was not until his third year in college that Richard was sure that his decision had been the right one. It was then that he began to see and appreciate the wide scope of metallurgy, which encompasses many other fields of engineering and pure science.

### The Ceramist

"Why did I choose ceramics as my curriculum in college? Well," says Ed Tocker of Baltimore, Maryland, "it appeared to offer a wide variety of opportunities for the graduate. I recognized that ceramics was one of America's major industries, and I learned that I could enter the research, production, or sales phases of large corporations specializing in glass, refractories, enamels, white-ware or structural clay products, depending on where my interests might be. To me that

spelled opportunity with a big O. When it came to selecting a school, I decided that Penn State not only offered a well-rounded ceramics curriculum, but also in its College of Mineral Industries provided me with close contact with students in other curriculums dealing with the study of the earth and its minerals, and that appealed to me as providing a good collegiate atmosphere."

Bob Susini, a third semester ceramist from Glassmere, became interested in ceramics in a different manner. "When I graduated from high school," Bob says, "I had no idea what I should take in college. An uncle suggested that I visit the Pittsburgh Plate Glass Research Laboratory near my home, which I did and was fortunate to have a chance to talk with the personnel manager. He told me quite a bit about ceramics, and said that Penn State was one of the leading schools in this field of instruction. That summer I worked in the lab and learned more about ceramics in general and glass technology in particular, and what I learned sold me on the idea of becoming a ceramist. There is no question in my mind about the opportunities for research and development engineers in the glass industry, and that probably applies to the other phases of ceramics as well."

"I come from a small town," says Dick Vidanoff of Ford City, "where most of the people, including my dad, some of my relatives, and a number of friends work either in a plate glass plant or a sanitary ware pottery. That has been my environment all my life, and I am beginning to realize that those ceramics plants have made my home town a thriving community. My high school biology teacher, a graduate of the University of Illinois, used to say that he wished he had taken training in ceramics—from his outside-of-the-industry viewpoint, it appeared that the opportunities for a graduate ceramist were plentiful, and those he knew in the industry were quite happy about their original choice. It appeared that way to me also, so after high school graduation I chose Penn



Ceramic student measuring drying shrinkage of clay body

State and the ceramics curriculum—the costs were within my reach, it was near home, and its reputation in the ceramics field was outstanding."

Charles E. Larsen, a fifth semester student from Altoona, admits that he became interested in ceramics while still in high school, and that this interest was encouraged by a Penn State alumnus who graduated in ceramics. "However," Charles says, "I enrolled in an engineering course at Penn State and completed my freshman year, but decided to switch to ceramics because of my interest in this field. Now I know that the change was wise, for my ceramic courses and the other general courses that I have taken in the Mineral Industries College have been most interesting and give me a feeling of being in the proper program. Of course the fact that this College is recognized for its high academic rating and is highly recommended for mineral industries training helps too—after all, I am a part of it now."

"Finances and quality of instruction were my chief reasons for choosing Penn State," according to Tom Prokopowicz, a seventh semester student from Susquehanna. "I felt that I would receive more education and instruction per dollar invested at Penn State than in any other college within my financial range. Getting into ceramics was due to the influence of a friend studying ceramics at another university, and through him I learned of the many opportunities in this expanding field. After I get my B.S. degree in ceramics, I would like to enroll for graduate work at Penn State to further my knowledge of solid state chemistry. If that is not possible, then I plan to apply for work with a company specializing in research and production of electrical ceramic bodies."

"Penn State was just over the hill from my home," says Harold Crain of Port Matilda, "so it was both natural and financially economical to attend at the main campus. My interest in ceramics was probably the result of having a refractories plant in my home town, for the character of the problems that developed in that plant and in several other nearby refractory plants indicated the need for people trained in ceramic technology. Since my enrollment in the ceramic curriculum, I have learned of the many opportuni-



Student observing reactions of ceramic materials in melting furnace



ties in Pennsylvania for graduate ceramists in research, development, production, and technical sales. My own choice after graduation is production work in the glass industry."

### *The Geographer*

It has often been thought that geography is only for the armchair traveler. This is not true, for the field has developed wide practical applications. It is possible to earn a very good living as a geographer.

Penn State students enter geography for a wide variety of reasons. As Robert Hunter, a senior from Dewey, states, "I entered the geography curriculum because I liked to travel; now I have become aware of the many opportunities in government, industry, business, and teaching." Because geography is a broad subject treating both physical and human aspects of the earth, it is attractive to students in the physical sciences as well as to those in the social sciences.

Gerald Karaska of Wilkes-Barre and Charles Schumaker of Pittsburgh like economic geography because of their interest in the way man utilizes the earth's natural resources. Other geography students, Walter Daron of Camptown, William Lear of Derry, and Reed J. Dunn of Dunns Station, want to enter the industrial world and use their knowledge of geography to analyze market areas, evaluate the capacity of a region to produce and consume, suggest possible development programs, and study trends and geographic shifts of population, industry, wholesale and retail distribution in relation to the needs of a particular company.

Fred Sawzyn of Chester and Ellis Harned of Paoli want to secure positions in political geography when they graduate. In order to prepare themselves to cope with the geographical problems of foreign policy which have now become so vital to our national security, they are taking courses not only in geography but also in economics and political science. Like many other geographers they hope to enter the foreign service branch of our government and see the world.

Physical geography also presents many fascinating opportunities and appeals, particularly to the outdoor man. David Young of Bethlehem and Charles Leech of Meadville



Work room for making maps

are emphasizing courses in physiography and soil geography as a result of their desire to work on either state or federal topographic and soil surveys. Regional climatology, which deals with the elements of weather and why climates vary from one place to another, is the special field of interest for Iola Ragins of Philadelphia and Joseph Gregory of Ford City.

Other students, such as Althea Rector of Glenshaw and Arthur Getis of Philadelphia, are preparing to become cartographers. You need not necessarily be artistically inclined to enter this field, for many cartographers are employed in the compilation of maps, after which a draftsman draws the map for final reproduction. Combined with map making is the new field of aerial photo interpretation which has attracted David Albert of Latrobe and Gary Shaw of McKeesport. The geographer is now using aerial photographs as an additional tool in solving problems of industrial location, city planning and rezoning, and the development of new highway routes.

These are only a few examples of the wide range of opportunities now offered by the field of geography. The field is open equally to both men and women. If you dream about far away places, if you are interested

in the patterns that nature unfolds before you as you drive across the countryside, if you wonder why the rest of the world is different from your own neighborhood, then you may find that geography is the career for you.

### *The Meteorologist*

A typical meteorology student tells how he feels about his curriculum in the following letter to a friend:

Dear Joe:

I was glad to hear that you will graduate from high school this year. Well, here is the information you asked for, regarding the reasons why I came to Penn State and selected meteorology as a curriculum, and what the work is like.

After graduation from high school, I had a chance to visit quite a few campuses. Honestly, there are few that can match Penn State's for beauty. The dorms are really luxurious, the classroom and laboratory buildings are modern and well kept, and there are ample facilities for recreation. Another important reason for my choice of Penn State was that expenses for living and tuition are much less than at most other universities of this size and standing.

As regards my curriculum choice, I can tell you that any young man or woman with an interest in natural or physical sciences or engineering will find meteorology a fascinating field of study. Meteorology is still a fairly young science and so has something of a pioneering spirit and adventurous appeal. I don't mean by this the types of jobs available at U. S. weather stations, in the white wastes of the Arctic (summer jobs in Greenland for a couple of our students are available every year), or those on lonely mountain tops. Rather, I mean the almost unlimited topics for study and research and the many as yet untapped possibilities for applying meteorological knowledge to various human activities.

The meteorological curriculum is no snap, but likewise, requires nothing that you can't get if you only make the effort. The first two years you take mostly English, math, and



A group of students in a geography laboratory



Professor demonstrates cloud behavior

several science courses. You also have a number of electives, and at a university the size of Penn State, there is an enormous choice of subjects to take.

Although the staff members of the Meteorology Division keep in touch with us, it is not until the junior year that we get our first courses in the major subject. The enclosed snapshots show you part of my instrument class conducted at the weather station on the roof of the Mineral Industries Building, where our observation work is done. The other picture shows some of the research work that I am helping with. Incidentally, the Division has quite a few research projects, and the better students have an opportunity to earn money in their spare time as technical assistants.

We have a very thorough training in all the theoretical and practical aspects of the subject. In our last semester we have to make public forecasts over the University radio station, and we certainly get a good taste of the public reaction to a sour forecast. We learn quickly that way!

Naturally, I am very busy, but I still find time for lots of outside activities. I am an officer of the student chapter of the American Meteorological Society that has regular meetings, and sponsors speakers here. Sometimes the faculty members take us along to national meetings where we have the chance to talk to the men in the field. Last September I went to Toronto, where the American and British Meteorological Societies got together, and met many interesting and well-

known figures from this field.

Of course, there are many other clubs and societies on the campus. I always enjoy the Concert series and all the other musical events. There is really something going on every night in the way of popular lectures. Also there are plenty of plays and shows on the campus and in town, dances and other social events, and, of course, plenty of sports events.

I will graduate at the end of this semester, and after considering the various opportunities, I have definitely decided to stay on for graduate work. I could have had my choice of a number of jobs, for instance, with the U. S. Weather Bureau, or with private meteorological consultant firms, either in this country or abroad. There are many industrial firms, state governments, and federal agencies that hire meteorologists. I also understand that more and more radio and television broadcasting stations are employing meteorologists.

Just the same, in spite of all these employment opportunities, I applied to the graduate school of this and two other universities and was given offers of graduate assistantships. In this last year, when I helped on some division projects, I found out that I really want to do research, but for this I must have more research experience and an advanced degree.

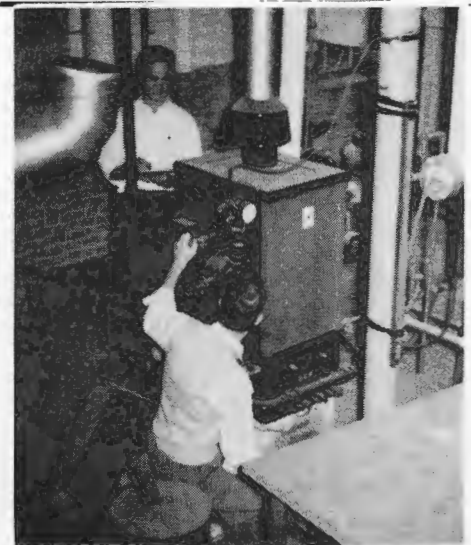
I hope that I have given you the information you will need to decide what you want to do. With best regards, I am,

Sincerely yours,

Lowell

### The Fuel Technologist

It was during a lab period that the bull session started among some seniors on the opportunities in the fuel technology field.



Students measuring efficiency of combustion apparatus

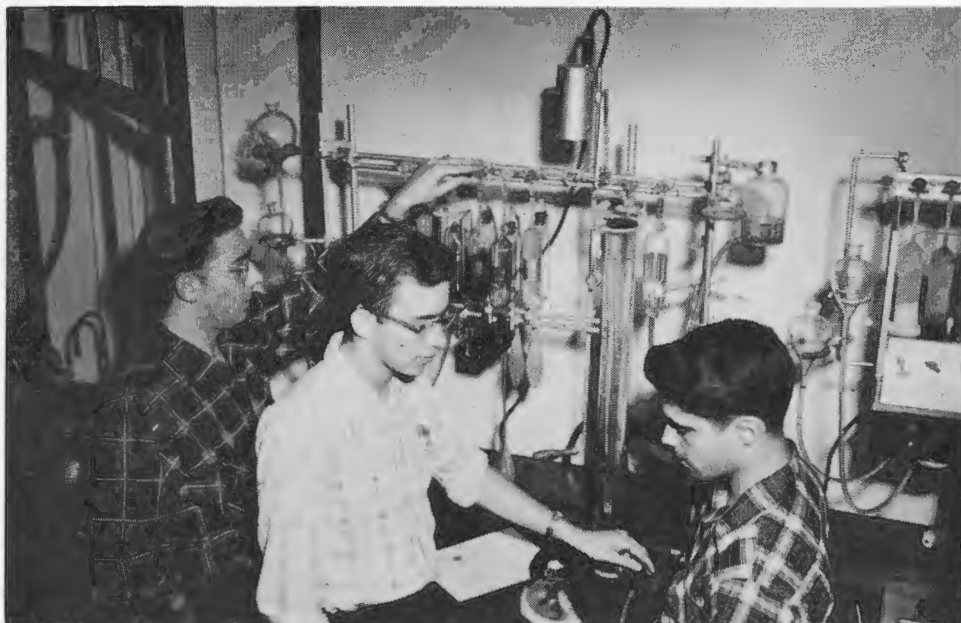


Students observing winds by use of pilot balloon

Don Frey had the floor and was quoting some statistics from a recent survey among graduates in the fuel technology curriculum.

"You know," he said, "those fellows represented 65 different job titles in 80 different companies of over 20 basic manufacturing industries. And the jobs ranged from applied chemistry and engineering to research





Students determining the quality of fuel gas

and design, not to mention service and sales engineering."

"That last one is my choice," said Tom Elston. "Selling appeals to me, and the technical training I've been getting will give me just the background I need to make the most of it."

"Me, too," said John Tihansky, "but not as a salesman. I'm going into the purchasing of fuels somewhere."

Don, however, voiced a different ambition. "That may suit you, but as for me, I'm going into lab work. I had a taste of it last summer on that job the department got for me with a coal chemical laboratory in the steel industry, and I got quite a kick out of applying some of my basic training in math, chemistry, and physics to the fuel problems that came up in the company operations."

Nearby, Don Michelson of Boston, who was running a sulfur analysis on a coal sample, and Jim Lander of Lebanon, who had just finished measuring the viscosity of a motor oil, decided their views on the subject were important too. Both started to speak, but Don got there first.

"Maybe what I'm doing right now doesn't add up to what I want to do later," said Don, "but my aim is to work in the oil industry, and knowing something about coal is probably good stuff to have. Anyway, I have several job prospects lined up, and they give me quite a choice on where I want to work."

"Now that you fellows have spouted off," said Jim in a semi-serious voice, "let me tell you where the great opportunities lie. Combustion engineering, that's where! The fastest growing use of fuels in our generation is going to be in the electric power field. That's the reason I decided to take fuel technology, because it would give me what I need to take any one of a number of jobs in the combustion field. Why, they are just crying for combustion engineers, service engineers, design, development and research engineers. And don't forget, the pay is good and the chance for advancement can't be beat."

Grant Lesoine of East Stroudsburg, who had been running a distillation test on gaso-

line, had also been keeping one ear turned toward the conversation. Like the others in the group, he would be getting his degree shortly, and the discussion of job opportunities impelled him to give his ideas on what comes after graduation.

"It certainly is nice to think of that job and the pay and the chance to do all those things you've been wanting to do for the last four years," said Grant, "but have you considered the value in taking graduate work and earning an advanced degree? I would like to do research on the chemistry of coal—you know, that the most amazing storehouse of tomorrow's products—and I feel that graduate training will qualify me to dig into that storehouse and come up with something really valuable."

"Back to your work, fellows," whispered Don Frey, "here comes the Prof."

"Take it easy, boys," cautioned the Professor. "Couldn't help overhearing you as I came in the door, and maybe what you've been discussing is just as important right now as finishing that lab experiment. What's the consensus on the best field for fuel tech grads?"

"I reckon there isn't any best field," Tom Elston answered. "It looks like we have chosen the best field for each one of us, and that's what counts."

### The Geophysicist and Geochemist

"I chose geophysics as my program of study because it included such courses as math and physics which I enjoyed in high school," says Dean Porterfield of Murraysville. "Now that I am within a year of getting my B.S. degree, I am more than glad to have picked geophysics. There seem to be plenty of good jobs open in the various phases of geophysics, I will have a choice of working in an office or out in the field, and the application is so broad that anyone with a technical aptitude can certainly find a place in this field of work."

Dean should know what he is talking about, for he and most of his classmates had summer jobs doing geophysical work for oil companies last year. The need for trained technical men in this type of work was certainly impressed on the group. As Bob Wylie of Philadelphia put it, "Ten jobs per man, not ten men per job."

Bill Stambaugh of Wellsville who liked chemistry in high school finds that geochemistry is attractive because "it is a new wide-open field with plenty of opportunities." As the name implies, this curriculum contains lots of geology, mineralogy, physics, and



Geophysics students measuring the pull of gravity

chemistry, and thus is not specialized for a particular job. Don Smith of Bethlehem chose geochemistry because he could easily "change his major to one of the other applied sciences without much loss, which gives a feeling of security and removes the fear of possibly having chosen the wrong career." This is true of geophysics also, for both programs provide a broad background of basic scientific knowledge useful in any field.

Both geophysics and geochemistry appeal to the outdoor man. "For me the thought of being shut up in a laboratory or office all day, year after year, is repulsive," says John Rowland of State College. Few fields of employment offer as much opportunity for travel and outdoor work coupled with daily use of complex technical apparatus. Geophysicists study such things as the earth's magnetism, earthquakes, volcanoes, and electrical currents in the ground. By setting off explosions and listening for echoes from deep beneath the surface, they prospect for oil and hidden mineral wealth. They are also employed in such varied occupations as planning highways and damsites, and surveying glaciers and the polar ice caps. Geochemists measure the earth's age by studying the decay of the radioactive elements, they engage in prospecting for valuable ores, and they learn how rocks and minerals are formed by making laboratory investigations at high temperature and pressure.

Qualifications for a career in these fields are an interest in the world about us and a liking for field and laboratory work. The petroleum and mining industries are crying for many more men than are currently being trained. Jobs are plentiful in government service as well as private industry and consulting work. Advancement is rapid; and most important of all, it is fun to work with all sorts of complicated physical and chemical apparatus, and to study the world about us.

### **The Mineral Preparation Engineer**

A typical mineral preparation student says:

I suppose all of us daydream a little at one time or another, and wish that we could win that big prize in the "match the name and face" or some other kind of contest—something like the idea of finding the pot of gold at the end of the rainbow. It's a harmless sort of pastime as long as you don't spend too much time on it. There are ways, though, in which you can fill your own pot or purse or bucket with gold, and not only enjoy the fruits of your labor but enjoy the labor itself. As a typical min prep student, which is short for mineral preparation, I'd like to tell you about our work and what it means to us—and perhaps you, as a potential enrollee at Penn State, will find a meaning that applies to you also.

That pot of gold idea is probably more closely linked to mineral preparation than most people realize. For example, back in the gold rush days in California, many a miner "washed" gold out of the sands of certain streams, and that was separating the valuable material from the worthless, which



Min prep seniors: Alexander Davidson, Barnesboro; Daniel Jacobs, Lansford; John Hudy, Lansford; John Warfel, Drifton; Robert Hamilton, Indiana

is just what we do in mineral preparation. Today, though, our gold may be coal, iron ore, manganese, or a host of other minerals in great demand by the markets of the world. The specialist who works on these recovery problems and produces results is the mineral preparation engineer, and that is what we min prep students are training to be.

This is engineering work, and if you plan to take the min prep program you ought to be the kind of student who likes math, chemistry, and physics, for that is the basic training we get before plunging into the strictly preparation courses. In the upper classes we learn how to apply basic scientific principles to the task of upgrading poor quality ore deposits, and that is important because they tell us the better grade deposits of most minerals in this country have been depleted and we must work with low-grade ores from now on. Of course that spells opportunity for the graduate mineral preparation engineer, and those of us who expect to graduate shortly aren't worried about having plenty of jobs to look over.

The other day I was discussing this matter of job possibilities with one of our professors, and he said that we were qualified to go into production or the actual control of a preparation process, or into research where we could develop better methods, or even into the sale of equipment where our background of preparation knowledge would be invaluable. And after we get some experience, we could even do consulting work.

I was going to add some comments from min prep students as to why they took this work, but it all added up to about the same thing: "It gives us the kind of work we like, and the job opportunities appear to be unlimited." So instead, I decided to run a picture of five seniors in the mineral preparation curriculum to show you the kind of fellows we have in our department. We'll be happy to have you join us when you come to Penn State.

### **The Mineral Economist**

My name is Dick Crosby, and I'm a senior in the mineral economics curriculum. If you take a look at the picture which shows four people working with some calculating machines, I'm second from the left. I'm to tell you about the min ec curriculum, so let's see if I can get the idea across to you in the limited space they've given me.

I found that one of the tougher problems you have to face when you decide to go to college is what curriculum to take. Now if you like math and the sciences, you will probably choose an engineering or technical career and, as everyone knows, there are plenty of opportunities for graduates in those fields. Going one step further, you may be interested in the mineral industries—then one of the curriculums in the College of Mineral Industries should be what you want. But if you don't like to tie yourself down to work in production or research but want to get into the business end of a mineral industry, the min ec curriculum will be where you belong—for it is a course in business administration for the mineral industries.

Most of the men who have graduated in min ec started out in some other curriculum in Mineral Industries and then found their interests were less in technical problems and more in business management. They had the sense to see, though, that they couldn't do a job as an executive in a mineral industry unless they had an idea of the scientific and technical problems which that industry had to overcome. So, instead of transferring to a different college and giving up technical training, they got into the min ec curriculum. Maybe you still in high school can play it smarter than most of us did who are in min ec now—you have the chance to start out in min ec and get through the four year program without the lost motion of those of us who didn't know about min ec until we had been at Penn State for a year or two.

When I was home the other week-end,



Lab section in the analysis of mineral data

some of the fellows I know who are still in high school were talking to me about what they thought they might take in college. Several of them who were doing well in math and science were interested in some sort of scientific or engineering training, but they weren't at all sure of just what field to get into. I told them that they ought to give the idea of getting into one of the mineral industries a whirl—that they'd better find out just what went on in each of them before they picked one to spend four years on. But I also let them have the word on mineral economics—that if they thought they were the executive type and liked to write, that they had better think about ending up in the office instead of the lab and get there by taking the min ec curriculum. Min ec certainly isn't for everyone who gets into the M. I. College—there are lots of you fellows who will like lab or field work—but for anyone who wants a business career in a field that is wide open to a good man, let me suggest that you give some thought to Mineral Economics.

Perhaps you would like to know how we go about getting all the courses I have mentioned into four years at Penn State, how we get our technical and business training without spending too much or too little time on either of the two. In the freshman and sophomore years we take the same basic-scientific courses that all students in the Mineral Industries College do. In the last two years, however, we are given courses in all of the fields of mineral technology and engineering, and we also take courses in accounting, business law, and statistics.

After we get our bachelor's degree, deciding what we want to do is made easy or hard, depending on how you look at it, by the large number of job offers we get. Some time ago I checked into the kinds of jobs that min ec graduates get and found that they were doing all kinds of things—production, management, purchasing, sales, government service, education, research, publishing, and many others. In each of these jobs, the proportion between the need for technical and for business training was different,

but in each the training of the min ec graduate came much nearer providing the proper background than any other curriculum would have done. That information gave me a comfortable feeling—I know I'll be able to look around and pick the job I really want rather than have to hunt for any kind of a job at all.

You've probably heard that you've got to have an advanced degree in many fields; for some types of work in min ec that is true, but most of our graduates meet the requirements of prospective employers after they have finished the normal four-year course. Some of us majoring in min ec however, have thought a good deal of taking graduate work next fall because it gives us a chance to get advanced training both in min ec and in the particular phase of mineral engineering or technology that we like most. When we get an advanced degree we are considerably more specialized and limited in the choice of an industry in which to work but, at the same time, we are fitted for a better job than when we finished our first four years. Graduate work then seems like the thing for the fellow who knows just what he wants to specialize in, but the min ec graduate who wants to find out as soon as he can what makes the mineral industries tick can get into business as soon as he has his B.S.

If you are planning to come to Penn State next year or shortly thereafter, and want to get more information than I've been able to give here, I'm sure that the min ec division staff members will be glad to talk with you and help you decide whether the min ec program is what you should take. As far as I am concerned, it fits the bill, but of course I'm a bit prejudiced since I've been through it.

## Student Honorary and Professional Societies in the College of Mineral Industries

After you have been in the College of Mineral Industries for a while, you will find that your chosen field offers more than merely attendance at classes and occasional consultations with your instructors and advisers. In nearly every curriculum there are either professional or honorary societies through which it is possible to get to know the students and faculty in your curriculum on a basis far less formal than that which prevails in the classroom. These societies sponsor educational programs for which distinguished speakers are obtained either from kindred fields on the campus or from your own field in other universities and in industry. Not the least of the activities of the organizations are the social functions which either follow the technical programs or are the entire purpose of the meeting.

There are also several societies whose membership is chosen from a number of fields in the Mineral Industries or from the entire range of scientific endeavor or even from all branches of scholarship. Through membership in such groups, you can make contacts with people working in subjects far removed from your own; you have the chance to find out something of what interests other people.

The requirements for membership in the various societies vary widely from simply an interest in the field of the society's specialization to the most rigid standards of scholarship and scholarly attainment.

The honorary society to which you, as a student in any of the curriculums of the College of Mineral Industries, are eligible to become a member is Sigma Gamma Epsilon. You are eligible for admission to this society if your grades average 2.0 or better (out of



Honorary and Professional Society Keys



a possible 3.0) and if you show promise of making useful contributions in your future work in your chosen field.

If you major in any of the Earth Sciences, you are eligible for membership in the Penn State Mining Engineering Society, which is the student chapter of the American Institute of Mining and Metallurgical Engineers (A.I.M.E.), although you will find this Society most valuable to you if you are in Geology, Mining, Geophysics, or Geochemistry. The Penn State chapter, as its name indicates, is sponsored by the Division of Mining Engineering, but you are welcome to join it, no matter what the curriculum in which you are enrolled; the requirements for membership are simply that you be a student in good standing in the College of Mineral Industries.

If you take work in Geography, there are two societies of which you may become a member. The first of these is the Penn State Geographical Society which is open to any student who majors or minors in Geography. The second is Gamma Theta Upsilon which is open to you if your grades are good.

The Division of Meteorology sponsors a student chapter of the American Meteorological Society which invites to membership not only all students in the Meteorology curriculum but also any others who have an interest in that field.

If you are in the curriculums in Mineral Engineering, you may be selected for Sigma Gamma Epsilon, and you also are eligible for membership in the Penn State Mining Engineering Society. The Division of Petroleum and Natural Gas Engineering sponsors the Petroleum Engineers Society which is open to all members of the Division. Like the Mining Engineering Society, the Petroleum Engineers Society is affiliated with the A.I.M.E. This division also has a chapter of the national Petroleum Engineering honorary society, Pi Epsilon Tau, to which you may be admitted in either your junior or senior year if your grades are good enough. The divisions of Mineral Economics and Mineral Preparation do not have societies of their own, but if you are in either of these curriculums, you are eligible for membership in the Mining Engineering Society and in Sigma Gamma Epsilon.

If you major in any one of the Mineral Technologies, good grades will insure your election to Sigma Gamma Epsilon. In the Division of Ceramics you will find two student organizations which you may join. The first of these is the Penn State Branch of the American Ceramic Society which offers membership to all undergraduates majoring in ceramics. The second is Keramos which is the Ceramics Professional Fraternity and to which members are elected on the basis of their scholastic ability.

The Division of Metallurgy sponsors the Penn State Chapter of the American Society for Metals, and membership is open to all undergraduate students in the division. The Division of Fuel Technology does not have a student organization of its own, but if you are one of its undergraduates you are welcome in the Penn State student chapter of the A.I.M.E.



The Faculty of the College of Mineral Industries

A number of the highly respected national honorary fraternities have chapters at Penn State and select outstanding undergraduates who meet their strict requirements for election to membership. These include Phi Beta Kappa, Sigma Xi, Tau Beta Pi, Sigma Tau, Phi Kappa Phi, and Phi Eta Sigma.

### Scholarships and Financial Aid Available to Students in the College of Mineral Industries

A number of scholarships and loan funds are available to deserving students of The Pennsylvania State University. These are described in a bulletin entitled "Student Aid," which can be obtained by writing to the Office of the Executive Accountant, 110 Old Main, State College, Pa.

In the College of Mineral Industries special scholarships are offered in each department and several are awarded on a College-wide basis. In the Earth Sciences, the President's Special Scholarship of \$1000 is awarded each year in two fields, Geology and Geophysics. In each field one student is chosen for the award at the beginning of his sophomore year, who has been outstanding during his freshman year. For students interested in the various facets of the petroleum industry the Edwin L. Drake Memorial Scholarships are offered. These carry stipends covering full tuition for four students in Petroleum Engineering, Geology, or Mineralogy. The Lane-Wells Scholarship, which is a \$500 grant to a deserving undergraduate student in Petroleum Engineering, is another example of the type of scholarship avail-

able to those interested in the discovery, extraction, and utilization of oil. For students in the Metallurgy curriculum, the American Society for Metals Foundation for Education and Research have provided a scholarship in the sum of \$400.

In recognition of high scholastic attainment a series of awards are made each year. An example of these which can be cited is the William Grundy Haven Memorial Scholarship of \$250 which is awarded each spring to an outstanding fifth, sixth, or seventh semester student. Another similar award is the Jerome N. Behrmann Scholarship of \$100 which is given to a graduating senior in the Meteorology curriculum who has been admitted to a graduate school.

In addition to the scholarships and awards of the type described above, the Rugh Fund provides a source of financial support which has benefited numerous undergraduate and graduate students. This Fund was established by E. W. Rugh '29 of the Garfield Refractories Company of Bolivar, Pennsylvania. Its use has been three-fold: (1) to render financial assistance to students in difficult financial straits; (2) to recognize and encourage high scholarship through a series of awards made each semester; and (3) to aid in the support of research programs being carried out by undergraduate and graduate students in the College of Mineral Industries.

These and other opportunities for obtaining financial assistance serve as important factors in enabling many students to complete a university career even though their own source of funds may be limited.