REPORT ON THE COLLEGE OF ENGINEERING

SEOUL NATIONAL UNIVERSITY

Seoul, Korea

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Seoul National University Cooperative Project

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REPORT ON THE COLLEGE OF ENGINEERING

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W. W. Staley*

INTRODUCTION

Early in the fall of 1955, Dr. Tracy F. Tyler, Coordinator of the International Cooperation Administration-University of Minnesota-Seoul National University project entered into correspondence with the writer to determine if he would be available for an assignment in Korea. Dr. Tyler had learned of this possibility through Mr. C. Tyler Wood, then Economic Coordinator for Korea. Mr. Wood had been informed by Mr. L.G. Nonini, Chief, Mining Division, United Nations Korean Reconstruction Agency that the writer would have a sabbatical leave from his duties as Professor of Mining at the University of Idaho and would be interested in considering an appointment to Korea. A similar tour had been spent with Mutual Security Agency-University of the Philippines in Manila during 1952-53. Later in 1955 the arrangements were completed for spending 12 months in Korea. The University of Idaho very kindly converted the sabbatical to a leave of absence in order that the appointment from the University of Minnesota could be accepted. This report will cover the period beginning June 25, 1956 and ending with the fiscal year, June 30, 1957, inclusive.

The underlying purpose for the arrangement between the University

*Adviser in Engineering to Seoul National University under International Cooperation Administration contract of Minnesota-International Cooperation Administration-Seoul National University of Korea to provide technical assistance and rehabilitation for, among other projects, the College of Engineering. The writer's object in going to Korea was to continue providing to Seoul National University and to Dr. Arthur E. Schneider, Minnesota's Chief Adviser on the project, the kind of assistance that had been started by preceding University of Minnesota Institute of Technology members of the contract team. Originally, the work was to be confined to the mineral industry field (Mining and Metallurgy Departments). Later, because he would be, at the time, the only long-term adviser to Seoul National University in the engineering field, the writer was assigned as Engineering Adviser to the entire College of Engineering, excepting such departments that would, from time to time, have a specific representative from Minnesota.

The general plan of action for University of Minnesota staff members serving on the cooperative project in Korea is for them to learn the fundamentals of organization and administration of Seoul National University, with particular reference to the component with which they are concerned and its relationship to the whole; to become personally acquainted with their Korean colleagues and leaders in the technical area or areas concerned; to familiarize themselves with the details of curricula, courses, teaching methods and procedures currently in effect in their areas; to become acquainted with the kind, amount and quality of research undertaken; to learn of the major problems affecting teaching and research in their areas; to establish appropriate liaison with technical societies or agencies in their technical fields; to avail themselves of every opportunity to gain first-hand knowledge of the country, its people and their aspirations, potentialities and limitations; and, through all of the foregoing to carry out to the best of their ability the contract objective of assisting Seoul National University to improve its teaching and research in the fields of their responsibility.

Briefly, within this framework the writer's major efforts became (1) to act as a liaison between the office of the Chief Adviser (Dr. Arthur E. Schneider) and the Dean of the College of Engineering (Dean Hwang, Yung Mo); (2) specifically, to consult with the Mining and Metallurgy Departments concerning equipment and supplies, curricula for the same two departments, arrangement of laboratories, etc.; (3) within the limits of his familiarity with their particular fields to lend assistance to the various other Departments in the College of Engineering; (4) to lend assistance and give advice in any way which would speed up the rehabilitation and physical improvement of the College; and (5) to help promote relations with industry.

During the writer's 14 months in Seoul an almost daily opportunity has occurred for lending assistance along the channels outlined. No further amplification, at this point, is necessary; as the report develops the reasons will become apparent.

Duties, so far as the assignment is concerned, began om June 25, 1956, the day of arrival in Seoul. They ended on August 23, 1957, the day the writer left Seoul on his return to the States. An indoctrination period of 5 days was spent at the University of Minnesota in early May, 1956. While there advice and help were given by Dr. Tyler, Professor Pfleider, Professor Lund, Mr. Weems, and Dean Spilhaus.

ACKNOWLEDGMENTS

The writer wishes to express his appreciation for the friendly spirit shown by all of the numerous Minnesota people connected with the University of Minnesota-Seoul National University project, both in Seoul and in Minneapolis, with whom he has been associated. Especially does he recall the kindness and help of Dr. Arthur E. Schneider, Chief Adviser, and Miss Gertrude Koll, Secretary for the Minnesota office.

At the College of Engineering the help and cooperation of Dean Hwang, Yung Mo will be long remembered. Dean Hwang is a very able administrator and the success of the project has been greatly due to his presence. Association with other members of the College faculty has been, without exception, most agreeable. In particular does he wish to mention Mr. Han, Chung Suk, graduate assistant in Mining Engineering, who eased the language difficulties and early transition stage immeasurably. The short history of the College of Engineering was materially improved through the help of Professor Nah, Ik Yung, Head of General Chemistry.

The help and patience of Academic Dean Yun, Tong Suk, Dean of Students Woo, Bum Shik, and Professor Yum, Yung Ha is gratefully acknowledged. Professor Yum represented the College when discussing procurement matters. The writer is indebted to the Mining Division of the United Nations Korean Reconstruction Agency for helping to arrange many of the field trips and especially wishes to mention Mr. L. G. Nordini.

It is with regret that the end of the writer's associations draws near. He wishes the College of Engineering a prosperous and successful future and fully expects that such will be the outcome resulting from the University of Minnesota program with Seoul National University.

HISTORY OF THE COLLEGE OF ENGINEERING

An attempt to compile information giving the history of the College of Engineering proved rather difficult. Written or published data are very rare. That found was somewhat disconcerting in that exact dates were not always given. Two semi-publications were available. They are:

1. A Summary of the History of the College of Engineering, Seoul National University, issued by the College of Engineering (1956)

2. A List of Mining Alumni from 1919 to 1956, Mining Department, College of Engineering, issued by the College of Engineering (1956)

The translation of the above literature from Korean to English was made by Mr. Han,Chung Suk, a graduate assistant in the College of Engineering. Mr. Han has very ably and kindly assisted the writer ever since starting his duties at the College. Also acknowledged is the very considerable help with the final checking by Prof. Nah, Ik Yung, Professor of General Chemistry. Professor Nah graduated from Seoul Technical College about 28 years ago. He has very kindly supplied correct names and dates explaining the numerous changes. It is through his efforts that a true perspective has been developed.

Seoul College of Technology was founded by the Japanese in 1916. It was located at the Central Research Laboratory which is presently near the College of Law and the College of Fine Arts buildings on the main campus. Originally, the buildings of these two Colleges were part of the Seoul College of Technology. The College opened with the following five departments: Textiles and Dyeing, Applied Chemistry, Ceramics, Civil Engineering, and Architecture. It should be mentioned at this point that at some later rather indefinite date, the original Seoul College of Technology became known as the Seoul Technical College. (The Technical College was renamed the College of Technology in 1944). The original College of Technology was indiscriminately referred to as the Technical College).

The College officially opened for students on the 25th of April, 1916. Mr, Masato Toyonaga was appointed the first Executive Dean by the Japanese Government.

In 1917 a Mining Department was added to the Seoul College of Technology. During December, 1919, Dr. Kisaburo Miyama was appointed to replace Dean Toyonaga. In March, 1922 the name was changed to Seoul Technical College. A month later some rearranging of departments was undertaken. The Department of Applied Chemistry was subdivided to include Ceramics (dropped as a separate department), Dyeing, and Applied Chemistry. The Mining Department remained unchanged.

During June, 1930 Dean Eikichi Yamamura was appointed as Administrative Officer. In April, 1938 the Departments of Mechanical Engineering and Electrical Engineering were added. Also at this time the Department of Mining was subdivided into Mining and Metallurgy.

About April, 1939, the Seoul College of Mines was completed and opened for students. Its location was the present Mining Compound, or Building Number 5, on the College of Engineering Campus. The Departments of Mining and Metallurgy were now established in the new

College of Mines. (Construction of the Seoul College of Mines probably started in about 1936 or 1937). This separate College of Mines was established by the Japanese to educate and train engineers for developing Korea's mineral resources. It was apparently realized that a serious need would soon be felt for increasing mineral production. They were somewhat remiss in not having made the decision earlier, as later events tend to indicate. A very hurried and insufficient job of mineral investigation and exploration was the result.

The first Dean of the Seoul College of Mines was Mr. Ichitoku Koyama.

All of the remaining Departments of Seoul College of Technology, with the new Department of Telecommunications, Motive Power, and Electrochemistry, remained on the main campus at the Central Research Laboratory.

The Seoul Technical College offered a three-year course. At the time the Seoul College of Mines opened, 12 Juniors and 30 Sophomores were transferred from the Technical College to the College of Mines.

In February, 1941 Mr. Kanichi Omori was appointed Dean of the College of Mines.

The structures at present occupied and known as Buildings 1, 2, 3, and 4 were apparently occupied about 1941. Just when construction was started for this group of buildings is uncertain. They housed the Keijo Imperial University Science and Engineering Departments.

After Liberation in 1945, the former Seoul (Keijo) Imperial University Science and Engineering Departments, the Seoul College of Technology (formerly known as the original Seoul College of Technology or Seoul Technical College) and the Seoul College of Mines were combined.

to form the present College of Engineering, a division of the larger Seoul National University. This adjustment took place during October, 1946.

Apparently, during the late summer of 1950 the Mining Compound (Building Number 5) was damaged by United Nations bombing and by the retreat of the North Korean Communist Forces following the landing of United States Forces at Inchon. About 1951 Seoul National University was temporarily located in Pusan. The present University buildings were either damaged beyond occupancy or were occupied by units of the United Nations Forces. For over two years the College of Engineering was temporarily located in Pusan. In September, 1953, Seoul National University was returned to Seoul. The College of Engineering, however, had to occupy temporary quarters in part of the College of Education buildings because the United States Army was still using the main group of buildings about 14 kilometers (8 miles) east of Seoul. The rest of the University returned to their former quarters. About July, 1954, the College of Engineering finally reoccupied its own buildings on the present campus.

The first mining graduates from the Seoul College of Technology were Kim, Kie Dok and Yun, Sung Sun in 1920. Mr. Kim is now President of the Coal Association of Korea and was a former Vice-President of Dai Han Coal Corporation; Mr. Yun is President of the Mining Association of Korea and is also a member of the National Assembly.

The first graduating class from Seoul College of Mines was in 1940. There were four graduates in this class. At present (1956) they are occupied as follows:

Son, Pyong Chang is now head of the gold refinery, Mukuk Gold Mines, Kubong, Chungchong-namdo

Song, Sung Yul is an employee of Won Chon Trading Company, Seoul

Ko, Tai Ok - address and occupation are unknown

Yun, Tae Kyu is deceased.

Among the many outstanding graduates since the founding of the Seoul College of Technology may be mentioned, in particular, Dr. Kim, Hyon Chul, until very recently Minister of Reconstruction and Economic Coordinator for Korea, and former Minister of Finance. Dr. Kim, who has again been appointed as Republic of Korea Minister of Finance, graduated in Mining Engineering in 1922 from Seoul Technical College.

The first graduating class from the College of Engineering following Liberation was in 1947; two men were graduated.

Since 1940 (the first class from the Seoul College of Mines) 282 mining majors have graduated. About 30 in mining engineering graduated with the 1957 class of Seoul National University.

Data for the mining and metallurgy classes of 1955 and 1956 indicate that the graduates are either employed in mining or are serving in the Korean Armed Forces.

Following graduation, the young mining engineers are invited by the mining companies to take an oral and written examination for prospective employment. The best qualified applicants are then selected and offered employment. Starting pay ranges from 30,000 to 40,000 Hwan per month. At the end of about a one-year apprenticeship it is customary to increase salaries by 5,000 to 10,000 Hwan per month. Employment is accepted in the engineering, mining, metallurgy, or office branches of the mineral industry. The companies arrange living conditions so that expenses are quite reasonable for single men. If the employee is married his starting pay is somewhat larger and a food issue is given him in addition to housing. The government-operated metal mines usually make a more attractive offer than do the coal mines. Privately owned and operated mines provide much better pay and living conditions.

There should be mentioned, in connection with the foregoing description of Seoul National University's College of Engineering, several other institutions in Korea in which an engineering education may be obtained. These other educational centers apparently offer about the same variety of training.

In Seoul is located the Han-Yang Institute of Technology, a private institution with an enrollment of about 1,000 students. This college was founded after Liberation. At Inchon is located the Inha Institute of Technology. The enrollment is also about 1,000. This privately run institution has been in operation for four years.

And finally attention is called to the government-operated (with both national and provincial support) universities in each of the provinces excepting Kyonggi-do and Kangwon-do. Four of these institutions include in their College of Engineering a department offering courses in the mineral industry.

In 1957 the College of Engineering of Seoul National University was under the administration of Dean Hwang, Yung Mo. Assisting Dean Hwang are Academic Dean Yun, Tong Suk, and Dean of Students Woo, Bum Shik.

INSPECTION TRIPS

A very necessary adjunct to aiding mineral industry education was to obtain, as rapidly as possible, familiarity with the mineral resources (natural resources in general) of the Republic of Korea. Early after arriving plans were evolved for visiting several of the leading mining operations. In fact, the evening of the third day following arrival in Seoul the opening opportunity arose for an introduction to mining in Korea - this was the dedication and transfer ceremony of the Taejon Mineral Assay Laboratory at Taejon in Chungchong-namdo.

The advantage of this and later trips for gaining a firsthand understanding of problems which would sooner or later face educators at the College of Engineering can hardly be over-emphasized. In fact, the fullest advantage for helping in Korea is best gained from an early use of inspection trips regardless of the field of interest. Following are listed the places visited while in Korea. In a later section a summary will be given for each. (See map at conclusion of report for locations).

1. Mineral Assay Laboratory, Taejon, Chungchong-namdo.
2. Coal fields at Macha-ri, Hambaek, and Changsung; tungsten mine at Sangdong; all in southern Kangwon-do.
3. Taechon-ni Gold Dredge development near Mokpo, Cholla-namdo.
4. Ku Ma Gold Mine, in extreme eastern Kyongsang-pukto.
5. Changhang Copper Smelter, Chungchong-namdo.

May 11, 1957 until May 25, 1957 was spent in Japan. Four of these days were devoted to attending the United States-Japan Joint Atomic Industrial Conference in Tokyo. The remaining time was spent in visiting several universities offering degrees in mining and metallurgy, and also inspecting a copper smelter and adjoining operations. The inspection trip to Japan was taken in the company of College of Engineering Academic Dean Yun, Tong Suk. The conference attended institutions and mining company visited in Japan are given below:

1. United States-Japan Joint Atomic Industrial Conference, Tokyo
2. Tohoku University, Sendai
3. Kyoto University, Kyoto
4. Hitachi Mine, Nippon Mining Company, Ltd., Hitachi.

LECTURE COURSES OFFERED BY ADVISER

At the request of the Mining Department the writer delivered a series of lectures for two semesters. The subject matter discussed was suggested by the head of the mining department. During the period September, 1956 to January, 1957 a one-hour per week discussion of Mining Methods in the United States was undertaken. During the interval April, 1957 to July, 1957 two hours per week were devoted to discussing the solution of a special mining problem.

Most of those attending the classes were senior students. A few graduate students and an occasional instructor listened in.

Mining Methods in the United States (Outline of lectures given)

A. Unsupported stopes

1. Small open stopes

2. Shrinkage stopes

a. Narrow veins

b. Wide deposits with pillars

3. Sublevel stoping

B. Partially supported stopes

1. Room and pillar

a. Irregular pillars

b. Regular pillars.

C. Supported stopes

1. Cut and fill

a. Horizontal

b. Inclined

2. Square set

C. Supported stopes (continued)

3. Stull and fill

a. With slushers

b. With timber slides

4. Sources of waste for filling material

a. Slag (granulated).

b. Sand and gravel

c. Development waste

d. Specially broken waste

e. Mill tailings

f. Combinations of above

D. Caving methods

1. Top slicing

a. Horizontal

b. Inclined

2. Sublevel caving

3. Block caving

4. Alaska-Juneau method

Solution of a Special Mining Problem

The following problem was outlined by Professor Hong, Choon Ki of the Mining Department. No attempt was made to make a formal and detailed arithmetical solution of the problem. It was discussed almost entirely from the standpoint of (1) how the information under A would be obtained, and (2) how the requirements listed under B would be met. A detailed solution of this problem would take far more than two hours per week for one semester. In self defense the writer wishes to state his awareness of the occurrence of several glaring inconsistencies on the basis of the data given in A. These were pointed out to the class and an explanation and correction suggested for them. These errors are not material to this report so nothing further will be said of them.

A. - Known Information

1. Deposit

Au-Ag-Cu-Pb-Zn bearing contact metamorphic deposit in limestone. The deposit is massive and has a chimney-like shape

Size: Diameter is 60 m. and depth is 120 m. (For other dimensions a sketch, not included here, was used)

Grade: Au, 5 g/t; Ag, 60 g/t; Cu, 1%; Pb, 8%; Zn, 10%. The gold is associated with the chalcopyrite which is the copper-bearing mineral. The silver is associated with the lead-bearing mineral galena. The zinc is present in the form of sphalerite.

Sp. Gr. of ore: 4.0

Ore blocked out: 2,000,000 MT. This was determined by diamond drilling

2. Mining

Output per day: 200 MT

Annual production: 60,000 MT

Shifts: 2 shifts of 8 hours each

Life of mine: 30 years

3. Power

33,000-volt high voltage power line passes through center of mine property. There is no limitation on the amount of power available for the mine's use

4. Water

River flows near mine at the base of the foothills. The minimum flow is 1 cu.m/sec.

5. Labor

Sufficient for all needs

6. Finances

Sufficient. Available $1,500,000 for importing machinery, tools, and supplies. For local needs there is available Hwan 200,000,000

7. Mine drainage

It is estimated that the mine will make about 100/gal./min.

B. - Required

1. Surface construction

a. Headframe

b. Ore bins

c. Hoist house, offices, machineship, warehouses, etc.

2. Mining system

3. Hoisting and transportation

Underground and surface, lateral and vertical systems

a. Cars, locomotives, scrapers, cages, skips, hoists

4. Compressed air

Drills and compressors

5. Underground construction

Support (timbering, masonry), stations, ore pockets.

6. Mine drainage

7. Ventilation

8. Transformers, motors, generators, and power lines

9. Machine shop

10. Employees

Management, supervisors, engineers, miners, timbermen, mill men, helpers, office force

11. Ore dressing (Mill).

Test work to determine flowsheet; crushing, grinding, classification, concentration (flotation, etc.), filtering; assaying

12. Disposal of concentrates

13. Disposal of tailings

SUGGESTIONS FOR CURRICULA CHANGES IN THE MINERAL INDUSTRY DEPARTMENTS

(With Additional Remarks Applying to the College in General)

The discussion to follow, the main content of the report, was assembled and given to Dean Hwang at an earlier date. This was done in order that questions which might arise concerning this very important subject could be discussed before the writer left Korea.

This section is complete in itself and the Summary and Conclusions originally accompanying it have been retained here in preference to combining them with the Summary and Recommendations concluding the rest of the report.

SUGGESTIONS FOR CURRICULA CHANGES IN THE MINERAL INDUSTRY DEPARTMENTS

INTRODUCTION

There are three principal features to engineering education or preparation for the mineral industry: geology, mining, and metallurgy. These are closely related and overlapping in the early stages of their application to the development of the mineral resources of a country. For example, the history of the development of Mining Schools and curricula in the United States closely parallels the country's industrial progress.*

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* This may be verified by consulting a series of papers which appeared in Tran. Amer. Inst. of Min. and Met. Engrs. during the early years of this century. Later, during the 1930s, a series of Mining School histories appeared in various professional journals which will also substantiate the comment. These sources of material were not available in Seoul for specific reference.

While the Republic of Korea is old, culturally, the determined development and utilization of her mineral resources are quite recent. Even under Japanese domination, southern Korea experienced not too great a mining activity. Possible exceptions would be gold and a few nonmetallics. After the Japanese entrance into World War II, an active search for minerals was started in southern Korea.

It is interesting to note that, for reasons best known to them, the Japanese saw fit to establish a School of Mines near Seoul at the present location of the College of Engineering. From the number, size, arrangement, and design of the buildings in this mining compound, and some remaining evidence of the equipment that was contained therein, careful thought must have been given to the reasons for selecting the site and establishing the course of training. (The writer understands that, in general, this same course of training is being followed at the present time by the College of Engineering). At the present (March, 1957) this badly war-damaged group of buildings is rapidly undergoing rehabilitation so with a few minor exceptions the original collection of structures will probably be available for occupancy sometime during the spring of 1958 (that is, laboratory equipment and supplies should be installed by then).

Mineral production in Korea extends back many centuries. Gold has been of leading interest until recent years. Under the Japanese a fair amount of progress was made in developing the mineral resources. By far the major part of their efforts lay in the northern half of the Country. There, iron and coal were extensively mined although neither one provided Japan with anywhere near her requirements. During the decade previous to Japan's entry into World War II, important lead-zinc deposits just south of the 38th parallel at Ongjin were developed, and minor deposits at a few other localities in southern Korea were opened up. After Japan actively entered into World War II she stepped up her endeavor to locate base metal deposits in both southern and northern Korea - copper, lead, zinc, molybdenum, tungsten, etc. Her success with this program was not too startling. From very meager information now available it would appear that several things contributed to the rather insignificant results obtained from this very intensive campaign: (1) while the geological investigations were quite comprehensive (in fact, they more or less covered the entire country). They were not particularly detailed or accurate, nor were favorable areas later checked by detailed investigation with subsequent drilling; (2) in what is now known as the Republic of Korea the frantic search for minerals did not really start until about 1941 or 1942. The three years remaining before the war ended were insufficient for completing the investigation much beyond surface exposures. It would appear, from the one report available, that ore was mined with slight attention directed toward developing additional ore reserves during the mining operations. Gold mining was stopped during World War II and has not yet revived to where it even remotely occupies the status it enjoyed previous to the war.

The conclusion has been reached that a natural division of Korea is largely responsible for the past indifference paid to the mineral potential of southern Korea. It seems doubtful that the present dividing line (more or less following the 38th parallel), which is the natural boundary I refer to, could have been deliberately selected so it would split the country into almost two equal areas, one of which contained the known natural resources of the former country and the other the greatest agricultural potential of the two portions. Nevertheless, this appears to be exactly what happened. Indications are that development under the Japanese followed this same thinking: minerals (principally iron and coal), timber, and hydroelectric power development were almost exclusively confined to what is presently known as north Korea; and agricultural production along with considerable gold mining but, with the exception of tungsten and graphite, insignificant other mineral production came from south Korea. Thus it would appear that a conclusive investigation of the Republic of Korea's mineral possibilities has been neglected.

The present sum total of mineral exploration is insufficient to predict, at this time, just how extensive the future production may become. The mining department of the United Nations Korean Reconstruction Agency has done a great deal toward extending the coal reserves and other nonmetallics. Unofficially, their engineers believe that the future is not without promise for metallic mineral production. Mineralized areas are quite widespread throughout southern Korea. The classical geological concept, that mineralized areas occur near the granite and the invaded rock contact, is indicated in Korea. The economics of most of the geological evidence must still be demonstrated.

What is needed are well educated, trained and experienced mineral industry engineers to investigate and evaluate the many prospective localities, and who also are sufficiently well prepared to economically extract, treat, and dispose of the valuable minerals when found.

A real advantage to Korea, now and probably for many years into the future, lies in developing mineral production for export. Metals and mineral products usually command a cash premium on world markets. Thus through this means may be brought to Korea the opportunity for improving her foreign exchange. Until engineering and scientific investigations prove otherwise, there are good reasons to expect a not inconsiderable production of materials that may: (1) be sold abroad;

(2) be used at home and thus reduce imports; and (3) provide raw materials for furthering home development. For export may be mentioned materials containing tungsten, molybdenum, copper, lead, zinc, fluorite, graphite, gold, etc. Many of the substances just mentioned are presently imported into Korea. It is not too unlikely that, in the future, internal needs may be satisfied and exports also be made of many of these. For internal development is mentioned the possibility of producing sulfuric acid leading finally to ammonium sulfate fertilizer; the development of an improved ceramics industry; more extensive utilization of the anthracite coal directly as a fuel, through conversion to gas for fuel or, with further synthesis, to organic materials; the development of Korean iron ore deposits and production of much of the needed steel requirements; and finally the alunite deposits (quite extensive in Cholla-namdo and Kyongsang-namdo) might well prove of value for their aluminum content.

The basic requirement for the successful pursuit of the generalized opportunities enumerated in the preceding paragraphs is a strongly developed College of Engineering. Even though the recommendations to be put forth are directed specifically at the mineral industry divisions of the College, it should be recognized that all branches of engineering are dependent to a greater or lesser extent upon the production of minerals and the metals or products derived therefrom. And in conclusion, many branches other than mining and metallurgy obtain employment in the mineral industry both directly and indirectly.

DEVELOPMENT OF EDUCATIONAL REQUIREMENTS

Mineral industry education curricula in the United States have been undergoing many revisions during the past 25 years or less. There are many reasons for this, few of which are particularly pertinent to suggesting geology, mining, and metallurgy curricula for Seoul National University. This fluctuation suggests that the homestretch is being reached in the leveling off of mineral development processes (discovery, extraction, and treatment) in the United States. (Other countries in which mining has become well advanced have probably had or are having the same sort of experience).

It most certainly is not intended to imply that the mineral industry - education or practice - in the United States or elsewhere has become stagnant. Instead, the industry has reached that stage where, to a considerable degree, men are trained strictly to be mining engineers, geologists, or metallurgists, with little overlapping of the curricula of these three fields in the educational program - such technicians being able to only follow largely the narrow confines of their training. This must be avoided when educating Korean Engineers.

Previous to the 1920s a great many of the mining establishments in the United States required an all-around trained man. This is still true with many of the smaller operations both there and especially abroad, although in the States this becomes less true as each year passes. By an all-around trained man is meant one who has had training about equally divided among mining, geology, and metallurgy. Small operations - say those producing less than about 500 tons per day - still need this type of engineer although it is becoming increasingly hard to find one because of the strict specialization in any one of the many major fields of the mineral industry (mining: metal, coal, surface, underground; metallurgy; a variety of interests; geology: many specialties - economic, ceramic, petroleum, coal, metal, etc.). And also the smaller operations are rapidly being absorbed by the larger organizations, presumably for economic reasons. To agree with the proposition that all an engineer requires is the so-called basic training in mathematics, chemistry, physics, and English with a bare introduction to his profession, is completely foreign to the needs in Korea. Especially is this true when natural resources exploitation is just starting to develop as in Korea.

The mineral industry development in southern Korea is for all practical purposes just starting. With very few exceptions, within the foreseeable future, operations will be on a small scale (up to possibly a hundred tons or so per day at a few mines, with much less at many others), and the economical operation of most will be borderline and may even have to have help through government subsidies. These practically borderline operations cannot be burdened with a host of experts for each of the three major fields. In other words, when a mining company hires a mining engineer, there must be available one who is able to provide mining, geological, and metallurgical help. If the need for more expert advice, beyond the scope of this employee's ability arises, government experts or private consultants may be temporarily called upon.

A mineral industry course of study is recommended which will prepare the graduate of a four-year engineering curriculum as follows: (In the not too distant future this may have to change to five years as is happening in the United States.)

(1) Provide training through lectures, laboratory, field, and practical inter-semester experience to qualify him for serving the needs of the moderate-sized company with geological, mining, and mineral beneficiation knowledge.

(2) Include sufficient fundamental academic subjects to prepare him for advanced study either in Korea or abroad.

In many respects the present College of Engineering curricula provide the requirements demanded in (2). Korean students abroad appear to do very well if they have a good working knowledge of English. The present laboratory handicap should be overcome in the relatively near future as the International Cooperation Administration-Minnesota contract nears completion. In (1) above the situation is quite different and can be considerably improved.

<u>Curricula and Course Recommendations</u>

As a guide for present course requirements there is at hand a copy of CURRICULA - College of Engineering, Seoul National University, June 1, 1956, the recent CURRICULA LIST (March, 1957), and CURRICULA for both the Departments of Mining and Metallurgy outlining the course of study beginning with the April, 1957 semester. Since starting this report changes of a minor degree have already been made in the latter lists. As discussed later, this is a procedure that should be stopped.

After glancing through these sources the reader is struck with the great number of subjects offered - required and/or elective. Most of them are what may be called "chapter courses". A chapter course may be best defined as having been derived from consulting the table of contents of a handbook and then inserting in the college catalog a course for each chapter and sub-chapter. Let me hasten to add that this procedure is by no means peculiar to the College of Engineering of Seoul National University. Without doubt all of the 800-old institutions of higher learning in the United States have been, and more than likely still are, guilty of this infliction to a greater or lesser degree. It can rather definitely be said that all of the mining schools are. This method of selecting the content of a curriculum burdens the student with duplication, conflicting opinions and requirements from different instructors, minute detail (especially statistics) without limit, and from the College's viewpoint requires a larger faculty than ordinarily necessary. In fairness to the Mining and Metallurgy Departments it must be added that this situation exists among all 10 of the College's departments.

Little blame can be placed on the College for the meager part that laboratory instruction or opportunity enters into present courses. To some extent the influence of the Japanese system, which seems to regard laboratory work as of minor importance, may be responsible. But of major concern, however, is the fact that building facilities and equipment were, in many departments, almost totally destroyed during the Korean War. Through the assistance of the United Nations Korean Reconstruction Agency a minor amount of supplies and equipment have since been provided and by the time the Minnesota contract is concluded the laboratories of the College will be exceptionally well equipped. It should be added that the faculty level will also have been greatly enhanced by training many of the members at Minnesota and elsewhere.

<u>Course Nomenclature</u>

There is no intention, nor is it necessary, to list in minute detail courses of instruction either given at present or proposed. Many of the remarks which follow, and/or suggestions and recommendations (in principle) may be considered as applying to the College as a whole.

It is well to mention these now. Of minor importance possibly, but something that would prove very convenient, would be to initiate a system of designating courses in the College. At present each department simply writes out the entire name of the course (e.g., in Architectural Engineering: Professional Practices of Estimation; or, Architectural Accoustics and Solar Angle). Admittedly these are exceptional selections as most course titles do not exceed two or three words. This problem of both simple and unwieldy titles would be lessened if a system of both departmental names, initials, or abbreviations in conjunction with course numbers were adopted for every department in the College. Also the course title does not need to include, as at present in most cases, the departmental name, nor be so inclusive as to enumerate the major content of the course. This improvement would not only be of benefit here on the campus when recording students' records, but would prove helpful for the reviewing of Seoul National University courses by other institutions (such as those abroad). Take for example the following possibilities:

A. E. - Architectural Engineering

Min. - Mining

Met. - Metallurgy

M. E. - Machanical Engineering

Tex. - Textile Engineering

E. E. - Electrical Engineering

Nav. A. - Naval Architectural and Aeronautical Engineering

C. E. - Civil Engineering

Elect. - Electronics

Chem. E. - Chemical Engineering

Math. - Mathematics

Geol. - Geology

Phys. - Physics

Chem. - Chemistry

Gen. - General - Covering all of the introductory courses and social subjects (English, Korean, History, etc.). Many of the freshman and sophomore courses taken by all College of Engineering students could be included under "General".

In each department or division the courses would be given a number. It is fairly common practice to assign 1 to 99 to 199 to the junior and senior years; and numbers 200 and up to graduate or very advanced courses. For example, using Mining to illustrate:

Min. 42 Elements of Mining

Min. 120 Mining Engineering (I)

or for Mechanical Engineering:

M. E. 111 Internal Combustion Engines,

and so forth.

Some institutions use odd numbers for the first semester and even numbers for the second semester or vice versa.

Laboratory Recommendations

Probably the greatest expenditure made under the Minnesota contract will be for laboratory equipment and supplies and for technical assistance in this aspect of instruction. To take full advantage of the opportunities to be derived from this outlay, the time to be spent in the laboratory, and the content of such courses must be decidedly improved over present practice. With few very minor exceptions, laboratory courses are at present nil. This situation is almost entirely due to the lack of facilities and not to administrative attitude or failure to appreciate the importance of laboratory or field work. A half-hearted attempt is now being made to supplement certain courses with lab time.

At this time (March, 1957) the rehabilitation of the former Mining Compound (Building 5) is well along toward completion, and the arrival of equipment and supplies procured with the first FY 1956 allocation for this purpose is nearing completion for many departments. Purchases under the second FY 1956 allotment have been started and these items will start arriving in a few months. With these circumstances in mind the time would appear ripe for a decision on the laboratory situation. At this point it is well to recall the previous statement that these remarks apply to the College as a whole.

For many years institutions of higher learning in the United States have operated on the basis of 3 hours representing a laboratory period. Thus a 3-hour period per week per semester or per quarter was assigned a value of one credit, just as 50 minutes of lecture time over the same period gains one credit. (A very few institutions have adopted a rule for reducing outside preparation and study time to a credit basis and include such credits in their allowance to the student. This is by no means general and it may definitely be forgotten about so far as the College of Engineering is concerned.) In fact, it is common practice to reduce the lab hours to credits by dividing by three if by any chance credits are not shown for laboratory hours. If this practice is deviated from or an institution's policy is left unexplained on their transcript, much confusion and possible injustice to the student will result when evaluating transfer credits and completed work. Attention is called to this because there is every likelihood that many future Korean graduates will go to the States or elsewhere abroad for advanced study. In fairness to them they should not be penalised because of the credit recording methods of their parent institution.

In recent years many institutions have come to the conclusion that perhaps two hours of lab work should equal one credit. (To sort of salve their conscience they include one or two all-day field or observation trips or outside assignments so that the old 3-hour rule is partially satisfied.) Actual observation by many instructors tends to show that practically the entire laboratory output is accomplished in the first two hours. After that the student becomes tired and restless with the result that little is accomplished. This is particularly true of assignments requiring excessive use of the eyes (microscopic, drafting, mineralogy). Laboratory work where physical exercise or movement enters may usually run for the 3-hour limit (surveying, assaying, many chemistry labs, machine shops, field observations). It must be mentioned that the 2-hour lab actually came in following World War II. Laboratories were so crowded that 2-hour assignments became necessary along with night lab classes. As this pressure eased off, however, and the results were analyzed, the validity of the foregoing observations became apparent.

To summarize the laboratory-time situation: (1) labs involving eye concentration and stationary position can be reduced to 2-hour sessions per credit with an insignificant decrease in accomplishment or output conjunction with notes of returning staff members. (See Appendixes at conclusion of this report.) The material in the appendixes referred to will also give information for lecture assignments. The final grade is often arrived at in the following manner: each assignment, for example, may be given the perfect grade of 10; examination grades would be based on the number of questions; a perfect grade for the course would be the number of assignments times 10 plus the number of examinations times the grade alloted them. A student's final grade would fall between a certain minimum total for just passing, determined by the instructor, and the perfect total.

Freshman and Sophomore Years

A few suggestions can be made concerning the first two years. The comments to follow might well apply to all curricula for the common freshman year, but are directed mainly toward Mining and Metallurgy for the sophomore year. As a matter of fact the idea of a common freshman year may not be a good one when 10 major fields of such diverse interests are to be satisfied. It is realized that a great deal of latitude may be exercised when selecting the order in which a variety of subjects may be made available to the student.

Attention is called to Appendix D, Engineering Problems. In many ways this is an orientation course as given in the States. It is offered under different titles in many United States Engineering Colleges for the purpose of helping the freshman student select his major field (civil, electrical, etc.) a choice which apparently is not permitted at the College of Engineering. A secondary advantage of the course, and this commends itself to the Administration's attention, is to introduce the beginning engineer to the use of the slide rule while solving problems designed to acquaint him with engineering language, thinking, and methods.

Drawing Courses

As presently prescribed, Descriptive Geometry is taught during the freshman year and Engineering Drawing during the sophomore year. This is just the reverse of usual practice. In addition, the time distribution shows a disagreement with that usually assigned to these two courses. Fundamentally, Engineering Drawing should come first because it introduces the student to the principles involved in the use of drafting tools, carefulness in manipulation, lettering, projections, perspective, etc. Descriptive Geometry is more or less the solution, by drafting methods (graphical), of arithmetical and mathematical problems. It requires great care in the manipulation of lines, angles, and planes, and hence should be given subsequent to the introductory course, Engineering Drawing. Also, experience seems to indicate that the same time is required to present and assimilate the necessary knowledge for applying Descriptive Geometry to practical usage, as in engineering problems, sheet metal shapes, and geological and mining problems. Descriptive Geometry should be rearranged to follow Engineering Drawing.

As to credits, a more satisfactory way than that used at present would be three 2-hour drafting periods each week for two credits. This would apply to both courses. Thus Engineering Drawing could be completed during the first semester of the freshman year and the Descriptive Geometry during the second semester of the same year. This is the customary arrangement in the States. A few institutions, for policy introduce the beginning engineer to the use of the slide rule while solving problems designed to acquaint him with engineering language, thinking, and methods.

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Cultural Courses

The tendency among accrediting committees and others influencing United States engineering education is to strongly recommend (practically require for accreditation) a certain minimum instruction in the so-called cultural subjects, i.e., philosophy, history, sociology, literature, government, civics, languages, etc. (The Montana School of Mines at one time, and may still do so, required its engineers to take three credits in studying the Constitution of the United States. And the Philippine Congress passed a law that no graduate from a government sponsored institution (the University of the Philippines) could be granted a degree until he had passed 12 credits of Spanish. This was in effect in 1953 and forced their College of Engineering to go to five years for the Bachelor Degree.) Probably 6 to 10 hours (credits) may be considered an acceptable number for these courses.

The College of Engineering requires (and English and German under these conditions would ordinarily be considered cultural) 28 hours of such training. If the 12 hours of English and German are not so considered, there are still left 16 hour of cultural material. We are treading on touchy ground when criticism is directed at this stuff, but even so the value of all of it at the expense of specific engineering training is doubtful. Just what good is accomplished by requiring this array of cultural subjects might well be the subject of investigation by a dean's committee. This same investigation might also consider the desirability of eliminating the German requirement. Its usefulness, even though there is an influx of German engineers and trading companies into Korea, can hardly be developed during 2 hours per week per college year.

Other Sophomore Requirements

For the mining major in the sophomore year it would be a little better it Geology with its lab came the 1st semester and if Mineralogy and lab followed in the 2nd semester. One semester of general Surveying is insufficient. This should be extended to follow somewhat this arrangement (see Appendixes E and F): 1st semester, plane Surveying, 1-hour lecture and 6 hours of field work; 2nd semester, Advanced or Higher Surveying (really a continuation of the 1st semester), 1-hour lecture, and 6 hours of field work devoted mainly to topographic (including planetable), triangulation, and route surveying (railroad and highway location - brief discussion only; the regular Civil Engineering course can be taken as an elective if a particular student so desires). This course should allot no time for mine surveying, a course given later in the Mining Department. This would represent close to the average distribution as followed by United States mining schools. It is well to emphasize that the surveying just suggested would be taught by the Civil Engineering Department as a service course for the Mining Department. The Civil Engineering Department should be called upon for furnishing instruction to other Departments who may also require surveying or other service courses. Only mine surveying should be taught by the Mining Department. (See Appendixes E and F for suggestion on surveying.)

Two other courses that the College at present requires in the sophomore year might be reconsidered for the junior year - these are Engineering Mechanics (statics) and Electrical Engineering. Four credits seems excessive for Engineering Mechanics (if it is the usual course in statics then 2 to 3 credits should be sufficient; if dynamics is included then 4 credits are satisfactory) and 3 credits for the electrical engineering is enough (giving mining engineers and metallurgists a working knowledge of DC and AC generators, motors, circuits, and transmission - not detailed design and installation instructions; the instructor can devote an occasional class period to demonstrating in the lab the use of measuring devices and testing circuits).

Prerequisite Courses

There is no issued information showing prerequisites for courses beyond the freshman year. Confined to the College of Engineering itself this may not be too important although there is noted evidence of advanced work preceding the elementary courses. But again the possibility of Koreans studying abroad comes up. Other Educational Institutions list in their literature the courses that must have been taken before proceeding to more advanced work. American Universities are very sensitive about allowing students to take advanced work before certain preliminaries are out of the way. For example, attempting to take calculus before advanced algebra, or analytical chemistry before general chemistry, etc.

As the College of Engineering now operates, there seems to be no control exercised over taking advanced work first. The Heads of Departments, apparently at will, change the curricula coming after the Freshman Year and appear totally undisturbed over junior and senior work in the freshman and sophomore years. For the benefit of students and other departments, prerequisites for every course offered in the College of Engineering should be listed. No one should be permitted to take a course without satisfying the prerequisites until the permission of his adviser and the instructor of the course has been obtained. A standing committee should at all times guard this adherence to prerequisites. The standing of the College abroad would be very much strengthened if this policy were adopted.

In concluding this general discussion it is further recommended that the University authorities, at an early date, issue a College of Engineering Catalog or Bulletin similar to the Bulletin of the University of Minnesota or other American University. Each year a calender of dates could be issued to supplement the catalog or bulletin. There is no reason why curricula at the College cannot be sufficiently stabilized so that the resulting catalog could be used for several years before a new printing is required. The policy followed at present of changing curricula from semester to semester and even after the semester has started is most undesirable. The entire course of instruction should be studied and courses arranged in their proper yearly sequence.

MINING ENGINEERING

Junior Year

The junior year should contain the following courses. The remaining courses to bring up the required yearly total may be selected at the mining faculty's discretion, keeping in mind that excessive duplication of course content through requiring too many departmental courses must be avoided. Required courses should be: Strength of Materials (also known as Mechanics of Materials), 3 credits; Petrology, 1 lecture, 3 hours of lab; Structural Geology, 3 credits; Mineral Deposits, 3 credits; Mine Surveying lectures, 2 credits (it is suggested that the course be patterned after "Introduction to Mine Surveying" by Staley, not because of personal reasons but because there is no other text quite so suitable); Geological Field Methods (2nd semester), 2 credits lecture with occasional campus field work using Brunton compass, pacing, etc.; Ore Dressing, 2 credits of lecture and 6 hours of lab each semester. One 4-week period (March 1st to 30th) should be taken for a mine surveying practice trip to a mine. There the workings would be surveyed, notes computed, and the map drawn. One similar period (20th of July to 30th of August) should be devoted to surface and underground geological mapping and inspection of nearby mines and surface geology. For this field work see the later discussion for the Practice Mine. The time selected for holding these field trips may not be the most suitable. Agreeable temperature and climatic conditions must be considered.

Senior Year

During the senior year there should be included: 2 to 3 credits of the Metallurgy of Gold and Silver; 3 credits of Non-Ferrous Metallurgy including a short introduction to the metallurgy of iron and steel (this course would primarily deal with lead, zinc, copper, and tungsten with only brief mention of the most important other metals - aluminum, magnesium, bismuth, manganese, etc.); Mineral Deposits (II), 3 credits; possibly 2 credits of Dynamics (see previous comment on Engineering Mechanics in sophomore year); for those with a decided interest in geology, 1 lecture and two 2-hour labs each semester in Optical Mineralogy and Petrography (study of thin sections or rocks by transmitted - usually polarised - light; Mineralography, 1 lecture and two 2-hour labs; Mine Plant Design, 2 lectures and two 3-hour labs coming in one semester or divided between two semesters (lecture in one and the lab in the other); and Mine Examination and Valuation, 2 credits of lecture.

The preceding recommendations represent standard requirements. They also happen to meet the needs of a mining engineer in Korea. An intensive course in the metallurgy of gold and silver is unnecessary. The mining engineer needs a good understanding of the processes involved but not detailed training as would be required for the metallurgist. For the mining curriculum a few lectures can be spent on iron and steel to provide him with a good foundation in connection with future evaluation assignments. A knowledge of mineral deposits is quite essential to the "art" of ore finding. The subject is too comprehensive to cover in one course, hence, the second course. Dynamics is included to provide help to meet Requirement (2) suggested for the 4-year curriculum. It has practically become a must (although the necessity for this is doubtful) for accrediting engineering majors in the United States.

The Optical Mineralogy and Petrography, and the Mineralography courses are quite necessary for detailed geological examination and interpretation. The application of these tools often provides the clues necessary to predicting where ore may most likely be found. Or, they may be of great assistance to aiding the ore dressing expert in treating the mine run ore. They are standard tools for the mining geologist. The suggested course in mine plant design is the customary one: headframes, ore bins, hoists, underground haulage, etc. are usually treated therein.

And finally, a course in examination and valuation is recommended. At present this instruction is included with other subject matter not particularly related. This course, if properly considered, applies geological and the other engineering training to the examination and valuation of a mineral property. It teaches the procedure to follow in arriving at the ultimate decision: Is this prospect likely to become a profitable mine? The importance of amortization of capital for mining operations is emphasized. It will be noted that no mention is made of management with this course as is at present included. If management policies are to be discussed the College should organize a department for business courses. Later in this discussion business courses are recommended. Lecturers from the main campus might be had for this porpose. A well taught technical course cannot avoid reference to economics and management. What is more to the point Korea at present needs engineering knowledge more than she does managers. There are too many of them now who do their mining in the office. For Mine Examination and Valuation it is recommended that both "Principles of Mining" by Hoover, and "Mine Examination and Valuation" by Parke, be used as textbooks.

Additional Subjects to Complete Credit Requirements

Using the June 1, 1956 and the April, 1957 Curricula as guides the following recommendations become necessary. These remarks are directed toward the work of the junior and senior years.

The subjects listed as Required and Electives quite clearly meet the definition for "chapter courses". For example, there is listed Mining Engineering (I), (II), (III), and (IV), and also Mining Machinery (I) and (II), and Explosives and Blasting. The total time represented is 28 hours for which 21 credits are given, and these are by no means all of the mining courses that are likely to be required. It is interesting to compare this with two other institutions: Minnesota and Idaho. Minnesota is on a quarterly basis and it takes 5 years to complete their mining course. A total of 52 credits of mining courses on a quarterly basis are required. This reduces to a total of 34 2/3 credits of mining on a semester basis and to a total of about 28 credits of mining on a 4-year basis. It should be mentioned that the Minnesota total includes 11 quarter credits of mine surveying field work (unusually large). At Idaho a mining engineer graduates with a total of 21 credits of mining, on a semester basis, for his four years work.

The College of Engineering requires in its Required Subject List 40 mining credits. Mine Surveying is said to be taken by all students, although it is listed in Electives, so this 3 additional credits brings the total to 43. Under electives are listed many other mining courses which are probably strongly recommended to the student. (Departmental courses usually are!). Thus the total might rise to 50 or more credits. This total for the College of Engineering does not include any of the geology or mineral preparation or assaying courses which appear to be taught by the Mining Department faculty - just straight mining courses.

It seems advisable to recommend, at this time, that the practice of the various departments offering instruction in topics basic to other departments should be discontinued at the earliest possible moment. For example, courses in ore dressing and/or coal preparation should be taught by a Metallurgy Department (ore dressing) instructor with necessary consultation and advice as to the desired content and arrangement from the Mining Department; practically all assaying (wet) or analytical chemistry courses are best taught by the Chemistry Department (or perhaps the Chemical Engineering Department). An exception is fire assaying for gold and silver which is universally taught in the Metallurgy Department. Some types of metallurgical analysis are often taught in this department. Duplication of instructors, poorly prepared instructors, duplication of equipment, excessive stockroom inventory, undue utilization of floor space, conflicting opinions and information, and professional jealousies can all be reduced to a minimum by confining instruction to the proper department. This is a major fault at the College of Engineering at present. However, a movement is on foot to discontinue this practice and to assign to the proper department its specialty. After this has been accomplished equipment and facilities should be transferred to the departments concerned.

Back in the sophomore year is found Elements of Mining, 4 hours and 3 credits. The description of this course and the other 7 first mentioned above show a considerable overlap of content. The following table illustrates this to better advantage. The writer is aware that

Elements of Mining is usually used for the purpose of introducing mineral industry students to a semidetailed discussion on mining and mining equipment (this is quite apparent from the table). But this lack of detailed discussion does not mean that each of the topics so introduced should later recur as a separate [illegible]-credit course. Few of them are that important. If information at a later time is needed the engineer must then read up on the subject and dig out the necessary data. His college training is directed toward teaching him how this may be done. Every conceivable topic cannot become a college course. It should be repeated that this fault is not peculiar to Korea by any means, nor is it confined to the Mining and Metallurgy Departments in the College of Engineering.

It is recommended that Elements of Mining be retained with the following changes (follow as a text "Elements of Mining" by R. S. Lewis); leave out any formally allotted time for ventilation, illumination, safety, and valuation (just a brief discussion to show their connection to mining in general); leave out fundamentals of mining. Give a general discussion of remaining topics listed in the table for Elements of Mining so that the student has been presented the broad, correlated field of what mining engineering consists. Minute descriptions of details or time spent on other than very general statistics is of little value. Elements of Mining should be treated as an introductory course whose purpose is to familiarize the student with mining as a whole and tells him of the many sides which exist and how they correlate with each other. Only in a very general way discuss geophysical prospecting under prospecting as a detailed course is provided later on.

Table Showing Content of Mining Courses

Subject	Fund. of Min.	Prospect.	Drill- ing	Dev- elop.	Min. meth.	Sup- port	Drain- age	Shaft sink- ing	Hoist- ing	Tran- spor- tat.	Ven- tilat- ion	Illu- mina- tion	Safe- ty	Val- uat- ion	Exc- ava- tion	Blast- ing	Me- ag[illegible]
Ele. of Min.	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
Min. Eng. (I)		x		x	x										x		
Min. Eng. (II)			x			x		x								x	
Min. Eng. (III)							x		x	x							
Min. Eng. (IV)											x	x	x				x
Expl. & Blast.*																x	
Min. Mach. (I)**			x				x										
Min. Mach. (II)***									x	x							

* Also chemisty of explosives.

** Compressors, coal cutters, and picks, conveyors, loading machines included.

*** Laying rail, dredgers, aerial tramways, cableways included.

Rename Mining Engineering (I) to Mining Methods and delete discussion of prospecting. Tie development in with mining methods insofar as it develops or prepares the ore body for extraction. More or less detailed prospecting can be discussed under Elements of Mining, especially the broad application of geology, mineralogy, rocks, and structure to prospecting (see Chapter in Young, "Elements of Mining"). Change Mining Engineering (II) to Drilling, Blasting, and Mine Support. Discuss in detail the application and use of drifters, stopers, and jackhammers (with their variations); drilling rounds, selection of explosives and loading and detonation of the charge; support of ground - drifts, raises, shafts, stopes, etc.; use of timber, masonry, metals, and waste fill (see the set of tracings delivered to Mining Department on my arrival in Korea). Drop Mining Engineering (III). It conflicts with and duplicates Mining Machinery (I) and (II). Drop drilling from Mining Machinery (I). Introduce a new course: Mine Ventilation, Illumination, and Safety. This will substitute for Mining Engineering (IV) which is to be dropped.

Explosives and Blasting should be dropped as it will be superseded by the new course Drilling, Blasting, and Mine Support. No advantage will be gained by more than incidentally mentioning the manufacture and testing of explosives. This is a field that belongs in industrial chemistry or chemical engineering and not mining. The manufacturing of industrial explosives in Korea will no doubt be undertaken in the future. At that time Korean chemists will be needed. They will have been educated in the chemistry field and not the mining field. Mining engineers are employed to demonstrate the use and selection of mining explosives but seldom are they called upon to direct their production.

Change Mining Machinery (I) to include mine drainage (pumping, drainage tunnels, airlifts); compressed air; coal mining equipment (of the type and size suitable to Korean coal seams and not the monsters used in American coal mines).

Mining Machinery (II) should be altered to include only: hoisting, transportation, aerial tramways, conveyors (to handle mine run ore), and truck haulage.

Introduce the new course Surface Mining which should include: placer mining (simple methods -- panning, sluicing, rockers - hydraulicking, drift mining, dragline-type of excavators, dredging (both floating and particularly the dryland type), and open pit mining (for iron, limestone quarries, and other nonmetallics).

These changes require no special justification as they represent mostly a rearrangement and assembling of previous courses.

The preceding brief remarks are offered as a guide toward reducing the amount of duplication and number of courses now offered. The instructor must exercise great care and judgment in order that he not spend excessive time on minute details of design, and of the selection and application of ideas and equipment to isolated, insignificant, and irrelevant problems. Many instructors are caught in the trap of working out in mathematical detail, on the blackboard, a design problem. Most of the basic details of design principles (statics, mechanics of materials, etc.) have been mastered from Civil or Mechanical Engineering courses; it is rarely necessary or desirable to repeat such solutions in the mining course. Usually it is only required to point out or emphasize the application of these prerequisite courses. An engineer can spend the greater part of his professional career and never become confronted with most of the stuff contained in textbooks.

METALLURGICAL ENGINEERING

Sophomore Year

Many suggestions offered under Mining Engineering will apply equally to the Metallurgical Engineering curriculum. A few additional comments are of interest. Attention is called to the 10 credits of cultural requirements occurring in the sophomore year and to an additional 4 credits of these subjects in each of the junior and senior years. Addly enough these courses seem to differ from those required by the Mining Department. (See suggestions made there for having a committee investigate cultural course requirements; also course titles, description of courses, and statement of prerequisites.)

The recommendations made previously concerning Engineering Drawing and Descriptive Geometry should be applied to metallurgy majors. Also the discussion regarding Engineering Dynamics will apply here.

A course in Metallography is much too advanced for the sophomore year. In the present arrangement it is offered concurrently with the basic course "General Metallurgy". Of equal importance, the description of this course shows that it will duplicate, to a large extent, the two later courses in iron and steel. Metallography, as generally considered, is essentially a laboratory course wherein metal surfaces (all metals, primary or alloys) are polished and etched for examination with the microscope. It is a very important tool to the metallurgist for investigating fatigue and failure of metals, effect of heat, and the results of heat treating on metals. The sophomore year is not the place for it. Metallography should come near the last semester of the senior year so that all previous metallurgical knowledge can be used in its application and interpretation. (See comments under the Senior Year.)

For all other comparable courses recommendations for the Mining Engineering curriculum may be applied here.

Junior Year and Senior Year

Because most of the courses listed in the 1957 outline are continued from the junior into the senior year, it is best to combine the discussion for these years.

Metallurgy of Iron and Metallurgy of Steel - Both of these course are required and are given for 4 credits each; Iron comes in the junior year and Steel in the senior year. Eight credits for studying iron and steel is way beyond any reasonable requirement. The two present course should become a combined course, which is customary, and the name changed to Metallurgy of Iron and Steel. It should be offered the 1st semester of the junior year for 3 credits. Three credits will provide ample time to cover chemistry, smelting, and rolling practice, and to discuss alloy steels. These recommendations are made because it is almost impossible to discuss iron or steel separately from each other; the two courses would, therefore, simply duplicate each other.

Physical Metallurgy (I), Junior year, and Physical Metallurgy (II) senior year, each carrying 4 credits of lecture is excessive, and the four hours of lab are insufficient. It is recommended that the two courses in Physical Metallurgy be combined to one course of 3 lectures and two 3-hour laboratory periods. Additional instruction will be obtained later from the course in Metallography and the course in Iron and Steel will include some necessary physical metallurgy.

Metallography - The course in metallography now given in the sophomore year, should be moved to the senior year, 2nd semester. It should consist of 1 credit of lecture, and two 3-hour lab periods. The lab should cover the preparation of the surface of metal and alloy specimens (which have been subjected to various stages of heat treatment) by polishing and etching for microscopic examination. The grain structure is photographed and student deductions and reports prepared. A variety of copper, brass, iron, steel, aluminum, zinc, lead, bismuth, brazed, welded, and soldered specimens should be available for student examination. There will be a little of this type of work in the Physical Metallurgy laboratory. There the major lab work should consist of the production of actual furnace melts of different compositions at varying temperatures. The physical properties of this experimental work is determined in the laboratory. Eutectics and so forth are studied. There is little duplication between the two labs.

Electro-Metallurgy - Four credits are more than ample. It is suggested it be reduced to 2 lectures and one 3-hour lab. Also drop Electro-Metallurgy laboratory in the Senior Year.

Fire Assaying for Gold and Silver - This should be a required course instead of an elective as it is at present. It sould carry one lecture and one 6-hour lab and probably be held on Saturday. The usual way is to give the lecture at 8 A.M. Saturday and then start the lab. This laboratory does not lend itself to short interrupted periods. (It takes considerable time to get the furnaces hot and charges weighed out. You cannot stop half way through the job and start again the following day or week). By far the most satisfactory results are obtained from one long continuous period (6 hours).

Nonferrous Metallurgy - This course is offered in both years for a total of 8 credits. It does not include gold and silver which is given in a separate course. This is altogether too much time. An entirely satisfactory course may be offered for 6 credits, three each semester of the senior year. (As a matter of fact, many of the Metallurgy Departments in the United States have reduced this course to 4 credits.)

Ferrous Materials - Drop this course. It is, or should be, almost identical to the Metallurgy of Iron and Steel.

Nonferrous Materials - This course should be dropped. Its content would almost completely duplicate Nonferrous Metallurgy.

Alloys - A course in Alloys should be given to replace subject material dropped from Nonferrous and Ferrous Materials and not discussed in Iron and Steel or Nonferrous Metallurgy. Two credits of lecture for one semester should be ample. No laboratory is necessary as several alloy experiments can be included in both Physical Metallurgy lab and Metallography lab.

Production Metallurgy - The name is misleading for the course outlined. It should be changed to Foundry Materials and Practice. For best results this should be a laboratory course. One lecture and two 3-hour labs for one semester should provide ample information on foundry practice.

Structure of Metals - On the basis of the course description it would be more explanatory if called advanced Physical Metallurgy. Give it for 2 credits instead of 4 credits. No lab is necessary.

Surface Treatment of Metals - Change to Electro-Deposition of Metals. Four credits are too many. Change to 2 credits for one semester.

One 3-hour lab could be considered to accompany this course.

Physical Chemistry of Steel Making - Drop this as it should have been completely covered in the Metallurgy of Iron and Steel, General Metallurgy, Physical Metallurgy, Metallography, and Alloys. In fact, a course in Iron and Steel includes, to a very large extent, the chemisty of the process. This course would be repetitious.

Ore Dressing - Ore dressing, or mineral beneficiation, is of fundamental importance in the present stage of the development of Korea's mineral resources. It deserves more time than has been assigned. The following arrangement might be adopted:

The course should consist of 2 credits of lecture and two 3-hour labs each semester of the junior year. The lectures should cover crushing, grinding, sizing, classification, gravity concentration (tables, jigs, spirals, sink-float, electro-static, electro-magnetic, etc.), and flotation (machines, pulps, and reagents). Both theory and practice should be discussed. The construction and operation of equipment and machines should be discussed in the lectures. If possible the class should be taken on an inspection tour of an up-to-date concentrator. The laboratory experiments should follow the outlines that have already given the Head of the Department. It may be recalled that these outlines are: "Selected Laboratory Experiments in Mineral Dressing" issued by the School of Mines and Metallurgy of the University of Missouri, and "Mineral Preparation Notebook" issued by the Department of Mineral Preparation of the Pennsylvania State University. (Reference may be had to correspondence under January 31, 1957 in Dean Hwang's office.) Some attention should be given to flowsheets of operating concentrators and the design of flowsheets explained.

Advanced Ore Dressing - Two lectures covering essentially the concentration of nonmetallic minerals by flotation or other economical means should be included in an advanced course of ore dressing. Some time could be devoted to the theory of the composition of flotation reagents. The flotation of fluorite and graphite is important in Korea; these are nonmetallics. A laboratory period of 3 hours could be considered but it is not absolutely necessary.

Metallurgy of Gold and Silver - This course deals with one of southern Korea's important mineral assets. It should be a required course and not an elective one. The present four credits are a little more than necessary. A better arrangement would be 2 credits of lecture and one 3-hour lab for one semester. The lab would be devoted to cyanidation of gold ores with minor attention to amalgamation. Stamps and typical gold-silver milling equipment would be discussed here and only briefly mentioned in ore dressing. Also, because all other types of reducing machines have been thoroughly investigated in the ore dressing course, they would not be further discussed in gold and silver.

Metallurgical Plant Design - A course covering the design of metallurgical plants should be considered. It could be offered as an elective. This would cover the arrangement for locating ore bins, furnaces, slag disposal, metal fabrication mills, conveyors, etc. The selection and capacity of furnaces and other equipment would be investigated. The Changhang copper smelter, the Inchon steel plant, a cement plant, etc. are examples of metallurgical plants. Two 3-hour labs for one semester should be ample.

Design of Concentrators - This course should be required of all metallurgical engineering majors and be strongly recommended to mining engineers as an elective. It would require the selection of a flowsheet with subsequent selection and location of ore bins, crushing, grinding, classifying, and concentrating equipment; pumps, elevators, conveyor belts, launders, and filters would be included. In other words, the student would undertake the actual design of a mill for beneficiating an ore. The choice of hill-side or level-ground location would be compared. No lectures are necessary. Two 3-hour labs for one semester should be sufficient.

Justification - The justification for changes in the metallurgy curriculum have mostly been included with the above discussion. Many of the course titles previously used give more the impression of a trade school than of an engineering college; hence the suggestions for a few new titles. In addition, attention is called to the discussion at the beginning of this report on the necessity for mineral beneficiation. At the present time this is the really important metallurgical aspect of Korea's requirements. The other metallurgical demands are not at present nearly so urgent, nor are they likely to become so until production of raw materials containing essential metals has increased thus providing a source of materials for operating reduction plants.

ELECTIVE COURSES

It is common practice in the engineering schools of the United States to provide the student with a wide choice of elective material. Observation indicates that this is largely overdone. The average student is neither interested nor mature enough to wisely make selections of electives. At a few institutions the administration is sufficiently broadminded to permit the waiving of some required courses in favor of justified electives. If properly controlled this works very nicely.

The providing of a long list of electives in the departmental field means a lot of unnecessary duplication of courses with conflicting instructional concepts and opinions. More influential members of the department invariably have "pet" courses they want to teach and they pressure students into taking such courses. The opinion is ventured that most of such courses are out-of-date and absolutely without value. Then there is the instructor who inserts certain courses because his colleagues, in his judgment, could not or did not properly cover the groundwork for the later, more formal course. Of probably equal importance is the fact that many small classes containing - 1, 2, 3, etc, students occur. Small classes are recognized as making possible close individual attention. But when less than 10 or so are involved the opposite effect invariably develops. There actually is a minimum limit to the number of students who will excite well prepared and delivered lectures or output from an instructor. Economically, it is bad because this usually means an excessive number of faculty. Ill feeling among the faculty will also develop. Men who have very large classes, with the resulting paper work, quickly show resentment toward those with equal or less rank and pay but with small class memberships which entails less boring routine.

The elective situation in the Mining and Metallurgy Departments is not too bad. But the choice between Required and Elective Subjects can be improved as has already been suggested. For other Departments in the College, considerable hesitancy is felt toward offering criticism.

However, an impression is gained that the subjects under electives are excessive, and more or less duplicate in many instances the required courses. A very good plan to follow in listing electives is to choose courses from other fields, allied or otherwise. A well developed graduate plan will necessitate some advanced courses in the departmental field. Until that time comes it might be well to confine most of the selection to other divisions in the College.

Mining Department Electives

In the Mining curriculum it is strongly recommend that Mine Surveying should be changed from elective to required. (Mine maps are basic to exploration, development, mining, and geologic mapping and no mine can be considered well managed that lacks a strong mine surveying and geological department.)

The two courses, Strength of Construction and Materials for Construction, should be replaced by a course in Strength of Materials (sometimes called Mechanics of Materials). The new course should be changed from elective to required as previously suggested. This course gives the necessary fundamental prerequisites to any design course (mill plant, machinery, mine plant, mine timbering).

Elements of Metallurgy should be required. Because all mining engineers (about 40 men) will take this couse the Metallurgy Department should be asked to give a specially designed course for the mining people (if the Mining Department thinks this is necessary). It will cover the same ground as for the metallurgists but in much briefer fashion and with less emphasis on the theory (physical metallurgy) and construction details and operating procedures. A mining engineer needs general information along this path to complete his knowledge for mine valuation purposes.

Assaying (fire assaying for gold and silver with minor treatment for platinum and mercury by this method) should be required of all graduates in any field relating to the mineral industry. It is known that Stateside schools have materially reduced formal instruction in this field. The situation in Korea is very different and there will develop a need for technicians to do fire assaying at some early stage in their career. (In fact, this need, at least to a limited degree, seems to be already here.)

The selection of the courses described in the foregoing discussion should not be left to the discretion of the student or his adviser - the development of the mineral resources in Korea requires men trained in the elementary and fundamental duties connected with mining, milling, and smelting. These jobs have been known as bread-and-butter ones for years. That is, assaying, surveying, and drafting. No operation, so far as is known, has functioned or can function satisfactorily without them. They are the stepping stones for learning mine operation and supervision. From these rather lowly positions the mine management evolves.

In conclusion, serious thought should be given to discontinuing the present practice of changing the content of the curricula each semester or apparently at will. Curricula changes certainly must be kept flexible but not to the extent of bending them all out of shape. Changes in departmental courses should follow after due deliberation by all members of the department with approval by a majority vote. Final approval is had after presentation of proposed changes to the College Faculty, meeting for that purpose. The freedom of an instructor, regardless of his rank, to change curricula at any time is not good academic procedure.

Metallurgy Department Electives

In general, much of what has been said in the preceding paragraphs on electives applies to this department. The stress on departmental electives should be lessened. The following remarks are offered to indicate a few specific recommendations.

The Metallurgy of Gold and Silver should become a required course. Fire assaying for gold and silver has been discussed in detail elsewhere and its importance emphasized. It certainly should be a required course instead of an elective.

Because of the importance of metallurgical plant design, especially ore dressing plants, the metallurgical engineer should be urged to include preparation in Strength (Mechanics) of Materials. He should have the same course that the mining engineers take. A certain amount of instrumental control is necessary in construction work. Therefore, the metallurgy major should have an introductory course in general surveying.

Other electives to complete graduation requirements can be selected after consulting the adviser. There should be much to choose from in Chemical Engineering and Mechanical Engineering to interest the metallurgist. A very desirable elective would be the mineralography course given to geologists and mining engineers. Emphasis could be placed on mill products for grain size and point of unlocking when grinding.

In concluding the discussion on electives it is suggested that several courses in business be provided. A variety of 2 or 3 credit courses in accounting, management, business law, contracts and specifications, labor relations, business organizations (companies, corporations, etc.), and other similar studies are all quite desirable for the engineer.

TOTAL CREDITS

Attention is called to the following remarks wherein are given what appear to be many duplicating courses.

Architecture: Building Materials (I), (II), and (III); and Building Construction (I), (II), and (III) are given for a total of 16 credits! Offhand, it seems unlikely that these two courses could involve a difference in principles to the extent of 16 hours.

Chemical Engineering: Here there appears to be a great amount of duplication; Chemical Engineering (I), (II), (III), and (IV) - 12 hours individually listed are 3-credit courses almost running the alphabet (acid & alkalies, silicates, refractories, photochemistry, explosives, paper pulp, leather, etc., etc. to mention but a few.

Civil Engineering: This division is not quite so overloaded with apparent duplication. Mention may be made of (I) and (II) courses in Bridges, Road Engineering, Concrete, and Harbor Engineering courses.

Electrical Engineering: There are several dozen 2-credit courses. It would seem that many of these could be combined with resulting better presentation and correlation.

Mechanical Engineering: Here again there is a multitude of 2-credit courses running for a full year in many instances as with the Electrical Engineering curriculum. These subjects cover every conceivable topic involving machinery or tools. There are many 1-credit courses. The usefulness of most 1-credit courses in any field is doubtful. In fact, the same comment can apply to many 2-credit courses.

There is too much elapsed time between meeting periods; student attention and interest are lost.

Metallurgical Engineering: This Department has been discussed in detail.

Mining Engineering: This Department has been discussed in detail.

Naval Architecture: Once again there occurs the (I), (II), (III), and (IV) series of courses. Many of them would seem to have a course content similar to other courses carrying a definite title.

Aeronautical Engineering: An adviser is at this time (June, 1957) preparing recommendations in this major.

Telecommunications: About everything electrical is offered as a 2-credit per year course. It just does not seem possible that there could be so many different kinds of electrical communication devices and applications.

Textile Engineering: Here again occurs the (I), (II), (III), etc. type of courses of which there are several varieties. Almost every kind of textile material and machinery is represented by a 2- to 3-credit full year course. There must be a terrific amount of duplication involved. And it seems questionable that the machinery for the spinning and weaving technique of different fibers would vary to the degree that detailed descriptive courses must be given for each.

The subject of total credits, and the courses that make the total, should be thoroughly investigated. The object of the investigation would be:

(1) To arrive at a closely similar total for all the Departments,

(2) Elimination of courses whose content duplicates and overlaps each other whether in the same Department or in another Department.
(Many Departments seem to offer very similar courses under slightly altered titles, thus getting clear out of their field of interest.)

(3) Establish prerequisite requirements for <u>all</u> courses in the College and:

(a) Insist that the regulations be followed.

(b) Reorganaze the order in which courses are taken so they will come in years subsequent to the prerequisites.

(c) A printed list of courses will always show the prerequisites to each course. Any standard American University or College Bulletin may be consulted for the procedure and form to follow in listing courses and prerequisites.

PRACTICE MINE

There are two interpretations that may be applied to the term "practice mine". The one that almost immediately comes to mind is a place for practicing drilling, blasting, timbering, and the multitude of odds and ends connected with getting underground. Actually, this is one type of practice mine and many years ago most of the mining schools of the world operated a mine of this kind in connection with the formal campus training. Today most of them have fallen into the discard. In most cases a more satisfactory substitute has been adopted: the student is urged (in many schools required) to spend his summer vacations working at an operating mine, mill, or smelter. Some mining schools, such as the Montana School of Mines, are located in an active mining camp. This is a very ideal situation because the student in permitted to work (at Montana) two shifts per week. Thus he gains both experience and the financial means to attend the School.

The College of Engineering has, it is believed, an exceptionally good arrangement for getting students practical experience during vacation periods. As is apparently presently done the practice should be continued of having majors spend at least one period in a metal mine or a coal mine and, depending upon their major interest, the remaining periods required would be spent in the operation of primary interest. If things develop as planned by the International Cooperation Administration and/or the Republic of Korea officials there will in the near future be surface mining operations in iron ore. Also there will be at least two cement plants quarrying raw materials. Some students should be channelled into these operations for experience. There seems to be little necessity for an off-the-campus College-operated mine to provide practical mining experience. There is coming to the Mining Department a large variety of mining equipment which should be put to practical laboratory use just as rapidly as space in Building No. 5 becomes available. Drilling demonstrations could be arranged and carried out at one of the numerous granite hills which adjoin the campus. Here the equipment whose regular function is drilling holes for blasting may be operated by the student; he can timber the opening as it progresses. The compressor and drilling equipment can be stored in a small structure close to the start of the operations. The mucking machine (Eimco) and the slusher can be used for loading the broken material. It is conceivable that several sets of mine car trucks and a few lengths of light-weight mine rail could be obtained from one of the government owned and operated mines. The completely equipped surface and underground diamond drilling rigs would be demonstrated in the same locality.

Practice Mine For Field Trip

The other type of practice mine is the one we are mainly interested in describing and recommending. Here we want a sufficiently extensive collection of mine workings to provide experience in mine surveying and underground geological mapping. The ideal arrangement comes when the surface geology not only provides variety in mapping experience but at the same time permits correlation with the underground observations. Locations of this sort are not too frequent - in fact, they are rare. A limited knowledge of Korea does not indicate where such as ideal location may be found.

There is much conflict of opinion among teachers of field geology as to what constitutes field work. Some of the stuff many of the pure geologists wish to do or require is downright silly (horseback riding, camping out, daylight to dark hours, closely guarded morals). To gain an insight into why some things are done requires knowledge of the instructors' backgrounds. The biggest time-waster is the camping out mania with all it entails of someone in charge of food supplies, a cook with the students helping, a student camp manager, etc. The idea is that you may have to put up with such vigors after graduating so you must learn how to do it now! In this day and age few men will work for a company which continually makes such demands. Economically, the exploration companies cannot afford to operate under such conditions. The advocates of this procedure are invariably leaders of local boyscout troops and mentally have never grown up. Then there is the type who does not want to stay put in one spot, but insists on galloping over hundreds of square miles during a few weeks time.

These observations may seem beside the point so far as this discussion is concerned. But on the other hand, with many Koreans going to the States they may pick up ideas of this kind. These few remarks may help guard against these mistakes. It is believed that the permanent location, with established living facilities, is better in all respects. (Experience gained during the past 30 years through trying probably every conceivable kind of field trip substantiates the statement.) The reason is simple: the minimum amount of the student's time is concerned with things foreign to the work at hand, and he can concentrate on his assigned problems and not laways have in the back of his mind camp assignments after long hours in the field. If the same permanent camp is used year after year the instructor can do a much better job of organizing the assignments.

Location For Mine Surveying and Field Geology

Practice Mine

For a practice mine it is suggested that the College authorities investigate the United Nations Korean Reconstruction Agency's Yangji-ri School Metal Mine Project. This is a gold-bearing, sulfide mineralized quarts vein formerly mined by the Japanese. It is located near Chinchak-ni (also known as Chungso), Chungchong-namdo. Chinchak-ni is 179 km south of Seoul. The highway (February 1957) was in very good shape. The village of Yangji-ri is located 1.5 km almost due east of Chinchak-ni on a good gravelled road. Facilities for accommodating about 40 students and faculty would certainly appear to be available at Chinchak-ri and more than likely could be arranged for at Yangji-ri. The trip to the mine was made in a Japanese-type jeep-stationwagon. Nowhere along the road were conditions observed which would have caused any difficulty for one of the Seoul National University student buses (unless extreme bridge trouble developed), which is suggested as a means of transportation for personnel and equipment. The general route is as follows; Seoul - Suwon - Chonan - west to Yeson - Hongsong - Kwagchon - Chinchak-ni - east to Yangji-ri. (The English spelling of Korean words is not what it might be; that available for the above towns is given.) Anyone following this route must keep in mind that the signboards (if found!) have a different spelling; and also that the pedestrians and police do not always seem to know what town they live in!). The driving time from Seoul by the above described vehicle was about 6 hours.

A few miles north of Chinchak-ni is located an operating asbestos mine and a coal mine. The direction to these mines may be seen from the main highway. Each may be reached by a one-day trip and would provide additional geological study in the Yangji-ri mine-area. To the south of Chinchak-ni, about 68 km or 2 hours driving, is Changhang where a copper smelter is located. When the United Nations Korean Reconstruction Agency's plans are completed there will also be a 100-ton per day differential flotation plant located at the smelter. (More than likely a sulfuric acid plant will also be built there). One day would be sufficient to inspect this plant. From the above few casual remarks it would seem that the Yangji-ri area would suggest itself as a possible location for a practice mine for mine surveying and field geology.

The location and the property was selected by the United Nations Korean Reconstruction Agency engineers because it offered the possibility of helping to pay its way while being used as a School Mine. The original plans called for training miners and supervisors (shift bosses) and mill operators who would then disperse to other operations throughout Korea. These plans, for reasons not too clear, have failed to materialize. The flotation plant is supposed to be stored in warehouses at the mine. Much of the crushing equipment, etc., may be seen stored on the ground around the camp buildings. Local people are slowly running the mine dump through a sluice box to recover the gold-bearing pyrite (also minor copper sulfide minerals and possibly galena and sphalerite). The concentrates thus gained are taken to the Changhang smelter. The United Nations Korean Reconstruction Agency hopes to install the milling equipment before their services in Korea are terminated. The mine is several hundred feet deep with entrance through an inclined shaft; United Nations Korean Reconstruction Agency has started a vertical shaft. Several levels are open and at present the mine is kept unwatered and the timbering kept in repair. There are numerous mine building, all of which seem to be in good shape. They could be used for conducting the office work which necessarily follows the field observations. The surrounding topography is not excessively difficult so the maximum time could be spent on mapping with a minimum of mountain climbing. Vegetation is present but did not look like it would cause too much trouble for making geological observations. However, following the spring season it might become quite dense and troublesome. The maximum number of rainless days would appear to be available during the March vacation period. However, this period might prove too chilly and windy and should be further investigated.

The administration at the College of Engineering should, unless a more suitable location is known, immediately start investigation as to the United Nations Korean Reconstruction Agency's intentions for continuing their program at Yangji-ri. They should also interview the interested Republic of Korea government officials to learn if the mine is available and to determine if the government will keep the mine in a state of accessibility for the College's use and, of course, if the government will permit the College of Engineering to use the mine, buildings, and other facilities for the purpose outlined above.

Whether or not the Yangji-ri mine is selected for a practice mine serious thought should be given to formulating plans for a field trip as previously discussed. The Sangdong tungsten mine might be considered. Transportation to that locality is quite difficult. Because of their usually wet and always dirty condition it is doubtful if a coal mine should be considered.

Justification for Practice Field Trips

It hardly seems necessary to try and justify actual field experience for mine surveying and geological mapping. Perhaps, however, a few remarks will clarify the benefits to be had from this program and help to dispel any serious doubts.

The mining graduate, a year or so after receiving his diploma, and having in the meantime gained practical experience in mining and timbering operations, will very likely enter one of the following fields. In fact, he may do so immediately upon concluding his college career.

Available will be the engineering department or the assaying department. We are not so much interested in assaying as metallurgy graduates usually provide the personnel for this work. Some mining graduates do accept employment here and for that reason it is mentioned.

In the engineering department, and at a small mine the occupant of this position is known as the mine engineer, one of the first, if not the first duty will be mine surveying and underground geological mapping. It quite often occurs that no other employee is qualified to help or instruct the new surveyor in his duties. Even though a qualified superior is available he certainly cannot neglect his work to instruct the mine engineer in his new duties. While mine surveying is considered a rather lowly sort of job, its actual necessity to the successful operation of the mine is much beyond the opinion that is held for it. A few mining companies, but very few, are beginning to recognise the importance of underground surveying and mapping and these companies classify the mine engineer with other departmental heads in salary and responsibility. Mine surveying is important - as a matter of fact, no mining operation of any consequence can successfully continue without the benefits derived from accurately prepared mine maps. A few mines in their early development and while still in high-grade ore and with limited workings, have for a time progressed without the knowledge supplied by the surveyor.

Among the many reasons for mine surveys may be listed: correct orientation between surface features (geology, building, streams, topography, highways, property boundaries, etc.) and the underground workings; correct alignment (direction and elevation) if two underground headings are to meet; correct transferring of orientation through surface opening to lower or higher mine workings; provides a map - plan and sections from which the management can plan mine development; provides a base on which to establish mine ventilation; for the geologist accurately mapped drifts, crosscuts, stopes, etc. on which he may plot the geology; these and other reasons for the mine surveyor could be given. A practice mine for survey will offer the opportunity to develop a reasonable amount of facility in conducting a survey and will inspire confidence in its outcome. There is no subsitute for field experience in mine surveying when a student. One of the vacation intervals (about 4 to 5 weeks) is ample. Speed is not particularly the end to be attained - technique and accuracy are the important goals toward which our aim should be directed.

A practical mapping course in geology needs less argument supporting it than did the mine surveying. As a guide in the search for ore the geologist is indispensible. The future output depends greatly on his knowledge and ability in interpreting geological evidence. It is a widespread custom to record the evidence of geological phenomina on maps, surface or underground (and prepared, incidentally, through his familiarity with mine surveying).

Both surface and underground geology are mapped and correlated with each other; and this evidence may be interpreatd by comparing it with similar information obtained from other mining districts throughout the world. The geology field work instructs the student in the principles and fundamentals of observing, recognizing, recording, and interpreting mineralogical and geological evidence. It indicates how he may make use of structural geology and his studies in ore deposits for directing the mine management in its search for more ore. His technique is established for surface mapping: strike, dip, tracing faults and contacts, rock identification, structural and stratigraphic details; geologic cross sections; all this and more gathered into three-dimensional pictures, if necessary, for the economic use of the geological knowledge thus obtained. Through underground mapping, he is trained to likewise recognize essentially the same features.

It is difficult to overestimate the importance of field courses in mine surveying and/or field geology.

OPTIONAL MAJORS IN THE MINERAL INDUSTRY DEPARTMENTS

Recommendations for Geology Option

At present there is no geology option other than a minor choice through electives. In the Liberal Arts division, on the main campus of Seoul National University, studies leading to a degree in geology are offered. This is not at all uncommon to find a geology curriculum located in a liberal arts division. Investigation will usually show that, when located in this division, the student's preparation is such that he must, with very few exceptions, return for graduate work eventually leading to the Doctor's Degree. An examination of the study list at arts colleges readily provides the answer: the undergraduate years contain courses not directly applicable to the practical aspects of geology (biology, zoology, literature, religion, history, etc.), but probably most important an astonishingly small requirement in engineering subjects (mathematics, engineering drawing, surveying, etc.). There is another handicap under which the so-called B. S. geologist labors. He usually attends a university which does not have a mining or metallurgy department. Thus he gets training in only one side of the mineral industry. The College of Engineering has none of these drawbacks.

The difficulty of trying to insert into the College of Engineering a new curriculum is vaguely understood. As a matter of fact, such action at present is unnecessary. What might be done is to prevail upon 10 or 12 of the 40 mining students to develop an interest in geology. Then at the beginning of the junior year or perhaps the second semester of the junior year, these men would substitute geology courses for many of the mining and metallurgy courses. For the present development of the mineral industry in Korea, this degree of specialization is probably sufficient. Too many should not be trained too hurriedly as finding jobs may become serious. At the start these men would more than likely be employed mostly by the government Geological Survey or the Bureau of Mines. Some employment might be found with foreign agencies helping to develop Korea's minerals.

It is recommended that serious consideration be given to providing this option in the Mining Engineering curriculum. If put into effect it should be planned to become fully operative at the time the Minnesota trained geology major returns to his duties. This would be approximately two and one-half years hence.

Recommendations for Ore Dressing Option

The pressing requirement in Korea's early stages of mineral development is the beneficiation of the raw material - metalliferous, nonmetallic, and coal. This will require ore dressing experts - men who are qualified to select flowsheets on the basis of testing investigations, and to design and construct concentrating plants.

The Metallurgy Department would be well advised to start immediately a program of training the major number of their students in the field of mineral beneficiation. These students should be prepared to undertake crushing, grinding, classification, and concentrating investigations (flotation, sink-float, cyanidation, etc.); to select the proper flowsheet (equipment, movement of material through the plant, economic recovery to expect); undertake the structural design of mill buildings and their erection; to become familiar with the actual operation of a mill; and to do and direct laboratory control work in both wet assaying (common metals and nonmetallic constituents) and fire assaying for gold and silver. The importance of adopting this recommendation can not be over emphasized.

Recommendations for Ceramics Option

In the United States, ceramics is of sufficient importance to command its own durriculum as an independent department. Korea is perhaps not yet ready to set up a separate department in ceramics. The need for qualified personnel in this field is evident. In the Seoul area (Kyonggi-do) alone, are numerous plants utilizing the principles of ceramics. Mention may be made of: burned (common) brick; glazed tile and brick; household utensils (sanitary ware, dishes, pots, jars, etc.); roofing tile; drain pipe, small pottery fire-pots; etc. In the Pusan area the same output accurs. To what extent these ceramic endeavors are directed by college trained and qualified engineers is not known. A little visiting around Seoul gives the impression that plant operations follow along traditional lines: that is, the process is handed down from generation to generation and is pretty much of a closely guarded family secret. This is not at all unusual in this business. Some of the greatest European ceramic factories apparently still follow this procedure.

There is no specific effort made at the College of Engineering to train ceramics experts. In other countries the ceramics departments are commonly in the mineral industry division of the institution.

This is possibly a logical location under certain circumstances as ceramics utilizes raw materials ordinarily thought of as being produced by mining operations. Actually, ceramics is not a producer of raw materials but is a consumer. The principles involved are not related to geology or mining and but indifferently to metallurgy. Therefore, ceramics in the early stages of its development could justifiably be taught in a department not particularly related to the mineral industry.

At the College of Engineering a very few courses relating to ceramics are offered as electives in the Chemical Engineering Department. As any effort exerted toward establishing more interest in the field will start practically from scratch, three departments now existing at the College could be considered for offering a major in ceramics. These are: Mining, Metallurgy, and Chemical Engineering. As there is actually little close relationship between mining operations (aside from geological investigations for raw materials with later mining operations to extract to material) and ceramic processes, the Mining Engineering Department may be at once eliminated. The choice then falls between Metallurgy and Chemical Engineering. These fields both make use of chemistry and physical processes. And each, although metallurgy possibly to the greater extent, are extensively interested in preparing raw materials for later processing to finished or semi-finished products. In my opinion, becuase of the part that fundemental chemistry plays in ceramics as well as chemical engineering, a ceramics major would better be placed in the Chemical Engineering Department at this time. It must be confessed, however, that a strong case could be made for placing ceramics in either department.

The recommendation is made that the College Administration investigate the desirability of offering a ceramics major, and that they also consider the department in which the major should be offered. In the future, as reserves of raw materials are discovered and developed, and the importance of ceramics increases, consideration can be given to establishing a Department of Ceramics. For the present a very excellent option can be set up in Chemical Engineering with the Metallurgy Department offering much of the lecture and laboratory work involving preparation of raw materials, furnace operation, kilns, high temperature measurements, etc.

So far as additional equipment is concerned there is no need for any. Both departments are, or will be, well supplied with laboratory facilities easily adapted to ceramics. No special furnaces need be bought. Raw materials abound with which laboratory experiments and investigations may be conducted.

GRADUATE STUDY AND RESEARCH

After the undergraduate facilities have been arranged and stabilized (curricula, laboratories, buildings, faculty, etc.), graduate student research should be considered. Faculty research should also be encouraged for those members who show an inclination toward investigation, both abstract and practical. Ordinarily instructors guiding or directing graduate students are themselves interested in research. Every effort should be made to encourage faculty members thus inclined. In this way a strong research program may be developed. A conviction is felt that not all educators combine both teaching and research ability and aptitude. After many years of observation it would appear that the reverse is more often true. If an instructor is teaching what is considered an average load, and it should be the administration's duty to see that this arrangement is met, then he should not be held for compulsory research. Research under these conditions should be optional. Average load is a pretty flexible thing. It could depend on student-hours or teaching (class hours per week times number of students met); or upon simply the class (lecture) hours per week; or on the laboratory hours per week; and any of these combined or separate but also combined with student consultation, committee meetings, departmental administrative assignments, etc. In spite of the indefinitness of "average teaching load" it is likely that the equivalent of about 10 lecture hours per week would be considered a maximum load in most American universities or colleges.

Graduate student research is really where the interest should lie. But faculty guidance and assistance must be available, hence the few foregoing remarks. The availability of material and opportunities for graduate work in the mineral industry are almost unlimited. There is little evidence of much investigative work of this kind being conducted in Korea. The field is wide open for problems to be solved both on the campus and in the field. Many of these investigations will be of a semi-research nature, and in this respect will not differ greatly from similar investigations made in past years at other colleges.

Many opportunities are available to the Mining Department for geological mapping of essential areas; study of ore deposits; determination of which sulfide minerals carry gold (at present knowledge is uncertain but of considerable importance); stratigraphic sequences; rock classification through thin section studies; age classification through fossil studies; investigation of granite-hostrock contacts for possible ore deposition; identification of minerals in placer sands;

investigation of pegmatites. These are but a few of the interesting and economically important possibilities that may be mentioned. Mining methods, mine models representing mining methods, ventilation problems, transportation problems (inter-mine levels), drilling round, and supporting ground may be suggested for more direct mining research. In mining, statistical information is quite often of value and is considered a logical type of investigation. A series of mining methods and costs for typical operating mines would have useful value.

In the field of metallurgy we could develop a great variety of investigations, particularly in the branch dealing with mineral beneficiation. Gold and silver ores, suffide ores - simple and complex; grade improvement of tungsten concentrates; crushing, grinding, and classification; flotation, cyanidation, and gravity concentration; coal washing and other preparation; purification of nonmetallic minerals; and similar to mining methods and costs a series of investigations on milling methods and costs. This incomplete list offers some inquiries that may be undertaken with benefit in the field of ore dressing.

Metallurgy proper is not without many attractive opportunities. Brass, copper, iron, and steel (ball and/or roller bearings produced in Korea) present a wide range for investigation for improvement in production and quality. Raw materials such as the alunite for aluminium metal, monazite for its contained rare-earth metals and thorium, bismuth smelting and refining, anthracite coal beneficiation, use of anthracite as a substitute for coke, ferro-tungsten and ferro-molybdenum all present problems which come to mind.

The foregoing remarks have been directed primarily toward the College of Engineering, Seoul National University. It is worth mentioning however, that excellent opportunities exist for advanced study at one of the neighboring Far East universities also receiving assistance from the International Cooperation Administration. This is the University of the Philippines near Manila. Their College of Engineering and the Geology Department (which is in another division of the University) have been exceptionally well supplied with equipment and since 1952 they have had technical assistance and many members of their faculty have gone to the States for additional study and training. Perhaps some thought should be given to a reciprocity arrangement between these two universities for exchanging graduate students. English is the language used for all instruction in the Philippines and is also almost universally spoken there. There is a close similarity between may of the problems confronting both Countries in their efforts to improve mineral output. In some respects there is a similarity in geological problems. A great deal of benefit could eventually be derived if this arrangement were to be worked out.

SUMMARY AND CONCLUSIONS

The preceding report has almost grown beyond its usefulness. What started out to be a few pages of remarks has assumed almost startling proportions. It is sincerely hoped that the reader arrived at the Summary and Conclusions by the long route and not by the most direct one. Also it is hoped that the report will be accepted as a critical analysis and not as a collection of criticisms which it is in no way intended to represent.

It is difficult to prepare a brief statement which will contain the essence of the recommendations made in the body of the report. Objectively, the report is an attempt to indicate how curricula at the College of Engineering may be improved. The standard for making the comparison and recommendations which follow are quite naturally influenced by American practice for engineering education.

Basically, there is nothing extraordinarily out-of-line with the present College of Engineering curricula and methods. However, in view of the very modern laboratory facilities which are arriving almost daily, considerable alteration of course structure and content was believed desirable if laboratory usage and lecture-room instruction were to be modernized and thus permit full advantage to be taken of the arriving equipment. Rehabilitation of the buildings and facilities were all designed with the idea of improving Korea's economy. It does not seem desirable to retain a quite different Japanese educational influence.

In the following paragraphs the actions, conclusions and recommendations of this adviser are briefly summarized. These comments are not given in any particular order of significance or recommendation.

(1) An introduction was prepared to explain why mineral industry education is necessary to the economy of Korea.

(2) Engineering requirements were discussed.

(3) Many of the recommendations apply to all Departments in the College of Engineering in addition to Mining and Metallurgy.

(4) Recommendetions were made to adopt a system of initials or abreviations to represent each department of instruction, and further suggestion made to assign numbers to courses in conjunction with the initials. A system of using the numbering for each year was also suggested. The advantage of preparing and recording student records under this system was pointed out.

(5) It was suggested that a more realistic outlook be taken of the time devoted to laboratory work and recommendations were made regarding the hours to be assigned to laboratory classes. Also, attention was called to several courses that should have definite minimum hours of laboratory work.

(6) Several assignment sheets from an American University were obtained and included for guidance in developing certain freshman and/or sophomore courses.

(7) The rearrangement of freshman and sophomore courses was discussed in considerable detail.

(8) It was recommended that the Dean appoint a committee to investigate the cultural courses now required, to include in their report recommendations for obtaining uniformity among the departments for their requirements and, finally, to determine the minimum total number of credits to be taken in cultural courses.

(9) The recommendation was made that the various departments confine teaching to their own particular fields, to discontinue the encroachment on allied subjects in other departments, and to call upon other departments for service courses. It was furthermore recommended that laboratory equipment and supplies be immediately reassigned to the department specializing in instruction requiring such materials.

(10) A total absence of prerequisites was noted. This has in some cases permitted or encouraged advanced courses occurring in the curricula before the completion of introductory subjects. Recommendation was made that prerequisites be established for all courses beyond the freshman year. In connection with this it was recommended that a College of Engineering Catalog or Bulletin should be printed. Curricula at the College should be stabilized as soon as possible, and there is no reason for not doing so immediately following

the completion of rehabilitation. After this is accomplished, the Catalog would need republishing at only infrequent intervals. A yearly addendum could be issued, when occasion demanded, to note any absolutely necessary changes. Each year a single page Calendar of Important Dates for the College Year could be published.

(11) The practice of faculty members changing their department's curriculum requirements at a minute's notice (and this time interval is to be taken literally) is deplorable and the practice should be stopped immediately. It is recommended that the following standard procedure be instituted for making Catalog changes:

(a) The departmental faculty first approves all course changes, including the content.

(b) The head of the department then recommends the desired alterations to the Executive Committee or Council representing the College of Engineering faculty. By majority vote the recommendations are approved by this Committee or Council.

(c) And finally, the entire College faculty, meeting for this purpose, reviews and approves proposed Catalog Changes. Any other procedure will keep curricula in an impossible state of confusion.

(12) Various courses now listed for the Mining and Metallurgy Departments were reviewed and recommendations made for dropping, combining, shortening, or adding new courses. In some instances, suggestions were made for changing the present content of courses.

(13) The present situation concerning elective courses was quite thoroughly studied. Numerous suggestions were submitted for improving opportunities and for eliminating the excessive duplication between courses and between departments. It was further recommended that a wide choice of business topics be made available (at present as electives, but at some future date some may become required), and that members of the faculty on the Main Campus of Seoul National University be called upon as the instructors for these courses.

(14) The desirability of establishing a practice field camp at a semi-operating mine for the Mine Surveying and the Field Geology courses was reviewed and recommendations made in favor of this action.

(15) In setting up the mineral industry departments at the College of Engineering insufficient recongnition was given to several optional fields of application. Therefore, it was recommended that an option be offered in Mining Geology (in the Mining

Department), an Ore dressing option (in the Metallurgy Department), and a Ceramics option in the Chemical Engineering Department with close consultation from the Metallurgy Department.

(16) Several recommendations were made regarding research and graduate study; among these was offered the possibility of a liaison with the University of the Philippines for exchanging graduate students and possibly faculty members.

(17) In several Appendixes were given actual lecture and laboratory assignment outlines for guidance in teaching similar courses at the College of Engineering.

WRITTEN REPORTS

There is no need to repeat at length here the reports written on the various visits to mining or metallurgical establishments during the stay in Korea. If necessary, the original writeup may be consulted in the Minnesota office file in Seoul. These reports cover both those of places visited and other data specifically prepared or accumulated as of future advantage to the College of Engineering. In abstract form they are as follows:

Mineral Assay Laboratory at Taejon

A few days after the writer arrived in Seoul, the Mineral Assay Laboratory at Taejon was turned over to the Republic of Korea Geological Survey. The design, construction, and equipment of this laboratory was an accomplishment of the United Nations Korean Reconstruction Agency. In addition, men had been trained to carry out the functions for which the laboratory was designed. It is a very completely equipped establishment for investigating minerals, rocks, and ores - chemically and microscopically. Many types of metallurgical investigations may be undertaken, especially those of a beneficiation aspect. The Laboratory occupies a rather self-contained compound: there are European-or Western-style quarters and Korean-type quarters in addition to the laboratory facilities. Mr. L. G. Nonini of the United Nations Korean Reconstruction Agency did an outstanding job in designing and organizing the unit. The Republic of Korea is fortunate in having this laboratory.

The Mineral Assay Laboratory is located at Taejon, Chungchong-namdo, about 90 miles or a 4-hours' train ride south of Seoul.

Macha-ri, Hambaek, Sangdong, and Changsung Coal and Tungsten Areas

Approximately east of Seoul, about 125 miles, is located the

Yongwol coal area. A little farther east of Yongwol is the famous Sangdong tungsten mine. Northerly from Sangdong is the Changsung coal field, in many respects containing the best coal presently known in southern Korea. Travel to and from the region was by train and jeep. The coal seams are worked through numerous tunnels driven along the strike. These levels are connected by inclined surface haulage installations. The coal from Macha-ri and Hambaek is transported by aerial tramway (the former) and railroad (the latter) to the government-owned power plant at Yongwol. The coal from the Changsung field is lowered by counterbalanced, standard gauge railroad cars from the mine area to the end-of-rail in the valley far below whence it is carried by railroad and/or ship to various points throughout Korea. At present this is the most important coal field in Korea.

The Sangdong tungsten mine is on the main road from Yongwol to Changsung. It is the most outstanding and important metal mine in Korea and may well be the largest tungsten mine in the world. The reserves are not yet completely ascertained. This is a well-run operation. The property and mill were rehabilitated by the Utah Construction Company in 1952 and 1953. At present a chemical plant is under construction by the same company. This plant is to produce almost chemically pure scheelite. It was interesting to note the large number of placer miners operating for many miles below the property (men and women), industriously sluicing the old river sands. For years the Japanese and the Koreans had let the mill tailings discharge into the river. The mill recovery had been quite low with the result that the river sands are a veritable "gold mine" of fine scheelite and other tungsten minerals. It is said that one ton of concentrate is recovered per day from the numerous operations.

For a detailed discussion of this or any other area in Korea the reader is referred to "Mineral Resources of Southern Korea". (See later reference).

Taechon-ni Gold Dredging Project Near Mokpo

About 60 km. a little northwest of Mokpo, Cholla-namdo, a rather large gold dredging operation has been given assistance by the United Nations Korean Reconstruction Agency. A Yuba-type dredge, with riffles, has been installed for operating in seawater. This operation must be conducted in spite of a 10-to 12-ft. tidal fluctuation. It is at present the only gold dredge in southern Korea. The area was thoroughly drilled by means of Empire drills before deciding upon dredging. There is conservatively estimated something over $3,000,000 gross in the deposit. Only gold will be recovered, as the heavy sand content is apparently too low for economical recovery.

This area was mined by hand methods for many years. At the time of installing the dredge it had reverted to agricultural use. This is true of probably nearly all former placer gold areas in Korea.

Mokpo is about 250 miles south of Seoul on the southwest coast of Korea in Cholla-namdo. The train trip takes about 9 hours. The dredging area is accessible by either car or boat.

Ku Ma Gold Mine

In almost the extreme northeastern part of Kyongsang-pukto is located a formerly rather productive gold area. At present the only activity of consequence is the privately operated Ku Ma Mines. The property consists of a dozen or more tunnels driven along the vein or to intersect the vein. A rather considerable tonnage of material is blocked out, probably best classified as probable ore and possible ore. There is a 20-stamp mill with plans underway to add another 10 stamps. A Diesel-electric power plant supplies light and power facilities. Almost the entire recovery in the mill is from a large Wilfley table, the concentrate from which is trucked periodically to the copper smelter at Changhang. Amalgamation plates are in the circuit but little gold is recovered because of the small free-gold content. After positive ore reserves are developed, it is proposed that future milling will be by flotation.

The trip to Ku Ma was made in the middle of winter. Transportation was by train and truck going, and by truck, bus, and train returning. It takes about 12 to 14 hours from Seoul and is about 150 miles. The property is under the direction of Brig. General R. S. Whitcomb (Ret.).

Changhang Smelter

During February a visit to the copper smelter at Changhang, Chungchong-namdo was made in company with Mr. Paul Scholla, Office of the Economic Coordinator mining engineer, and Mr. Han, Chung Suk. This journey was by jeep-station wagon. On the return trip the United Nations Korean Reconstruction Agency School Metal Mine at Yangji-ri was visited.

The rehabilitation of the smelter is a United Nations Korean Reconstruction Agency project. At present the output is about 90 MT per month. With the new improvements, and the flotation plant to be installed, they expect to triple this output. This was an interesting tour, especially the very unusual reverberatory copper smelting furnaces still in use.

The School Metal Mine was established by the United Nations Korean Reconstruction Agency Mining Section with the intention of training miners and bosses. It is almost inoperative at present. In another part of this report this project is recommended to the College of Engineering as a practice mine.

Instructions, Equipment, and Supplies for Preparing Slides and Transparencies

At the request of Prof. Yum, Yung Ha, Mechanical Engineering Department, a complete discussion was assembled of the foregoing topic. This amounted to about 60 pages of typewritten material. Equipment and supplies necessary for reproducing the copy, either from drawings or photographs or through the microscope, were completely discussed. The final printing and mounting of the slide material, black and white or color transparencies also was outlined in detail. Formulas for photographing and lettering the copy were given as were data on filters. Finally, suggestions were offered for economically preparing the classroom for projection purposes. This report has been dittoed and issued separately through Dr. Schneider's office to other divisions of Seoul National University.

Mineral Resources of Southern Korea

A badly mimeographed copy of the above titled manuscript was inspected and most of the contents typed and somewhat rearranged by this writer. The structural, paleontological, and economic geology of Korea south of the 38th Parallel of Latitude was quite completely given by the original author. Many of the detailed descriptions of the minor producers were not recopied, but sufficient examples were included to give a good, general background for understanding the geology of southern Korea. Many tables, not originally in the manuscript, were compiled and assembled to take the place of the individual mine descriptions and locations. Thus no properties were excluded from the final typing. Information obtained by the present writer in the way of articles, translations, and particularly geology maps were included in the report. Soon after the writer's arrival in Korea he assembled a geological time scale of Korea (north and south).

This, with a few additions by Mr. Bob Hall, a mining engineer with the United Nations Korean Reconstruction Agency, was traced and Ozalid prints made by the United Nations Korean Reconstruction Agency.

The finally typed copy assumed rather large proportions: 277 pages, Appendixes A, B, and C, and 18 Plates. A copy is in the School of Mines Library, University of Minnesota, one in the Minnesota office, Seoul, and one at the College of Engineering. In addition the writer of the present report has a copy.

Mineral Resources of Southern Korea should be of considerable value to Korean students at Minnesota in their geological and ore dressing studies. In this respect it could be used as a guide for outlining their course of study there and for emphasizing certain phases of both subjects.

Summary of Export Materials.

During late 1956 the Korean government issued (in Korean) a summary of raw materials and manufactured products the country would have available for export. Specifications, as regards purity, packaging and shipping were included. With the help of Mr. Han, Chung Suk this publication was translated into English. Only that part of interest to the mineral industry was reproduced. It will be found as one of the Appendixes with the Mineral Resources Report above described.

Processes for Manufacturing Sulfuric Acid (for Office of the Economic Coordinator engineer)

To help the Office of the Economic Coordinator's mining engineer appraise the sulfuric acid producing potentialities at the Changhang smelter, several pages of descriptive material on the various methods of commercially producing sulfuric acid were assembled. Sources of sulfur, methods of manufacturing and a few cost data were reported.

History of the College of Engineering

With the help of Mr. Han, Chung Suk as translator, the available information was read to obtain some idea as to the history of the College of Engineering. Primarily, interest was in the establishing of the College of Mines by the Japanese. To get this information required a rather detailed assembling of dates, and to complete the picture it was found desirable to mention other institutions in Korea where engineering, especially mining, is taught.

Suggestions for Curriculum Changes in the Mineral Industry Departments, Etc.

This is included as a part of this report and was presented in a previous section. It was assembled previous to the final report for the administration at the College of Engineering.

DIRECT SUGGESTIONS TO THE DEAN'S OFFICE

The opportunity arose on several occasions when suggestions could be made to Dean Hwang. The very gracious manner in which he accepted them is hereby acknowledged.

It is only natural that, in the course of 14 months, a great many suggestions and recommendations would pass between the person acting as Adviser and the Dean's office. Several such instances deserve specific mention.

Employment Opportunities for College of Engineering Students

Briefly, it was suggested to the Dean's office that they inform the following organizations of the presence of a College of Engineering from which technical help could be obtained. This inspired the thought, on the College's part, of expanding the field to various organizations outside the Seoul region. Those suggested at the time were:

1. Mr. William Seymour, Rehabilitation Engineer, Office of the United Nations Command-Economic Coordinator, Yongsan, Seoul

2. Col. S.E. Smith, Commanding Officer, U. S. Army Construction Agency of Korea, APO 301, San Francisco, California

3. Utah Construction Company, for which cconcern Mr. Arthur Kendall is in charge of the mining and exploratory drilling under an International Cooperation Administration contract. Their address is APO 102, San Francisco, California

4. Korean Geological Survey, headed by Dr. Kim, Ok Joon.

A procedure was suggested for informing these concerns of the engineering fields of study and research and faculty consultation facilities available at the College.

Elimination of Duplication Between Departments

It was observed that many departments were offering courses which ordinarily were best offered in other departments. For example: Several departments offered courses in chemical analysis; several drawing courses were offered; surveying was taught in several departments; etc.

The best type of instruction is not always obtained when instructors are called upon to step out of their special field. The result was that a committee was appointed to study ways and means to eliminate this sort of repetition and to recommend that instruction be confined to the departments best qualified to handle the subject. Presumably, the equipment will be transferred to the respective departments when final judgment has been decided upon.

Ore Dressing Laboratory Experiments.

Very complete outlines of ore dressing experiments were obtained from the Missouri School of Mines and the Department of Mineral Preparation of Pennsylvania State University. These outlines were turned over to the Dean for transfer to the Metallurgy Department. The Missouri pamphlet was compiled as a result of a questionnaire which had been submitted to a number of Schools teaching ore dressing and represented a very excellent choice of experiments. The laboratory work was described in detail. The publication from Pennsylvania was somewhat similar to the other but included more explanatory material with problems and answers. Between the two pamphlets the Metallurgy Department at the College of Engineering should be able to select a very high-type laboratory course in ore dressing.

Staff to Minnesota in Mining Geology and Ore Dressing.

Considerable written discussion was provided the Dean concerning the course of study that should be provided at Minnesota for these two faculty members and copies forwarded to Minnesota. Both men are being recommended for a two-year study period with a Master's Degree objective. As the candidates in Mining and Metallurgy so far sent to Minnesota have taken more or less coal mining and/or preparation it was strongly recommended that these two men be restrained from selecting such studies. The purpose of their going to the University of Minnesota is to become prepared for teaching mining geology in all of its phases with particular emphasis on metalliferous geology, and mineral beneficiation as applied to sulfides, tungsten minerals, other nonmetallics (but not coal) and the cyanidation of gold and silver ores. A minimum of instruction is to be devoted to physical or process metallurgy. Only as a fill-in source of material, after other possibilities were exhausted, would these two men be permitted to include coal studies in any form. Coal is important to Korea and it is not being ignored, but for some reason it has been allowed to assume and influence on the educational program much beyond its economic or practical significance.

Engineering Staff Members to be Sent to the States.

Assistance was rendered in screening and selecting the members to be sent to Minnesota for advanced study. It is of interest to remark that fir choices by Dean Hwang and his staff and the writer were the same in all selections.

Metallurgical Analysis for the Office of the Economic Coordinator

Mr. John C. Damon, a power plant expert with the Office of the Economic Coordinator, was confronted with the problem of the steel grinding balls, used for pulverizing anthracite coal, showing an excessively uneven wear. At his request, the College of Engineering undertook the task of determining the cause. The problem was given to the Metallurgy

Department where it was very ably solved. The final solution of this troublesome problem was greatly assisted through the use of equipment recently received through the Seoul National University-Minnesota project. Chemical analyses, hardness tests, and photomicrographs were made to arrive at an answer to the wearing of the steel balls. The carbon, manganese, and chromium content was quite different in the two specimens (hard and soft). And also a considerable variation in the final heat treatment of the two specimens was noted from the hardness tests.

Request of McGraw Hydrocarbon for Graduate Engineers.

Purely as an intermediary, help was given in assisting the College provide the McGraw-Hydrocarbon Company with several engineers. This Company is constructing a large fertilizer plant near Chungju in Chungchong-pukto. Several graduates were interviewed and I believe several candidates were selected.

This matter of placing graduates from the College of Engineering requires much more serious study. Unless there is a rapid and continuous up-surge of activity in the mineral industry, and a more widespread demand for the other engineering professions, there could well become an excessive and serious surplus of engineers. We must not forget that about 350 are graduated each year from Seoul National University; there are two private engineering colleges in the immediate area; and of the remaining Provinces six have engineering departments in their provincial universities. It would behoove the College of Engineering authorities to immediately undertake a program of seeing that the graduates are placed in jobs, more or less commensurate in salary and conditions which warrant the time and effort required to obtain and engineering education. The number of engineering graduates, when compared with the employment possibilities, present-a rather disconcerting and discouraging picture. Most of the opportunities seem to be with government agencies (and the absorption here is limited) and a few private concerns. The College should promote a campaign for publicizing, to every possible employer, the importance of using this increasing supply of trained engineers. The impression is gained that many concerns, who could advantageously use engineering help, are unaware of both their need and the source of supply. The College should distribute an attractive brochure (pictures, short snappy descriptions of the use of each engineering field, and brief and to the point remarks calling attention to the new laboratory facilities with emphasis on their use in teaching practical applications). This little publication should be in every respect a high-class piece of literature, and would be sent free to all prospective employers. This distribution should be country-wide and not confined to the Seoul area.

The brochure idea is widely followed in the States for inducing prospective students into a particular field and also to inform industry of the quality of training in addition to how well the company will be served by employing him.

OUTSIDE SERVICES RENDERED BY THE COLLEGE OF ENGINEERING

The College of Engineering has been able to offer considerable help to several organizations supervising rehabilitation work. There is no need to discuss these; simply listing them will give sufficient explanation.

1. Strength tests on concrete specimens for the United States Army and the Korean Military Advisory Group
2. Metallurgical investigation of grinding media for the Office of the Economic Coordinator
3. Assistance to the Office of the Economic Coordinator Mining Department
4. Assistance to Ku Ma Gold Mine (Private concern)
5. Assistance to McGraw-Hydrocarbon Company
    a. To obtain engineering help
    b. For translation of operating instructions for fertilizer plant
6. Assistance in enlising the aid of the Korean Military Advisory Group to obtain the loan of equipment for use on the erosion and drainage problem endangering the campus. (This trouble is a direct condition resulting from the occupancy of the campus by the United States Army). (See photographs following report showing terracing).

REHABILITATION OF NUMBER 5 BUILDINGS (MINING COMPOUND)

The remarkable job of repairing and returning to usefulness the original set of buildings comprising the former Seoul College of Mines (see History of College of Engineering) may best be illustrated by submitting a few photographs of before and after (see photographs concluding report). In the office of the Chief Adviser, and also in that of the Engineering Adviser at the College, may be seen a small album of photographs showing war damage. Probably a copy of this same group of pictures may be found on the Minnesota campus.* Shown in this group of illustrations is the damage resulting from bombing, machinegunning, and troop occupation. Practically every window pane was broken (hundreds of them); there were no doors left; all electrical conduits and fixtures had been removed by channeling them from the masonry walls; piping was destroyed (water, gas); and the heating plant and gas plant were almost completely demolished. A large section of the roof of one of the large buildings was bombed out along with the second floor. Another of the large buildings had the complete roof and ceiling removed. In several cases one end of a building was missing. All structures had sufficient roof tiles destroyed to permit internal damage from rain and melting snow. For all practical purposes there was no evidence of the equipment and machinery which formerly occupied the buildings and had been removed by looting. Many internal changes had been made by occupying American troops. Water had so damaged many wooden floors that they, with the supporting beams, had to be completely replaced.

The above remarks very briefly review the damage sustained by the College of Engineering Mining Compound.

*See Seoul--Minnesota's Adopted Sister: Bev Mindrum; Ivory Tower, p. 5
Vo. 58, No. 128, April 15, 1957

During December, 1956 work was started to repair the Mining Compound with materials obtained under the Seoul National University-Minnesota project. Sufficient cement-sand roof tile were made to retile almost the entire roof area including the covered walkways connecting the buildings. In the meantime building materials (lumber, glass, roofing paper, cement (from Japan)) had begun to arrive. A contract was let by the College of Engineering and workmen started making, on the job, window frames, doors and framing, benches and other laboratory fixtures, etc. Loose bricks and tile facings were replaced; damaged ceilings repaired or replaced; holes and cracks in floors and walls repaired; glass installed in all windows and many doors; doors hung; and all woodwork painted or stained or varnished. A barbwire fence has been erected surrounding the area with security check stations. All barbwire entanglement left by the troops has been removed. The main item remaining is the installation of electrical work, water and gas facilities, drains, and means for heating during winter weather. A large number of laboratory desks, tables, and similar fixtures have been constructed on the job and are ready for installation when electrical and piping fixtures have been put in place. One building, in which drawing classes are taught, is already in use.

Upon completing the installation of the utilities, new equipment now stored in Buildings 1, 2, 3, and 4, will be moved to the Mining Compound. It is proposed that the following will occupy various buildings in the Number 5 group:

a. Mining Department

b. Metallurgy Department

c. Chemical Engineering Department

d. Freshman chemistry laboratory

e. Beginning drawing classes

There is considerable space available so possibly other service courses may be given in this group of buildings.

MISCELLANEOUS ASSISTANCE

Several miscellaneous projects, where assistance was possible, should be mentioned. Many other opportunities of more minor importance, also occurred.

a. Checking and helping with arriving equipment; all departments

b. Assisting Head, English Department with book translation and preparation for publication, to be later used in English courses at the College

c. Teaching two classes for Senior and Graduate Mining students (a total of 2 credits)

d. Representing Minnesota-Seoul National University at the Office of the Economic Coordinator atomic energy meetings.

MINNESOTA CONTRACT EQUIPMENT RECEIVED

Every department and subdepartment in the College of Engineering has received aid in some form under the Seoul National University-Minnesota project. In the case of the Mathematics Department it was books. And in addition to the academic departments there were assigned purchases to a General Services Department. This department has control of common interest equipment (audiovisual; reproduction - ditto, mimeograph photographic, etc.), emergency power plant, shops, etc.

The re-equipping and supplies program has ranged from scientific laboratory equipment to practical examples of field equipment, and from office supplies to laboratory supplies of chemicals and other consumable goods. The fundamental rule governing the approval of requests was set up by Minnesota in the following priority: (1) undergraduate needs, (2) graduate student requirements, and (3) research. This rule was quite closely adhered to. In a few instances, by using judgment when applying the rule, apparatus could be obtained which would prove suitable for all three fields of use even though not completely suitable without minor additions. The impression is felt that too many persons doing teaching have the notion that all that is necessary for research is to run down to the corner store and buy the equipment ready-made. It is worth emphasizing that equipment for a research project invariably evolves and is constructed as the project slowly unfolds and develops. Aside from a certain amount of glassware, electric motors, measuring devices (energy, electricity, and power) temperature control equipment, gauges, and other simple and fundamental pieces of equipment found in all laboratories, of even the most elementary kind, research-solving contraptions are just not available on the market. To start, the apparatus is quite often constructed in a temporary way from odds and ends at hand by using simple wood or metal working tools.

College of Engineering authorities quite early assigned a very able young man the task of supervising all incoming shipments. This was handled in a most capable manner by Mr. Kim, Chul Sang. Mr. Kim has super- vised the unloading, unpacking, checking, trouble-shooting, and disposal of all incoming supplies and equipment. Damaged or missing items were immediately reported to the Dean's office. From the Dean's office a report was promptly made to the Seoul National University officials, the Mi[illegible] office, and the Insurance Company representative for action.

Equipment received by the various departments was carefully stored under safe conditions (to prevent pilfering or damage) or immediately placed in service in the laboratory. Because of the rehabilitation of the Number 5 Building area, and the lack of present laboratory facilities for the departments to be later installed in Building 5, most of the equip- ment for those departments has been stored in Buildings 1, 2, or 3. To the best of the writer's knowledge no equipment has become damaged or lost because of storage.

SUMMARY AND RECOMMENDATIONS

Accompanying the quite comprehensive report on Suggestions for Curriculum Changes in the Mineral Industry Field, Etc., is a complete Summary and Conclusions for that section. So far as the overall report is concerned, the following summary is given. Actually, the report has intentionally been kept brief and an attempt made to write it in summary form.

1. In the Introduction, reason for the assignment, and duties and various examination trips were explained.

2. Several written reports were prepared during the 14 months spent in Korea. These have been reproduced in abstract form in the report and the source of their availability given.

3. A few services that might be rendered by the Dean's office were discussed. This can be further amplified by remarking that wide publicity should be given to the very complete facilities rapidly developing at the College of Engineering. These laboratory facilities and useful knowledge gained from the education of faculty members abroad are available to government agencies and private concerns for aiding research programs and improving products and production. If full advantage by these agencies is not taken of what the College has to offer, the program will not have completely accomplished its purpose.

4. Progress in rehabilitating Mining Compound buildings was discussed. In this writer's opinion the results have been most satisfactory. In addition, the erosion and drainage problem surrounding the campus and left by the United States Army has been greatly rectified. Equipment loaned by the Korean Military Advisory Group materially aided the erosion control program .

5. A comprehensive survey and discussion of suggestions and recommendations for improving the curricula at the College was made with its own summary and conclusions.

6. A short history of the College of Engineering was translated from the Korean and included in the report.

7. The content of two courses taught by the writer were given in outline form.

8. A map showing the location of the areas visited in Korea, and several photographs illustrating the rehabilitation of the campus and Mining Compound buildings concludes the report.

APPENDIX A

ENGINEERING DRAWING
(49 class periods, 2 hours each)

UNIVERSITY OF IDAHO, MOSCOW, IDAHO

TEXTS: Engineering Drawing by French, 8th Edition
Engineering Drawing Problems by Roland O. Byers

Per.:	Plate Assignment	:	Reading Assignment
1	Orientation		
2	*Lettering	Chap. 1-2	Lettering
3	"	" "	"
4	Use of Instruments	" 3-4	Use of Instruments
5	" "	" "	" " "
6	" "	" "	" " "
7	Use of Scales	" 4	" " Scales
8	Geometric Construction	" 5	Applied Geometry
9	" "	" 5	" "
10	Orthographic Projection & Film	" 6,7,9	Ortho. Projection
11	" "	" "	" "
12	" "	" "	" "
13	" "	" "	" "
14	" "	" "	" "
15	" "	" "	" "
16	Exam. #1 (6 weeks) 7½% Grade		
17	Sections & Conventions	" 13	Sections & Conventions
18	" "	" "	" "
19	Sect. & Film, Dimens.& Notes	" 19,20,21	Dimensions & Notes
20	Dimensioning	" "	Dimensions
21	"	" "	"
22	"	" "	"
23	"	" "	"
24	"	" "	"
25	Exam. #2 (MidTerm) 7½% Grade		
26	Isometric	" 16	Pictorial Drawing
	SPRING VACATION		
27	Isometric	" 16	Pictorial Drawing
28	"	" "	" "
29	Oblique	" "	" "
30	"	" "	" "
31	Perspective	" "	" "
32	"	" "	" "
33	"	" "	" "

Per.	Plate Assignment		Reading Assignment
34	Screw Threads & Fasteners	Chap. 22,23,24	Screw Threads
35	" " "	" "	" "
36	Freehand Sketching & Film	" 8 + 18	Freehand Sketching
37	Exam. #3 (12 weeks) 7½%		
38	Freehand Sketching	" 8 + 18	Freehand Sketching
39	Assembly & Detail Drawings	" 21 + 28	Working Drawings
40	" "	" "	Limit Dimensions
41	" "	" "	
42	" "	" "	
43	" "	" "	
44	" "	" "	
45	" "	" "	
46	" "	" "	
47	" "	" "	
48	" "	" "	
49	" "	" "	
50	Final Examinations		

*A lettering plate will be accomplished each week and due first period each week

APPENDIX B

DESCRIPTIVE GEOMETRY
(49 class periods, 2 hours each)

UNIVERSITY OF IDAHO, MOSCOW, IDAHO

TEXTS: Geometry of Engineering Drawing by Hood, 3rd Edition
Descriptive Geometry Problem Sheet

Per.:	Plate Assignment + Problems			Subject	Chapter
1	Orientation				
2	1	5 + 8		Objects Desc.	2
3	3	3 + 8		Locating Points	2
4	4	6 + 13			
5	5	13 + 18		Visualization	2
6	7	3 + 5		Auxiliaries	4
7	7	10 + 14		"	
8	8	7 + 11		"	
9	8	13 + 16		"	
10	9	3 + 9	Exam. 30 Points	"	
11	10 + 11	3 + 7		Mult. Aux. & Obl.	4 + 5
12	11 + 12	20 + 5		Obliques	5
13	12	8 + 12		"	
14	13	4 + 6		Straight Lines	7
15	14 + 15	10 + 14		"	
16	17	4 + 16	Exam. 40 Points	"	
17	19 + 19	9 + 3		"	
18	20 + 22	3 + 10		"	
19	23 + 24	10 + 6		"	
20	25 + 26	8 + 7		"	
21	27 + 28	7 + 6		"	
22	30	4	Exam. 40 Points	Curved Lines	8
23	31	5		"	
24	32	3		"	
25	35 + 40	5 + 2		"	
26	41	4 + 10		Planes	
	SPRING VACATION				
27	42	11 + 15		Planes	
28	44	5 + 16		"	
29	45	2 + 6		"	9
30	46	4 + 9		"	
31	47	2 + 4		"	
32	48	2 + 3		"	
33	49	3 + 11		"	
34	50	3 + 8		"	
35	51	5 + 8	Exam. 40 Points	Intersections & Devel.	10
36	54	3 + 8		" "	
37	55	14		" "	
38	56	7		"	
39	57	6		"	
40	57	9	Exam. 30 Points	Surfaces	11

Per.	Plate Assignment + Problems		Subject	Chapter
41	60	9	Single Curved	
42	61	4	"	
43	62	3	"	
44	63	1	"	
45	65	2	"	
46	87	2	"	
47	87	8	Topographical & Mining	14
48	87	20	"	"
49		REVIEW		
		FINAL EXAMINATIONS		

APPENDIX C

ENGINEERING DRAWING, DESCRIPTIVE

GEOMETRY & ENGINEERING PROBLEMS EQUIPMENT LIST

UNIVERSITY OF IDAHO, MOSCOW, IDAHO

ENGINEERING DRAWING

T-Square 24"
Set of Drawing Instruments - Dietzgen S1242P2 or Equal
Drawing Board 18" x 24"
Triangle 30° - 60° ; 9" (Lettering - Braddock Rowe)
Sheet Backing paper 18" x 24"
Triangle 45° - 10"
Scale - Triangular - Architects - KE - 8895 or Equal
Scale - Triangular - Engineers - KE - 8893 or Equal
Irregular Curves - Dietzgen 2152-6 and 12112 or Equal
Protractor - 6" Clear - Engine Divided
Metal Erasing Shield - KE (Thin) or Equal
Pencil Pointer - File or Sand Paper
Pencils - 2- H. 2 - 2H, 2 - 4H, 2 - 6H
Stick Eraser - Pink Pearl or Blaisdell 536T
Eraser - Art Gum
Ink - Higgins Black India or Equal
Pen Holder
Pen Points - Henry Tank No. 5 and 12
Drafting Tape, Roll, Scotch
Combination Lock (National)

Descriptive Geometry

(Same equipment as used in Engineering Drawing plus the Following):

2 Blue Pencils (Mars Lumigraph)
2 Red Pencils " "

ENGINEERING PROBLEMS

Text: Engineering Problems - Curtis and Junk
Slide Rule - Post, Versalog or
KE 4081-3 or
Dietzgen 1732 or 1738
Engineering Problems Paper
(The following required equipment is normally available for Engineering Drawing):
30°-60° Triangle (Braddock Rowe - Lettering) 9"
Protractor - Engine Divided 6"
Engineers Scale - KE - 8893 or equal

APPENDIX D

ENGINEERING PROBLEMS

UNIVERSITY OF IDAHO, MOSCOW, IDAHO

Test: Engineering Problems - Curtis and Junk
One Two-Hour Laboratory per Week

Period	Chapter and Subject	Problems
1	Orientation, Problem Presentation, Slide Rule Selection	
2	3 The Slide Rule pp. 11-14 C, D, Scales; Slide Rule Adjustments	4-28
3	3 The Slide Rule pp. 14-18; A, B, K, CF, DF, Scales	29-48
4	3 Slide Rule Quiz #1; Cl, ClF Scales. Trig Functions	49-68
5	5 Vectors; Graphic and Component Method	85
6	6 Slide Rule Quiz #2; Free Body Diagram	95-96
7	6 Free Body Diagrams	101-102-103
8	7 Equilibrium of Force Systems Graphic Method	116-121
9	3 Slide Rule L, LL1, LL3, LL01, 2 and 3	69-82
10	7 Equilibrium of Force Systems, Compontent Method; Slide Rule Quiz #3	121-116
11	8 Moments	127-129
12	9 Force, Mass, and Acceleration; Slide Rule Quiz #4	134-137
13	10 Friction	145
14	11 Work, Power, and Energy; Slide Rule Quiz #5	147
15	16, 17, 18, 19 Application of the Slide Rule to the Fields of Engineering	
16	Review for Final Examination	
	FINAL EXAMINATION	

APPENDIX E

FUNDAMENTALS OF SURVEYING

(This is a Two-Dredit Course for Mech. and Elect. Engs.)
One-hour lecture and 3 hours field work each week.

UNIVERSITY OF IDAHO, MOSCOW, IDAHO

Text: Elementary Surveying by Brinker & Taylor, 3rd Ed.
International Textbook Co., Scranton, Pa.

Assign. No.	Recitation Assignment	Problems	Field Problem
1	1-1 - 1-7; 2-1 - 2-13	None	Film
2	4-1 - 4-31; 3-1 3-6	4-1, 4-2	Taping and Pacing
3	5-1 - 5-31	5-3, 5-6	Taping
4	5-22 5-36	5-13, 5-17	"
5	6-1 - 6-10; 7-1 - 7-11	6-5, 6-11, 7-3	Leveling
6	HOUR QUIZ	None	"
7	8-1 - 8-26	8-2, 8-6	Leveling
8	9-1 - 9-13	9-3, 9-9	Transit
9	10-1 - 10-15	10-6	"
	SPRING VACATION		
10	11-1 - 11-11	11-6	Transit
11	12-1 - 12-15	12-4, 12-8	LAB QUIZ
12	HOUR QUIZ	None	Map Survey
13	13-1 - 13-19; 14-1 - 14-15	None	" "
14	16-1 - 16-11	16-3, 16-19	" "
15	19 and 20 (all)	20-13, 20-14	" Drafting
16	21 and 25 (all)	None	" "
17	REVIEW	None	" "
18	FINAL EXAMINATION		

APPENDIX F

ELEMENTARY SURVEYING

(One Lecture, Two 3-hour labs)

UNIVERSITY OF IDAHO, MOSCOW, IDAHO

Text: Surveying by Davis & Foote, 4th Ed. McGraw-Hill Book Co.

Period	Recitation Assignment	Problems	Field Problems
1*	Introduction		Movie
2			Pacing and Taping
3			7.1 - 7.29
4*	1.1 - 1.2, 3.1-3,16	1, 2 p. 143	
5			Taping
6			Taping Angles
7*	8.1 - 8.27	6.13 p. 179	
8			Leveling
9			"
10*	10.1-10.2, 11.1-11.3	1 p. 229	
11			Leveling
12			"
13*	12.1-12.26	1, 3 p. 271	
14			Profile Leveling
15			" "
16*	HOUR QUIZ		
17			Compass Traverse
18			Compass Problem
19*	13.1 - 13.33	1, 8 p. 312	
20			Angles with the Transit
21			Transit Traverse
22*	14.1 - 14.29	None	
23			Inaccessible Distances
24			LAB QUIZ
25	15.1 - 15.21	1, 3 p.363-4	
26			Lat. and Dep. Problem (Chapter 18)
	SPRING VACATION		
27			Land Area Problem (Chapter 19)
28*	17.1 - 17.23	None	
29			Stadia Problem
30			Plane Table Mapping

Period	Recitation Assignment	Problems	Field Problems
31*	6.1-6.2 - 24.1-24.16	None	
32			Plane Table Mapping
33			" " "
34*	HOUR QUIZ		
35			Topog. Map Survey
36			" " "
37*	22.1-22.21	None	
38			Topog. Map Survey
39			" " "
40*	23.1-23.31	1, 3, 8 p. 613	
41			Topog. Map Drawing
42			" " "
43*	20.1-20.24	1 p. 515	
44			Topog. Map Drawing
45			LAB. QUIZ
46*	REVIEW	None	
47			To Be assigned
48			" " "

FINAL EXAMINATION

*Lecture Period

Fig. 1 - College of Engineering - Damaged Mining Compound in Foreground.

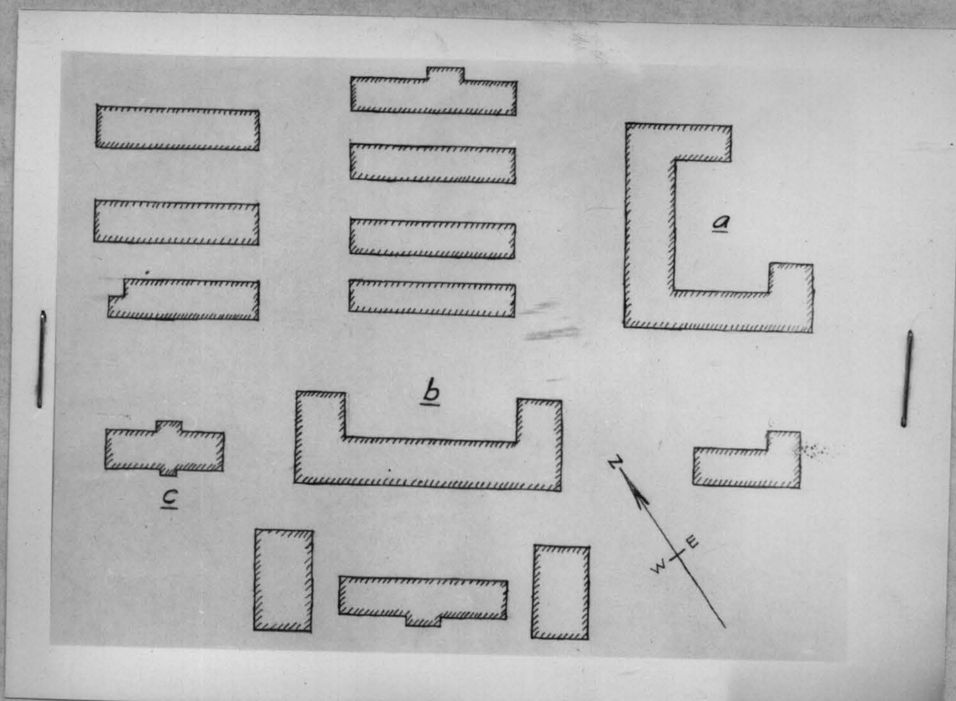


Fig. 2 - Sketch of Mining Compound. See Figures 3 and 4.

↓a ↓b

Fig. 3 - Several Damaged Buildings in Mining Compound
(See Fig.2 for location of "a and b".)

↓a ↓b

Fig. 4 - Mining Compound Buildings After Rehabilitation
(See "a" and "b" Fig. 3)

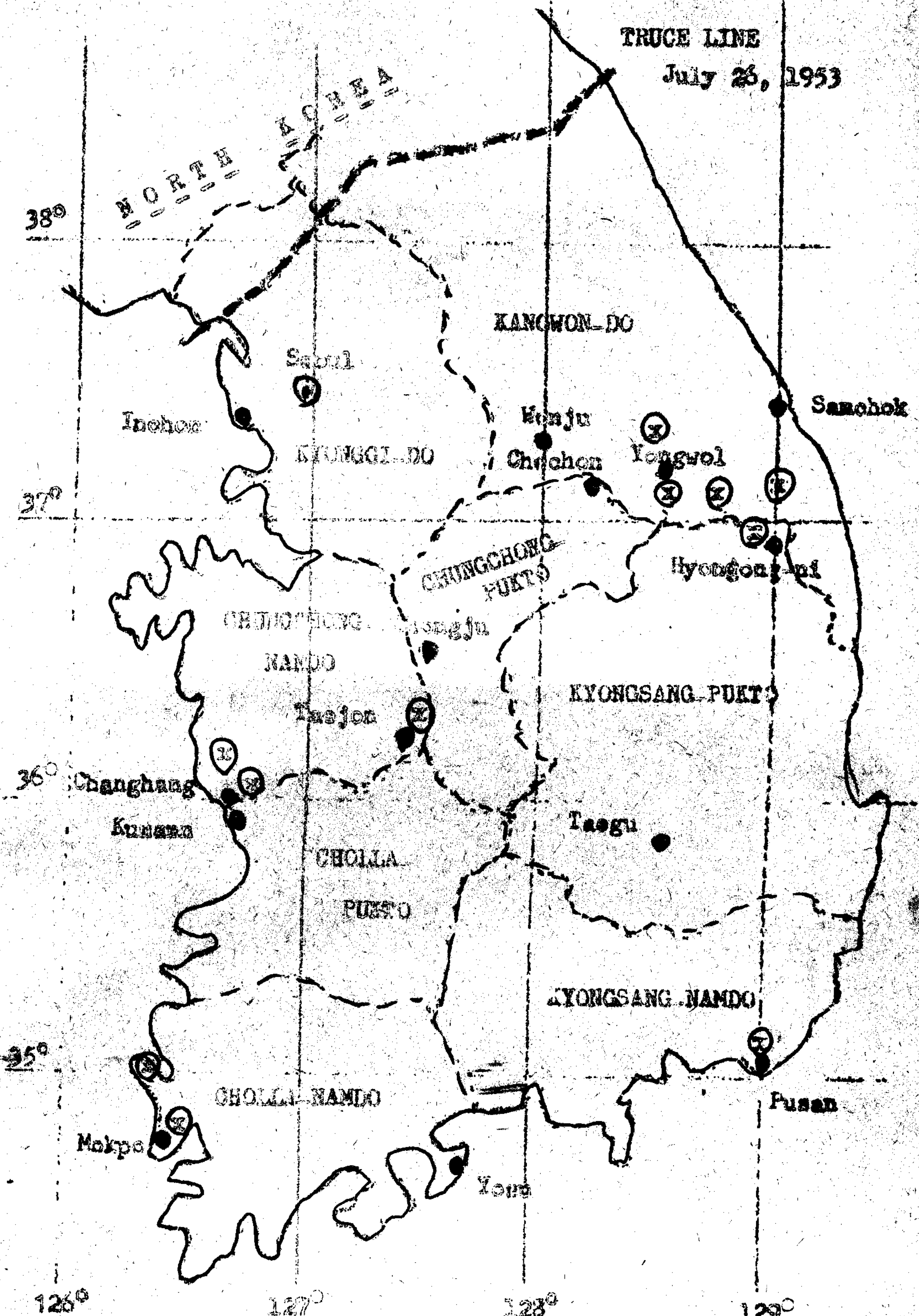
Fig. 5 - Erosion Before Terracing. Part of Area
Shown in Fig. 8.

Fig. 6 - Terracing For Erosion Control.
Looking North.

Fig. 7 - Terraces For Erosion Control. Upper Level. Looking East.

Fig. 8 - Terraces For Erosion Control. Lower Level. Looking South. (See Fig. 5)

Fig. 9 - Classroom in Repaired Building.
(See Fig. 2, Building "C".)



REPUBLIC OF KOREA

Areas Visited......

0 50 100 Miles