theorizing as well as the more practical application of his science.

The author attempts to prove that "the main factor governing igneous intrusions is the system of stress to which the rocks are subject, and that existing dislocations, planes of stratification, and other accedents and complex lines of weakness are of secondary importance in determining the shape and position of the intrusion."

MINING.

Mining in Nicaragua, by T. Lane Carter. T. A. I. M. E. Bul. 48, p. 965.

A very interesting presentation of all phases of the subject. Anyone will find it worth reading, and it should be very helpful to anyone intending to work in that part of the world.

NOTICE.

The Alumni Association has for some time been trying to locate the following graduates. Some of these have not sent in their address for several years. If any of the readers of the Magazine know the whereabouts of any of the following men, they will be helping the work along by sending what information they can to the Assistant Secretary at Golden:

Walter D. Abel, '06.
Walter J. Atkinson, '96.
J. E. Bergh, '02.
Albert Berry, '05.
Chas. E. Breed, '01.
Harry F. Bruce, '00.
Herbert A. Canning, '97.
W. E. Canning, '09.
Paul H. Carpenter, '10.
Burt Cole, '92.
Chas. R. Ewing, '00.
Louis D. Fry, '03.
Geo. W. Griswold, '96.
Frank R. Hamilton, '98.
L. P. Hills, '08.
Geo. F. Hoyt, '96.
Gilbert E. Jewel, '93.
Fred G. Kelly, '99.
Victor E. Kerr, '00.
Oscar A. Lampe, '98.
N. W. Logue, '97.
Wm. B. Middleton, '83.
Wm. E. Newman, '96.
Enrique A. Schuman, '97.
E. M. Smith, '05.
Howard Spangler, '05.
J. J. Weisz, '09.
Chas. E. Wheeler, '94.

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Genesis Of Ore Deposits.

George J. Bancroft.*

(Lecture delivered before the Colorado School of Mines Technical and Engineering Society and later before the Colorado Scientific Society.)

The study of the genesis of ore deposits is one of the most fascinating studies connected with mining. Its fascination is, no doubt augmented by the fact that we have so little direct knowledge bearing on the subject. At the present time almost all of the theories of ore genesis are merely tentative hypotheses advanced simply to aid in gaining more definite knowledge rather than the final laws established by enduring facts. It is this tantalizing haze of the unknown which adds to the charm of studying ore deposits and spurs one on to attempt to add to the reclaimed area of science one small tract, at least, of the great desert of the unknown.

To my mind, a theory is not at all a satisfactory one unless it starts somewhere, ends somewhere, and presents a logical sequence of progress from the beginning to the end. Hence, in briefing my gleanings from the field of the study of ore deposits I shall endeavor to present only such theories as have the above characteristics. Moreover, as this is to be a very short paper, I will make no attempt to the history of my ideas, nor shall I hesitate to borrow part of one man's theory and to attach it to another's, and then mayhap add a piece of my own if by so doing I can present a theory which begins somewhere, ends somewhere, and has a logical sequence of progression, nor will I, in this short paper, try to make any defense of, or argument for or against, any theory. I will simply present the theories which appeal to me, and my readers will naturally exercise the same discretion and accept what appeals to them and reject what does not.

I shall endeavor, so far as possible, to avoid the use of that foolish system of nomenclature which besets our science of mineralogy and stick to simple words. There are, however, two or three technical words which it is easier to use than walk around, namely:

Syngenetic—which means "born together with," and signifies an ore deposit which was formed at the same time and by the same agencies as the country rock.

Epigenetic—which means "born upon" and signifies an ore deposit formed after the country rock was in place.

Metasomatic Replacement—which means the replacement in whole or in part of the crystals of the country rock by the salts of a salt bearing solution.

The first question one naturally asks when studying the formation of ore deposits is—where did the metal originally come from? We see that the great majority of the surface rocks are either barren or extremely lean in metal values, while workable cre deposits of any kind are few and far between, and such as there are, we observe, are nearly always associated directly or indirectly with eruptive rocks. To my mind, the most plausible explanation of the original source of the useful metals is that it came from the Barysphere. Physicists and astronomers have weighed the earth and found it not "wanting," but over weight. Chamberlin and Salisbury in their treatise on geology give the specific gravity of the entire earth as 5:57, while the average specific gravity of the lithosphere is given as 2:7. It is very evident that the center of the earth is much more dense than the exterior. While it is no doubt true that the material near the center is greatly compressed by the pressure of the super-incumbent masses, still we have no reason to believe that the compression of the rocks **alone** is sufficient to account for the great specific gravity of the earth, and it is far more logical to assume that the central materials themselves are heavier.

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The nebular theory of the formation of the earth is as well accepted as any theory on the subject, and while this theory does not necessarily involve a molten condition of the earth, yet it does involve a transition stage of incoherency when the earth was neither nebular nor solid, in which period the heavier particles would naturally gravitate towards the center, while the lighter ones remained on the outside.

We have no reason to suppose that the interior of the earth contains elements foreign to the surface, so I think it a fair assumption that there is a so-called "barysphere," composed very largely of those heavier elements which we have to a limited extent on the surface. The analysis of meteors gives collateral evidence in support of this view. Meteors are supposed to be similar to the original units that formed the earth, and they contain much greater percentages of the heavier metals than the rocks of the lithosphere.

Looking now at the matter from another angle, we see that the great majority of our mineral deposits are associated with eruptive rocks, but on the other hand all eruptive rocks are not associated with ore deposits. The inference is plain, I think, that those eruptions which were sufficiently deep seated to disturb the barysphere produced ore deposits, while eruptions arising from shallower depths did not.

The metalliferous deposits which are not associated with eruptive rocks form a very small group, and even then many of them are secondary deposits whose primary source was eruptive rock. Thus, placer deposits of gold and tin are nearly always the secondary concentration of eroded deposits, which in turn were associated with eruptive rocks. Some iron deposits also are nature's concentrates from the erosion pulp of granitic areas, but the iron-bearing granite is under suspicion at least of being an eruptive in many cases. Probably the bog-iron and bog-manganese deposits are as far removed as any class. If we follow back the lineage a geological generation or two, we are very apt to come again to eruptive rocks. So I think that, after delving into the formation of the earth and finding at least reasonable evidence of a barysphere, composed largely of the heavier metals, the next logical deduction is that the metals reached the surface through eruptive action. This leads us to a consideration of eruptions and eruptive rocks.

Just what causes eruptions is not as yet fully understood. It is fairly well accepted nowadays that the earth is solid to the core. Eruptions, then, must be due to local conditions. A great many plausible theories have been advanced to explain volcanoes. These theories involve chemical reactions or residual molten reservoirs or local release of pressure or local intensified pressure due to crustal movements, etc., etc.

It does not make any material difference in the logical chain of our thought which theory is adopted to explain eruptions, and for the sake of brevity I will not rehearse any of them.

Eruptive rocks, as they issue from the earth in a molten state, are not at all like molten slag or "dry melts." The magma of an eruptive is a curious mixture of molten rock, sulphur, water-gas, chlorine and various other gases. There is abundant evidence to show that magmas flow from the earth in a molten condition at temperatures that would not soften the same rock, once it has solidified. I have seen lava flowing down the side of Vesuvius which was hardly a dull red heat. I have also put blocks of lava in the assay muffle and know that it will not melt at a bright red heat. Not only does a magma differ from molten slag in the temperature of flowage, but in the process of cooling it exhibits many peculiarities. In fact, it is the processes attending the cooling of magmas to which we trace the majority of ore deposits.

I will adopt the following classification of ore deposits, looking at them from a purely genetic standpoint: First, deposits which are part of the original magma; second, deposits in fissures, cavities or porous rocks resulting from emanations from the magma; third, deposits resulting from the leaching and reconcentration by meteoric waters of either of the first two classes; fourth, deposits resulting from the erosion and reconcentration of either or all of the first three classes; fifth, deposits resulting from concentrations of metal from non-eruptive rocks.

First—Deposits which are part of the original magma. I do not mean to include in this class veins in eruptive rock which may have been enriched by emanations from the same rock, but only such deposits as are part and parcel of the original rock, that is, are syngenetic.

For some reason, which I am free to say I do not understand, magmas, in cooling, disregard the laws of gravity and form segregations of their various constituents, quite at variance with the earth's pull. Thus, in the case of the Mackinaw nickel mine at Monte Cristo, Washington, there is a large dike of nickel-bearing peridotite penetrating a country of quartenary slate and shale. Along both contacts of the dike are deposits of nickel ore. The deposits are about eight times as rich in nickel as the rest of the dike, yet they are part and parcel of the dike. So far as I know, they are not on veins or fissures and can be explained only on the theory that in cooling there was a segregation and concentration of the materials of the dike.

Eruptive rocks which are sufficiently rich to pay to work the entire mass of the dike or stock are extremely rare. Most "porphyry" mines are the product of magmatic segregation, secondary enrichment, or both. There are, however, three tin mines one hundred and twenty miles northwest of Johannesburg, South Africa, which are working on pipes of greenstone in a granite formation and milling the entire pipe. These pipes are from ten to twenty feet in diameter. It is likely, however, that part of the metal is epigenetic in character.

The great low grade copper mines at Ely, Nevada, and Bingham, Utah, are, I think, generally recognized as deposits of magmatic segregations, augmented somewhat by secondary enrichment. Although they are very low grade, yet the mass of the parent eruptives are much lower grade and not at all workable.

Among the well-known ore deposits which have been classed as magmatic segregations may be mentioned the famous iron deposits of the Urals, Russia, (1) of which the Cysokaya Gora is the most prominent; the magnetite deposits of Taberg and Routivare, Sweden; (2) the Etta Knob tin deposit (1) of the Black Hills; South Dakota; the Norwegian nickel deposits (2); the nickel deposit of Varallo, Italy (3); some of the magnetite deposits of Puget Sound, Texada Island, etc.

Second—Deposits in fissures, cavities or porous rocks resulting from emanations from the magma, i. e., epigenetic.

This class covers the great majority of the ore bodies with which the average mining engineer has to deal, and it would be impossible at this time to follow out all the ramifications which pertain to the study of the genesis of this class of deposits.

That ore deposits in veins were formed by emanations resulting from eruptive action has been recognized by the more experienced students of the subject for many years, but the puzzling thing to my mind for some time may be voiced by the question—why should the metals leave the eruptive rocks? Granting that the metals reached the surface from the barysphere by means of eruption, I could discover no logical reason why the metals should not stay in the eruptives; and yet it is a matter of practical everyday experience that the dikes of eruptive rock are generally very lean, while the valuable ore deposits are found in nearby veins, cavities or zones of crushed or porous rock.

I finally arrived at a plausible explanation of this phenomena through the study of chlorine and its reactions at various temperatures upon the metals and rock making minerals. The other halogens, no doubt, play an important part also, but they are present in less quantities and I am not familiar with their reactions.

Mr. Francis Church Lincoln, working with Prof. J. F. Kemp, of Columbia University, has compiled a very complete list of all the available analyses of volcanic emanations (Economic Geology, Vol. II, No. 3), and his conclusions are as follows: "Magmatic emanations which are expelled as gases and vapors become at the ordinary temperature of the earth's surface solids, liquids and gases. The principal gases are carbon dioxide, methane, hydrogen, hydrochloric acid, hydrogen sulphide, sulphur dioxide, nitrogen and oxygen, with less carbon monoxide and ethane and a very little hydrofluoric, hydriodic and hydrobromic acids. Water is the only important liquid, and it makes up a large percentage of the total emanation. The solids are chiefly chlorides and sulphates of the alkaline earths and of iron, together with a much smaller quantity of metals and mineralizers."

T. Wolf found that near the crater of Cotopaxi the fumes were mostly of hydrochloric acid with some free chlorine, while at the lower levels hydrogen sulphide was found with a trace of sulphur dioxide. (1)

Sainte-Claire Deville found chlorides of iron and copper in a fumarole of Vesuvius. (2)

R. Bunsen found various metallic chlorides in the sublimates around fumaroles of Mt. Hecla in Iceland. (3)

A characteristic of volcanic emanations is that chlorine is found either free or as the chloride of the metals, or as hydrochloric acid, while a characteristic of hot mineral springs is that the water contains large quantities of the chlorides of sodium and potassium.

As pointed out in my paper before the New York meeting of the American Institute of Mining Engineers, the chlorine would be in combination with the heavier metals, and would not break up the silicates, at temperatures ranging from 150 C. to 1100 C. (atmospheric pressure), and this range covers the temperature of the ordinary magmas. Moreover, the metallic chlorines are all volatile at high temperature. Thus we have a condition which logically explains the tendency of the metals to leave the parent eruptive and precipitate in nearby veins. The metals being in the condition of gaseous salts would tend to burst out from the magma as horizons of lower pressure were reached and seek escape through crevices, veins, crushed zones, porous strata or open channels. These gaseous emanations would sooner or later be cooled to the point of liquification. In case this happened short of the atmosphere there would result a hot aqueous solution containing metallic chlorides, sulphur, hydrogen sulphide and the various other elements and compounds of a magmatic emanation.

The United States Geological Survey has conducted a great number of experiments on the reactions between acid metallic salts and the common rock forming silicates, such as orthoclase, augite, amphibole, etc., etc., and the engineer in charge of this work, Mr. Eugene Sullivan, uses these words in the summary (Bulletin No. 312): "The natural silicates precipitate the metals from solutions of salts, while at the same time the bases of the silicates are dissolved in quantities nearly equivalent to the precipitated metals. The bases most commonly replacing the metals in these

processes are potassium, sodium, magnesium and calcium."

Thus it will readily be seen that the magmatic emanation would, as soon as condensation takes place, begin reactions with the wall rocks of its conduit. Some rocks are, no doubt, acted upon more readily than others. A very silicious sandstone would be the least likely to precipitate metals, and it is well known that there are very few important metallic deposits in sandstone. The Neglected mine in the La Platas, Colorado, is a vein traversing red sandstone and porphyry beds. The ore is almost entirely in the porphyry beds, the sandstone horizons being barren. On the other hand, CaO would be one of the most active precipitants, and it is fair to assume, I think, that where hot eruptives penetrate limestone beds, the lime in immediate contact with the eruptive would be calcined to CaO. Thus porphyry-lime contacts are notoriously likely places for the occurrence of ore bodies, as at Globe, Arizona; Bisbee, Arizona; Cananea, Mexico; Leadville, Colorado; Cortez, Nevada, etc., etc. Limestone itself is a precipitant, but not nearly so active as CaO. Other rocks such as granites, schists, gneiss and the various porphyries nearly all have feldspars or other silicates which would be more or less readily acted upon by the magmatic solutions.

A study of magmatic springs, which we may consider the liquified volcanic gases, mixed with some meteoric water, and changed by passage through the rocks, shows on the average an abundance of chlorides of sodium and potassium, CO_2 and H_2S, but no metallic chlorides, so I think that the inference is plain that the volcanic emanations reacted as outlined above with the potassium and sodium silicates somewhere in the underground passages.

Alfred C. Lane, State Geologist of Michigan, has worked out much the same theory to account for the great iron deposits of Michigan. In the Journal of the Canadian Inst., Vol. XII, page 19, he says: "Now we know that chlorine and chloride of iron are attendant on many volcanoes and volcanic eruptions, so that we should certainly keep a place for chlorides among the possible salts.

"We have simply to imagine, then, according to Leith's theory, that the waters leaching the iron from the basic rocks found their way into basins which also received the waters of rivers containing alkali carbonates or silicates, just such waters as come off the Laurentian Highlands in the Ottawa River today, as the recent analysis from R. A. Daly, which I cite above, shows."

Mr. Lane then goes on to give the chemical reactions which would occur, showing that either ferrous or ferric chloride and sodium silicate would result in ferrous oxide, common salt and silica. If the precipitation took place in shallow oxidized waters it is probable that the sulphur fumes which are always present in volcanic emanations would not attack the ferrous oxide; while if the precipitation took place in a vein removed from atmospheric influences the oxide would be at once attacked by H_2S and converted to a sulphide. This reasoning agrees with the facts as we find them. It is agreed, I think, that the Michigan iron ores were formed on the surface, and they are oxides; while the primary deposits in veins are nearly always sulphides.

Thus it will be seen that a little further study of fresh volcanic emanations and their reactions with the rocks of the lithosphere will probably clear up all doubts as to the genesis of this class of deposits.

Carbonaceous matter will precipitate gold and gold only from a chloride solution, and this may account for the many deposits of very pure gold in connection with the carbonaceous formation, as the specimen gold mines in the carbonaceous shale of Farncum Hill, Summit County, Colorado, or the famous gold mines of Ballarat, Australia, where the ore shoots follow a narrow carbonaceous cross vein called the "indicator."

The variety of forms which deposits of this class may assume is infinite. There are, however, certain well-known types or classes of which it is well to take notice.

(a) There is the simple fissure vein, containing ore shoots. The ore shoots are generally longer vertically than horizontally, and often have a pitch. All the ore shoots in a group of closely related veins will often have the same pitch, so it is evident that the pitch was determined in some manner by the mode of genesis.

It has been somewhat generally accepted that ore shoots represent channels of flow. There are, however, some objections to the acceptance of this theory. For instance, some ore shoots pinch out at the bottom and there is not even a vein below in the direction from which the flow apparently came, according to this hypothesis.

It occurs to me that ore shoots may represent zones favorable to precipitation, even where there is no change in the country rock accompanying the ore shoot. To take a very simple case, let us suppose a vein and dike crossing each other. Some of the emanations from the dike find a vent through the vein. As the emanations or solutions from the dike get further away from the source of heat, a zone will be reached at which the temperature will be very favorable for precipitation. This zone would then be marked by an ore shoot. It might be at right angles, or at any other angle to the direction of flow. Moreover, a certain temperature zone might be favorable to the precipitation of a certain group of metals, while another temperature zone would be favorable to another group of metals. In such event ore shoots in the same vein would differ one from the other, and it is well known that such is often the case.

That ore shoots generally occupy places in the vein where there are more or less

open channels is a fact well known, and this, no doubt, has led to the belief that ore shoots followed the more open channels. That an open channel would be favorable to the formation of an ore body cannot be denied, but with our present knowledge of the formation of ore shoots it seems to me just as reasonable to suppose that the ore shoot formed the channels as that the channel formed the ore shoot. Wherever the magmatic emanations begin to react with the country rock there would naturally be formed a more open place, because in addition to chemical action between metallic chlorides and the feldspars there would without doubt be many other reactions tending to break up and leach away the silicates, leaving behind only the silica or quartz. For instance, CO_2 is a common constituent of magmatic emanations and it will act on many of the silicates, taking their bases into solution.

This matter of the pitch and habit of ore shoots is perhaps the most important point where our theorizing touches the practical working of mines and from a practical standpoint it is the gaining of knowledge of this important matter which, to a large extent, justifies the study and research into this fascinating subject. When we arrive at the point where we can say with a fair degree of certainty just how a given ore shoot was formed, we can also say, with a fair degree of probability, where a kindred one is likely to be found.

Very good examples of fissure veins containing ore shoots may be seen in Gilpin County and Clear Creek County, Colorado. In this locality, also, neighboring veins generally show a uniform pitch of the ore shoots.

(b) A large class of ore bodies are found along contacts between eruptive and other rocks. In some cases the deposit will be mostly on the eruptive side of the contact and sometimes on the other. I think contact deposits are less likely to lie in distinct ore shoots than in the case of veins, but there are some notable cases of very continuous contact shoots; as at Leadville in the porphyry contact. As a rule contact deposits are irregular pockets or deposits. It frequently happens, however, that the pockets will lie along certain horizons or zones, as at Bisbee, Arizona, where the contact deposits consist of a string of pockets of great size, extending along a certain geological horizon for several miles.

Many veins occupy the same fissures as that occupied by a dike without apparently being in any way related to the dike. In such cases it is supposed that the dike was cold and its habitat simply presented a line of weakness when a subsequent eruption started mineralizing agencies.

(c) A very important class of ore deposits consist of anticlinical folds. The folding of the rocks has shattered the more brittle strata and thereby provided channels for the circulation of underground waters.

The most beautiful and noted of this class are the saddle reefs at Bendigo, Australia. La Trinidad and Nacozari, Sonora, likewise have been determined to be anticlinical deposits.

(d) Ompregnation Deposits.—This class is so varied that it would be impossible to cover the field in this paper. An old river channel, a porous stratum, or a crushed zone may form the habitat of an ore body and its outline may be as irregular as that of a clinker.

(e) Deposits in Open Cavities.—In the quartzite at Ouray, Colorado, and in the limestones of some of the Missouri zinc-lead fields are found more or less open caves containing beds of ore. Similar deposits occur elsewhere, but they are not a very important class, and there is some question in regard to the Missouri ores, at least, as to whether they are of primary or secondary origin.

We come now to the third group in our general classification, namely: Ore bodies resulting from the leaching and reconcentration by meteoric waters of either of the first two classes. In this group are deposits of "secondary enrichment" which are formed by surface waters percolating down through a mineralized vein, dissolving the metals in the superficial zone, and precipitating them in the vein below in conjunction with the original minerals.

This action is particularly pronounced in copper and zinc ore bodies, because these two metals form soluble salts in the process of oxidation. The zone of secondary enrichment is often the only workable part of a copper mine. Chalcocite is the characteristic secondary ore of copper and calamine of zinc.

Iron ores also have a tendency to form deposits of secondary enrichment. When speaking of iron ores I refer to the oxides of iron because the sulphides of iron are not valuable as iron ores.

Alfred C. Lane, geologist of Michigan, is authority for (Journal Canadian Inst., Vol. XII, page 19) the statement that alkaline waters attack the iron silicates and that the iron may be precipitated by oxidation. Thus alkaline waters percolating through a bed of iron ore would tend to concentrate the ore on the side of issue.

In a similar manner ore bodies of migration are formed. If the metal which has been leached from an ore body is not precipitated in another part of that same ore body it may be precipitated outside.

In this way bog-iron and bog-manganese are formed, the proximate source of which may be epigenetic deposits of iron sulphide or oxide, or it may be syngenetic deposits, either sulphide or oxide. As examples I will mention, first, the iron deposits at the head of Hall Valley and Geneva Gulch, Colorado. In this case the iron apparently resulted from the leaching of large porphyry dikes containing iron pyrites. The waters gathered in veins and issued to the surface

in springs along the bottoms of the gulches. Here the iron has been precipitated in surface beds of very considerable extent. The Colorado Fuel & Iron Company owns the larger beds.

Second, I will mention the lake ores of Finland and Sweden. Here, according to Beck (Nature of Ore Deposits, page 99), the iron has been leached from granites and other iron-bearing rocks, and it is supposed that the humus acids were active in the leaching. The ore is precipitated in lakes or quiet pools and it is thought that a certain water plant, called the Iron Algae, is instrumental in the precipitation. The action forming these lake ores is going on at the present day so fast that certain lakes can be mined intermittently. The ore is very pure iron ore and a layer about eight inches thick is formed in some localities every twenty years.

Fourth class: Deposits resulting from the erosion and reconcentration of either or all of the first three classes.

Placer deposits represent nearly all of this group. There are, no doubt, placer deposits formed ages ago which have been solidified into rock and buried under later rocks. The "Deep Leads" of California are supposed by many to have been formed in this way. For a long time the Blanket at Johannesburg, South Africa, was supposed to be an ancient beach placer similar to the present-day one at Nome, Alaska, but I believe the latest students regard it as a porous stratum that offered a convenient conduit for magmatic solutions. The "Deep Leads" of California are ancient river channels buried under eruptive overflows. Some of the gold found in them was no doubt placed there by processes of erosion and mechanical concentration, but the evidence is fairly good that the coarse gravel of the buried stream beds offered convenient channels for the circulation of magmatic solutions and to the placer gold was added auriferous pyrites from the solutions. Thus these "Deep Leads" are not only a good example of ores of the fourth class, but represent as well how an ore body may be the result of two or more processes.

The principal placer deposits are worked for gold or stream tin, the black sands being sometimes worked, as a by-product, for various other metals.

Most gold placer deposits are formed by the erosion of areas containing gold veins and the mechanical concentration of the gold in the stream beds. As erosion progresses a portion of a stream bed may be left high and dry on the side of the valley. Such deposits are called bench placers. Good examples of gold placers, both valley and bench, may be seen at Breckenridge, Colorado.

Fifth class: Deposits resulting from concentrations of metal from non-eruptive rocks. As previously stated, I think this class is not a very large or important one. I have never seen an important ore body of any kind which did not give good evidence of a direct or indirect eruptive origin. Nevertheless, it is conceivable that a concentration may occur from non-eruptive rocks which would be of industrial importance. The only example I can give is the beds of black sand in the channel of Bear Creek, Jefferson County, Colorado. I am very familiar with the drainage basin of Bear Creek and know that there is only a very little eruptive rock in it. The country rock is quite uniformly schist and gneiss of Pre-Cambrian age, and it all contains a little iron. In excavating for the foundation of a dam, I found a very pure deposit of very heavy black sand about six inches thick. While I made no tests for iron, I think it is safe to assume that the black sand contained as much iron as some workable iron ores. If this deposit could be formed from non-eruptive rocks, it is conceivable that more important ones may also be formed from similar sources.

MODIFICATION OF FORMER CRETACEOUS CLASSIFICATIONS ON THE WESTERN SLOPE OF THE CONTINENTAL DIVIDE.

(F. C. Carstarphen, '05, Consulting Engineer, 517 Ideal Bldg., Denver, Colo.)

It has been my fortune, good or otherwise, to spend considerable time making a geological reconnoisance on the western slope of the Continental Divide. Also in my reports on the hydrocarbons of the Uintah Basin I have studied the general geology in some detail.

The resulting friendly discussion that has been carried on between myself and acquaintances, most of them members of the Alumni Association, has led me to the belief that some, at least, are not familiar with the work of Whitman Cross, and the U. S. Geological Survey in general, whereby errors of the Hayden, Powell, King and other surveys have been pointed out, and a modification of former cretaceous classifications adopted.

It was not many years ago that geologists were announcing the view, based on the work and reports of these early surveys, that the only commercial coal horizons in Colorado were found in the Laramie. This is but one of many questions that have arisen concerning the accuracy of these early reports. The discussion relative to these changes is clearly given in the following extract taken from Bulletin 350, by Hoyt S. Gale, of the U. S. G. S.:

"All the names of the cretaceous formations used in the reports of the Hayden, King and Powell surveys, with the single exception of Dakota sandstone, have been superseded by other names in the foregoing descriptions. The relations of this recently adopted nomenclature to the old classifications and also the relations of those formations to each other are indicated in the accompanying table of correlations. The classification of the cretaceous strata above the Dakota at Laramie, Lewis, Mesaverde and Mancos here replaces altogether the older grouping of Laramie, Fox Hills and Colorado as used by the King and Hayden surveys for this general region. Altho the term Laramie is retained in the present classification as the name of the uppermost of the formations of Cretaceous age as they are now recognized, this term is no longer accepted as it was formerly applied by any of the early investigators in this particular field—a point that is discussed in detail farther on. This more recently adopted nomenclature has already been introduced into the literature of northwestern Colorado geology (The Yampa Coal Field, Routt County, Colorado; Bull. U. S. G. Survey, No. 297, 1907). Still more recent stratigraphic studies have confirmed the tentative conclusions of the Yampa coal report, relating to the necessity for a revised nomenclature, and also the expediency of the names there adopted for the northwestern Colorado region.

"Altho the classifications and conclusions of the early geologic writers on this field have gained wide recognition and become very firmly established in a popular as well as more technical way, there is ample justification, and, indeed, urgent necessity, for abandoning entirely this older terminology and revising the basis of its stratigraphic grouping. This revision, as adopted here, is intended to accomplish three specific aims. These are, first, to do away with the uncertainty that prevails with regard to the precise definitions and limits assigned to

Table of correlations to explain the relations of the various groupings adopted for Western Colorado Strata.

(The horizontal arrangement is intended to indicate actual equivalency of the strata. The heavy lines indicate the various conclusions as to the age of the strata thus designated.)

	Hayden, about 1870.	King, Fortieth Parallel Survey, 1875.		Powell Geology of Vinta Mountains, 1876.	White, Hayden Survey, 1878; Ninth Ass. Rep. U. S. Geol. Survey, 1889.	Cross, San Juan folios, U. S. Geol. Survey, 1899.	Fenneman and Gale, Yampa Coal Field report, Bull. U. S. Geol. Survey No. 297, 1907.	Present Report.	
TERTIARY	Green River.	Uinta.	Green River.	Green River.	Green River.			Green River.	Tertiary.
	Wasatch.		Vermillion Crk. (a)	Various formations mapped as Bitter Creek.	Wasatch.			Wasatch.	
	All Coal bearing formations mapped as Lignitic.				Neither unconformity nor hiatus recognized.			Fort Union. (a)	
						Laramie.	Laramie.	Laramie.	
				(b)		Lewis.	Lewis.	Lewis.	
		Laramie.		Point of Rocks.	Laramie (c)	Mesaverde.	Mesaverde.	Mesaverde.	Cretaceous.
CRETACEOUS	Fox Hills. Pierre. Niobrara. Benton.	Fox Hills.		Salt Wells.	Fox Hills.	Mancos.	Mancos.	Mancos.	
		Colorado.		Sulphur Creek.	Colorado.				
	Dakota.	Dakota.		Henry's Fork.	Dakota.	Dakota.	Dakota.	Dakota.	
JURA-TRIAS	Jurassic.			Flaming Gorge.	Jurassic.	Gunnison. McElmo		"Flaming Gorge."	Jurassic.
				White Cliff.		LaPlata		"White Cliff."	
	Triassic.				Triassic.				

(a) Unconformity. (b) Local unconformity. (c) White regarded this Laramie as transitional between the Cretaceous and Tertiary.

certain terms by the various authors in the older work, the differing significance attached to the geologic term Colorado being the principal instance; second, to establish a stratigraphic and lithologic basis of separation of the formations instead of the previously adopted paleontologic basis, which depended on distinctions that are always difficult and locally impossible to recognize; third, to call attention to and correct an old and now widespread misinterpretation of the age of the beds formerly called 'Laramie' in this field—a group of strata that should never have been included in the formations to which that name was applied, even according to the original somewhat uncertain definition of the term. These points are considered in more detail as follows:

"First: The use of the same geologic formation name with varying significance is found in the application made of the term Colorado by the King and Hayden surveys. This disagreement is indicated in the correlation table on another page. In the reports of the Fortieth Parallel Survey the term Colorado is defined so as to include a considerably wider stratigraphic range than as it was later used by White in his work with the Hayden Survey. The reasons for this confusion are largely paleontologic, as stated by White in his report (Tenth Ann. Report U. S. Geol. and Geog. Survey Terr., 1878, pages 20-21, 30). He says:

"'While adopting the name "Colorado group" of Mr. King, I, for paleontological reasons chiefly, so restrict its application as to include only what I understand to be equivalent with Nos. 2 and 3 of Meek and Hayden's original section, leaving the equivalent of No. 4 to be included with the strata of the Fox Hills group, instead of with the Colorado group, as Mr. King has done.'

"The restriction of the Colorado was not successfully applied in the mapping of the Rangely district, where this subdivision could not be traced on a lithologic basis. White's usage of the term has, however, been generally and consistently followed in other fields for thirty years, and it is still of great value as a correlation term. As Stanton states, the group is a natural division from a lithologic as well as a paleontologic standpoint east of the Rocky Mountains, where the calcareous Niobrara separates the two dark shales, Benton below and Pierre above.

"Second: The necessity for the use of stratigraphic and lithologic distinctions as the primary basis in geologic mapping is well brought out by the difficulties that have been encountered in Raven Park and adjoining districts. White himself admits (The Yampa Coal Field, Routt County, Colorado, Bull. U. S. G. Survey No. 297, 1907) that 'all the groups of strata that are referred to the Cretaceous period in this report are, within this district, not only strictly conformable with each other as regards their stratification, but I have never been able to fix upon a plane of demarcation between any of them with entire precision.' White's grouping of the strata was made on a purely paleontologic basis, a policy which he considered imperatively necessary for the purpose of establishing at once wide-range correlations over extensive areas. Thus the division planes which he adopted depended entirely on scattering, and to a large extent inadequate, fossil evidence and not on recognizable changes in the rock strata themselves. His planes of demarcation were thus impossible of precise definition and could never or very rarely be identified exactly in the field. The geologic boundaries he has shown on his maps are therefore scarcely more than mere estimates or are purely arbitrary lines which had to be assumed in the absence of the criteria necessary to establish any actual subdivision. Even if sufficient fossil evidence were everywhere at hand to make such a division, it is extremely doubtful if it would serve the most useful purposes, as no one without paleontologic training could appreciate its value when drawn.

"Altho it now appears to be more practical to map geologic formations in any particular field largely on the basis of lithologic distinctions—that is, changes in the character of the rock strata themselves—no one will question the necessity of paleontologic evidence in determining the position of these rocks in the geologic time scale and their correlation across the larger areas or in discontinuous fields. The errors introduced by some of the older surveys as a result of attempted correlation on the basis of lithologic similarity of rock formations occurring in discontinuous areas have been as many and as serious as those resulting from the use of paleontologic criteria. The argument of the present work is that the more practical method of subdivision should be applied to any specific stratigraphic section. For any one field or basin marked changes in the constitution of the rock strata themselves furnish as important evidence of changes in geography and in conditions of sedimentation during past geologic time as do the fragmentary records of animal life that now happen to be preserved.

"A part of the confusion in the early geologic mapping based on paleontologic distinctions was probably due to the failure at that time to understand the significance of the so-called Fox Hills fauna. It is likely that the use of the term Fox Hills to define any particular formation representing a specific time interval in the Cretaceous history of the Rocky Mountain region will now be abandoned. This conclusion has been reached by Stanton and others after an extensive study of western Cretaceous stratigraphy, and, so far as known to the author, is not now disputed by anyone familiar with these problems. As stated by Stanton (Bull. U. S. Geol. Survey No. 257, 1905, page 66), 'Faunas similar to that of the Fox Hills sandstone have a great vertical range and are likely to be found at any horizon within the Montana group where a littoral or shallow-water facies is developed. The use of the term Fox Hills as a formation or horizon name outside of the original area in South Dakota is therefore of doubtful propriety, as experience has shown.'

"In most of the fields west of the Rocky Mountains or the Great Plains the term Pierre has also led to some confusion. Sections in central and northern Montana that have been described have defined as the Pierre formation (later named Bearpaw, altho still assigned to Pierre age) a shale body overlying the Judith River, Claggett and Eagle formations. The latter three formations are now considered to be in greater part the equivalents of the Mesaverde formation of northwestern Colorado and southern Wyoming sections. In the Colorado and Wyoming fields, however, Pierre has been used to denote beds which normally underlie the Mesaverde formation. The shales above and below the Mesaverde are of similar lithologic composition, resembling the Pierre shale of the Great Plains region, and also contain fossils that are commonly found in the Pierre of the Great Plains. Pierre is certainly a valid and useful term in the large area where the Niobrara is typically developed and Mesaverde and similar formations do not exist, but probably has no place in a section which also includes either the Mesaverde or the Judith River.

"Third: With regard to the previous misinterpretation of the term Laramie, so far as it relates to the River Park District, the solution is clear. None of the rocks in this field to which the name Laramie has hitherto been applied are properly so classed. The Laramie formation, in the sense in which the name was originally adopted, is almost certainly not represented at all by any of the strata exposed in the immediate vicinity of Raven Park. Either this formation was never deposited in this field or if it was deposited it was completely eroded at a later time, before the overlying Tertiary beds were laid down.

"The name Laramie was adopted by agreement between King and Hayden to apply to the cretaceous strata then thought to lie at the top of that system, conformably above the marine deposits. It was assumed at that time that marine conditions existed throughout a large part of the interior province during most of the cretaceous time, and that these conditions terminated with a succession of crustal movements that uplifted the Rocky and Uinta mountain ranges. Portions of this sea were supposed to have been cut off in interior basins at the time of that upheaval, so that their waters gradually became less and less salty, until the fresh-water conditions which marked Tertiary time were fully established. It was clearly the intention of the early investigators to denote the beds laid down during this transitional stage by a formation name, for which purpose Laramie was agreed upon. In terms of later geologic nomenclature, therefore, Laramie was probably meant to include all the brackish-water deposits which succeeded the Montana, or latest marine sediments then recognized in the cretaceous system. This formation was less certainly defined by an upper limit, but was in all probability intended to include all strata up to whatever beds should be considered as belonging to the fresh-water or tertiary basins established after the mountain-building movements already mentioned were completed.

"Early investigators did not at first recognize that temporary transitions to brackish and fresh-water deposition occurred at various periods during marine cretaceous time. Such conditions apparently prevailed for a while in certain interior basins at the same time that the normal marine deposits were being laid down in adjoining regions. These periods which preceded the close of the cretaceous were, however, of short duration, and were apparently terminated by incursions of the sea and reestablishment of salt-water conditions. The Judith River beds of Montana and the Mesaverde formation of Colorado are examples of deposits laid down during such periods. Both contain a fauna and flora resembling those of the Laramie, and were formerly supposed to be Laramie. Both are now known, however, to represent stages of fresh-water deposition somewhat similar to those which prevailed during Laramie time, but occurring long before the close of the cretaceous. It is perfectly clear that such beds cannot be included under any interpretation which can be reasonably given to the original definition and agreement as to the use of the term Laramie.

"The fact that Mesaverde time was succeeded by a considerable period of true marine deposition was entirely unrecognized at the time of the earlier surveys. Evidence of this return of salt-water conditions is found in the existence of a normal succession of marine strata overlying the Mesaverde formation in the Yampa River Valley, north of the fields structurally included with those of the White River Districts. The Yampa basin contains a great body of dark clay shale with lenticular interbedded sandstones and calcareous layers, overlain by a second large body of sandstones, sandy shales, and coal beds. Of these deposits the lower or shale group (Lewis shale) is of marine origin, and the overlying beds indicate a second transitory stage, reintroducing brackish and fresh-water conditions. The latter beds are thought to represent, at least in part, the Laramie, so far as the best interpretation of that term is at present understood."

I trust that you will find space for these interesting remarks, if not in one edition, in more if necessary.

The

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CLASS EDITORS.

EDWARD J. DITTUS.....1911
WALTER C. HUNTINGTON.....1912
ADOLPH BREGMAN.....1913
TSUNG TE KAO.....1914

SPORTING EDITOR.

HAROLD C. PRICE.....1913

VOL. 1. APRIL, 1911. No. 7

We wish to again call the attention of the Alumni to the grand reunion of the Alumni to be held in Golden, Commencement Day, May 26, 1911. Every alumnus should begin to make his plans to attend, and, after they are made, to see that nothing interferes to prevent his attendance. A number of the classes are planning class reunions at that time in connection with the general reunion, and we will have the largest number of graduates here then that have ever met at one time in the history of the school. Come prepared for a good time. There will be entertainment for everybody and plenty of old schoolmates you have not seen for years.

Older graduates, who have not visited the school in recent years, will be astonished at the wonderful growth of the school. One old graduate, who has not been in Golden before for ten years, visited the school recently on his return from a trip East. While in the East he visited one of the large technical schools there and, remembering the School of Mines as it was ten years ago, told them that they had a much larger school than the School of Mines. He was very much astonished at the wonderful growth of the Alma Mater, and is sorry he made the mistake of saying the Eastern school was the largest. A trip to Golden will convince the most skeptical that "the half has not been told." The May number will contain a more definite announcement as to the program for the Alumni reunion on Commencement Day.

CLASS EDITORS. It is with great pleasure that we announce the election of the following class editors for the Magazine:

Edward J. Dittus.....1911
Walter C. Huntington.....1912
Adolph Bregman.....1913
Tsung Te Kao.....1914

These class editors will furnish the college notes in the future, and as they are all bright, capable young men, with the backing of the entire student body, we know that they will make their section of great interest to every reader of the Magazine. These class editors were only elected a few days before this issue went to press, and they, therefore, had time to write only a few hurried notes for this issue.

SPORTING EDITOR—Harold C. Price, 1913, will be the sporting editor for the magazine and report the college and class games, athletic news, etc., in the future.

The rapidity with which the graduates are subscribing to the magazine and joining the association reminds us of one of Prof. Chauvenet's stories: On the rivers of China there are many house boats whose inhabitants depend, to a great extent, upon large flocks of ducks for their livelihood.. These ducks hunt their food on the river all day and just at sundown, when Chinamen on the boats beat gongs, the ducks all rush for their proper boat and hurry into their pens, each duck endeavoring to get into the pen first. The reason for this haste is that at the door of the pen stands a Chinaman with a switch in his hand and the last duck to go into the pen receives a sharp blow from the switch. We have a switch up our sleeve for the last duck, so you had better hurry.

CYANIDE TREATMENT OF CONCENTRATES.

There is an interesting article on the cyanidization of concentrates of more than ordinary difficulty, in the E. and M. Journal, February 18, 1911, page 368, by A. B. Parsons. It is a description of the process used at Goldfield, Nev., for disposing of the high-grade pyritic concentrates. The concentrates are given preliminary acid treatment, using commercial sulphuric acid, and then made slightly alkaline and agitated in a cyanide solution in a Pachuca tank.

The biggest trust on earth is the country newspaper. It trusts everybody, gets cussed for trusting, mistrusted for cussing, and if it busts for trusting, gets cussed for busting. There is but one way to bust this trust—pay your subscription. Thus says the Tombstone Epitaph.

Athletic News.

MINERS BEAT AGGIES AND WIN BASKET BALL TITLE.

Fort Collins, Colo., March 4.—In a game the Miners defeated the Aggies at basket ball here last night by a score of 24 to 16. The victory gives the Miners the intercollegiate championship of the State for the seventh consecutive season. The line-up:

MINERS.		AGGIES.
Tolman	R. f.	Taylor
Davis	L. f.	Stuver
Kissock	C.	Converse
Litchfield	R. g.	Newton, Probst
Rockwood	L. g.	Brill

Referee—Lannon, Mines. Umpire—Di-Vorchek, Aggies.—Denver Post.

BASKET BALL TITLE IS WON ON STANDING BY MINERS.

Golden Five Finishes With .800 and Colorado Quintet Comes Second.

By defeating the Aggies Friday night, the Miners settled any possible dispute of their title of college basket ball champions of Colorado for the season of 1911.

No tie now exists for the championship. The Mine five has won four out of five games, while Boulder has won three out of four, the fact that the State did not play Denver U. making the difference of one game. Had the Mines played the second game scheduled with the Aggies, they would have another game to their credit, but it was decided that it is unnecessary to play it, as they have a clear claim to college honors.

The five remains intact next season and with much good material in the Freshman class of this year expects to be able to put out a still faster team in the coming season.

While officially there is no intercollegiate championship because of a ruling made by the conference before the season opened, the Mines five had the college honors, and they will be recognized in the official review of the year. Following is the standing of the teams at the close of the season. It must be remembered that only conference fives can be considered in standings:

	Mines	Aggies	D. U.	Colo. Univ.	Won.
Mines	—	1	2	1	4
Aggies	..	—	1	..	1
D. U.	..	1	—	..	1
Colo. Univ.	1	2	..	—	3
Lost	1	4	3	1	

	Won.	Lost.	Pct.
Mines	4	1	.800
Colorado University	3	1	.750
Aggies	1	3	.250
D. U.	1	4	.200

—Denver News, March 5.

LITCHFIELD CHOSEN CAPTAIN.

Golden was the scene of much jubilation yesterday over the success of the Miners in the basket ball field. The players met previous to disbanding and elected R. E. Litchfield captain of next year's team. He has been one of the mainstays of the Mines team for two years. He is one of the most consistent players in the State. He played at Andover, a prep school, for three years previous to coming to Colorado, and, in addition to being a star at basket ball, also is an expert on the baseball diamond.

Captain Will C. Bryan, director of athletics at the School of Mines and coach of the basket ball team, awarded gold watch charms to the regular members of the championship five. These are emblematic of a basket ball and are works of art.

Conference Meets Saturday.

Much interest is being manifested in the regular March meeting of the Colorado Athletic conference, which has been called for next Saturday. Several matters of importance are scheduled to come up for consideration.

Among other things, the conference probably will be again called upon to pass on the Sinton case. As exclusively told in The Times a week ago, the School of Mines will refuse to compete with Colorado college in any branch of athletics in which Sinton takes part. This threat is based on the ground that Sinton's amateur standing is in doubt, and that the Mines students would be liable to disqualification as amateurs if permitted to compete against him. An effort will be made, it is understood, to restore peaceful relations between the two institutions.—Denver Times, March 5.

NEW OFFICERS ARE ELECTED.

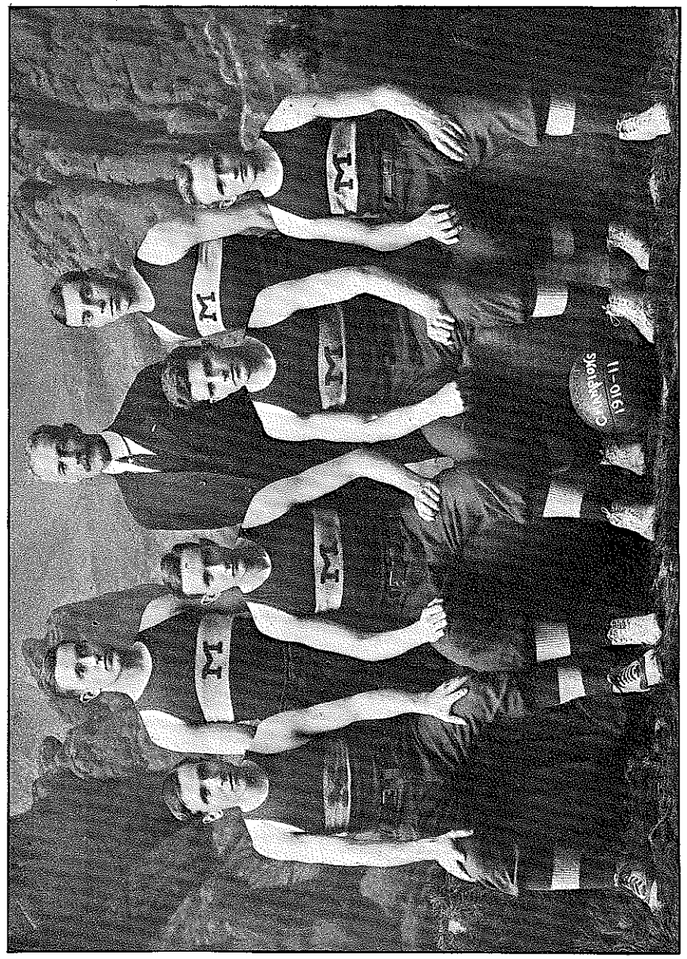
Faculty Conference Decides to Allow Members to Settle Their Own Questions.

(By Edward C. Day.)

The regular March meeting of the Colorado Athletic conference was held yesterday at the University Club. It marked the passing of two veteran members, Dean Parsons of Colorado College and Professor Fleck of the Colorado State School of Mines. The Tigers were represented by Professor Griswold and the Miners by Professor Charles E. Smith.

The two new members were honored by election to the principal offices of the conference. Professor Smith was chosen president to succeed Professor McDonald of the Colorado Agricultural College, and Professor Griswold was made Secretary.

Aside from the election of officers, little business of importance was transacted. As predicted in The Times last week, the case of Herb Sinton of Colorado College, who is



INTERCOLLEGIATE BASKETBALL CHAMPIONS, 1910-1911.

Tolman — Capt. Will C. Bryan — Thomas — Davis

Rockwood — Athletic Director — Kissock (Captain)

Litchfield

accused of being a professional, was brought up, but the conference refused to take jurisdiction.

It held that inasmuch as the matter had been previously passed upon by the conference and for the further reason that a new rule, only recently adopted, placed each college in complete control of the eligibility of its own athletes, there was nothing to be done.

Situation Unchanged.

This leaves the situation in exactly the same position as it was before the conference meeting. Incidentally it does not, to any degree, brighten the prospects for intercollegiate athletics during the coming year.—Denver Times, March 12.

At a meeting of the Athletic Association, Tuesday night, March 7, the following men were elected as manager and assistant manager of the various athletic teams: Manager of football for 1911, Arnold Harris; assistant manager, Crutcher; assistant manager of baseball, Strong;. assistant manager of track, Downs.

INDOOR BASEBALL.

Quite a bit of interest has been manifested in this sport. As the game was initiated into our list of athletic activities rather late in the season, there has not been the participation in the play that will probably be manifested next winter. The sport has been tried enough to prove that, in our ideal gymnasium, it affords splendid exercise and recreation. It is hoped that there will be class teams organized next year and that there will be a scheduled tournament.

The members of the faculty introduced the game here, and they have been the most active participants therein. They first played among themselves, and then, later, they accepted challenges issued by the Seniors. Four Faculty-Senior games have been played and the result thus far is a tie. The last game took place on St. Patrick's Day, and the Seniors won by a score of 23 to 19.

MINERS TRIM WEST TO TUNE OF 7 TO 1 IN FIRST GAME.

Wilson Strikes Out Fifteen Men, While Wickstrom Makes Nine Breeze the Air.

Golden, Colo., March 25.—The Miners won the first baseball game of the season at Golden today by defeating West Denver High School, 7 to 1.

The only feature was the work of the opposing pitchers. Wilson, who will probably perform in the box for the Miners this season, showed fine control and good speed. He struck out fifteen men.

Wickstrom of West Denver is either an exceptional high school pitcher, or the Miners are going to be weak with the stick, for he fanned nine and held the Miners to seven hits. West Denver's lone tally was scored in the fourth inning, when McIntosh gained first on an error and went home on Wickerstrom's single.

The Miners scored two runs in the second inning on hits by McGuire and Wilson and four runs in the fourth by singles by Davis and Captain Watson, and a combination of errors, sacrifice hits and some bases on balls. One more run was added in the seventh when Dyrenforth took first on an error, stole second and came home on a single by Solomon.

The Miners will open the inter-collegiate season next Saturday at Golden in a game with the Aggies.—Denver News.

College Notes.

SENIOR NOTES.

E. J. Dittus, '11.

The Senior class spent four days at the following mills near Colorado Springs: The Portland, Golden Cycle, Standard, and The Miners', and in addition visited the Colorado Springs Light and Power Company's plants. They spent one morning at the steam plant and the same afternoon at the hydro-electric plant. The trip was under the supervision of Dr. F. W. Traphagen, Prof. Haldane, Prof. Hazard, Prof. Cronin, and Fellow Keeney. The trip proved highly instructive, and every courtesy was extended by the managers of the various plants. The first day of the trip was spent under Prof. Patton, in observing the geology of the Garden of the Gods.

On March 17 the Senior class indoor baseball team defeated the faculty by an overwhelming score. March 20 the Senior baseball team played a snappy game with the school team and were defeated in the ninth inning by a narrow margin.

Glee Club practice was held by the class on Thursday, March 23, in the gym. Nearly all of the class were present, and the songs that will be sung on the "trip" were practiced. The evening was a valuable and pleasant one.

Prof. Cronin leaves on April 2 with the post-graduates and several members of the Senior class for Cripple Creek, where a week's efficiency test will be made on the hoisting and compressor machinery at the Elkton Mine.

JUNIOR NOTES.

Walter C. Huntington, '12.

The second Junior Smoker was given in the gym on the evening of February 24. It was a decided success from both a financial and a sporting standpoint. It is generally conceded to have been the best exhibition of local and outside talent ever given in the gym. The programme consisted of strap wrestling, barrel and sack boxing, two six-round bouts, and a wrestling match. The last three events were given by professional talent from Denver, and were certainly first-class. Spider Kelly, of pugilistic fame, exhibited his boxing bull pup, which was an interesting novelty. The "Glee Club" furnished music.

The class is indebted to Capt. Bryan for his help in arranging the bouts. The proceeds of the smoker were sufficient to pay off the remainder of our Freshman debt. Preparations for the Junior Prom are now under way.

The vacation from Mechanics and Construction which the Juniors enjoyed during March was brought to an end by the return of Prof. Allison from Panama the last of the month. Since then the said Juniors have proceeded to get busy again.

The Senior and Junior Mets, under Profs. Traphagen and Haldane, visited the Denver Mint on March 29 and saw how Uncle Sam makes the so-called "filthy lucre." From all indications the plant seemed to be quite a money-making proposition.

The P. G. men who intend to graduate in 1912 are entitled to show as much class spirit as the regular Juniors. Exercise your privileges here at the Mines, even if you have a degree of X. Y. Z. from Siwash or Podunk.

SOPHOMORE NOTES.

Harold C. Price, '13.

The coming of Spring finds a great bunch of '13 men out trying to make the baseball and track teams. It also finds these men anxiously awaiting the class baseball game and track meet. There is not the slightest doubt but that the mighty Sophs will again carry off the honors in these events. It looks as if there will be six second-year men on the ball team, namely, Bregman, Johnny Davis, McGuire, Solomon, Wilson, and, last but not least, Captain Watson. Fine chance any other class has to win the class championship. In the track team 1913 is even more in evidence, with McNeil, Dauth, Roberts, Young, Crutcher and Myers in the line-up. All of these men won points in last year's class meet, and most of them in the intercollegiate class meets. It has just been announced that Johnny Davis so seriously injured his ankle in the game with the West Denver High School last Saturday that he will be laid up for about a week. This will greatly handicap the Miners' chances against the Aggies on the 1st of April, and it is very much hoped that he will be in condition by that time.

THE PREPARATION REQUIRED FOR PROGRESS IN EDUCATION.

Tsung Te Kao, '14.

A learned man generally considers that the best period of his life was the few years spent in college. If he was successful in his college work, he would be glad to live those brief years over again. But there are many who fail in their college studies during the very first year. Those who get through the Freshmen work nicely perhaps never fail in the advancing studies. We know that most of the Freshmen in any college are graduates of academies or high schools. If they are able to get through their work in academies or high schools without much trouble, why can they not get along smoothly in college? Once a professor in a certain college gave this explanation: "It is because there is too great an interval between the standards of the college and the high school. The ability required for a student to master the college subjects is different from the ability required for him to master those of the high school. In high schools, the students chiefly develop their memory, but in college the ability they need, to carry on the work successfully, is not memory but reasoning power." If this statement is true, we may assume that the preparation which the students have had in high schools is not sufficient to enable them to get through college. The Freshman year in college is rather the year for preparation. One who has a good start in the Freshman year should be able to get through the remaining college years.

Now we have the pleasure to remind our Freshman class that we should not neglect the work we have at hand. One should not think that though he flunks in the Freshman work, that he will have a chance to make it up later and will be able to get on in the advancing work without further trouble. We wish to show that without good preparation at present, it is impossible to get on nicely in the future. In order to show that this principle is true, we may compare one's college life with the history of civilization. As a universal truth, the components of civilization, such as arts, governments, and institutions, are developed gradually. They are continuous growths. Great improvement cannot be obtained suddenly. For instance, modern civilization, in the Western countries, is the result of the blending of three elements—the classic, the Judaic, and Teutonic. Greece and Rome gave their splendid gifts, such as sciences, literature, laws, social arrangement, and models of imperial and municipal government. The unity of God, the brotherhood of man, and immortality are taught by Christianity, the widely spread religion of Judea. Teutons presented

their personal worth—the love of freedom and the capacity for growth, for culture, and for accomplishment. Without the former preparations, we could not have the present civilization. So it is with a student's college life—without good preparation in the first year it will be hard for him to do excellent work in the later years.

We may further illustrate the importance of preparation for future studies by the progress of leadership in religion and philosophy. We find that there were many leaders. Some of them acted as the harbingers of the others. For instance, without the influence of John the Baptist, there could not be so many believers in Christ. Without the great educator, Socrates, and the philosopher of noble birth, Plato, it would have been impossible for Aristotle to become "the master of those who know." If these philosophers had been born in the reverse order, we conjecture that in Socrates we would have found the culmination of the philosophical genius of the Helennic intellect. We believe, therefore, that great leadership in religion or philosophy was always based upon a foundation prepared beforehand. Hence we may deduce the statement that the success of the college life depends chiefly upon the preparation in the Freshman year.

Y. M. C. A. NOTES.

NEW OFFICERS ELECTED.

The election of officers for the year 1911-12 was held February 28 at the close of the regular meeting, with the following results:

President.....A. W. Harris, '12
Vice-President.....W. J. Eaton, '13
Secretary.....J. W. Dudgeon, '13
Treasurer.....C. D. Grier, '12

Prof. H. B. Patton and Rev. G. E. Keithley were elected members of the Advisory Board to serve for two years. Prof. Herman Fleck and Rev. Ira D. Hall are the retiring members of the Board.

Prof. William G. Haldane, of the metallurgy department, addressed the Christian Association on "System" at the meeting of February 28th. This was one of the largest meetings of the year, the attendance being between forty and fifty men, and everyone profited by the splendid address that was given.

RELIGIOUS MEETINGS.

An innovation was offered March 7th by having an illustrated lecture on "A Trip Through Sunny Ceylon," given by Mr. Louis Hieb, who for seven years was engaged in Y. M. C. A. work in that island. Fifty beautiful views, taken in different parts of the country, were thrown on the screen in the geology lecture room, and Mr. Hieb's lecture was both clear and concise. His work in Ceylon gave him ample opportunity to visit a great many places of especial interest to foreigners, particularly the ruins of cities that have been partly excavated in recent years. These old cities are proof that the Cingalese of that time enjoyed a state of civilization far in advance of that of today.

Although this was the evening of the annual election of the Athletic Association, there were about fifty people in attendance at the meeting.

"Christianity and Statesmanship" was the subject of an excellent address given by Dr. B. B. Tyler, of Denver, at the second meeting of the Christian Association in March. Dr. Tyler showed that the leading statesmen of the world today, as well as in past years, were Christian men, citing the example of Thomas Jefferson to prove that much that was untrue was often told of our great men. Jefferson, he said, instead of being the skeptic he was thought to be, was a devout churchman and had compiled a "Harmony of the Gospels," which can be found among his writings.

Prof. R. S. Hawley spoke before the Association on the subject, "Workers, Jerkers and Shirkers," at the meeting of March 21st. He spoke of the three classes of people in Christian organizations whom we can group under these titles, and urged all the men to be careful that they be "Workers." The "Jerkers" were those who are constantly stopping the progress of others by their erratic habits, and require starting very frequently. The other two classes need no explanation.

THE CABINET BANQUET.

The second annual Cabinet banquet was held at the home of Dr. Walter Joel King Monday, March 20th, at 5:30. In addition to the members of the Cabinet for 1911-12 and the retiring President, there were present the members of the Advisory Board, the General Secretary and the State Student Secretary of Colorado, Mr. J. W. Nipps.

After enjoying a delightful supper, which was prepared and served under the direction of Mrs. King, everyone listened with interest to the report of the retiring President, Mr. Ralph V. Thurston, '11, who in a brief address summarized the work accomplished during the year just closed, and then introduced Mr. A. W. Harris, '12, the newly elected President. Mr. Harris outlined the work for the year and urged the men in charge of the committees to put forth their best effort during the time they are in office. Secretary Watson was then called upon, and he responded with a short talk in which he expressed the pleasure he had received from his work in this school and his gratitude for the help given him by the loyal Association members.

The address of the evening was made by Mr. Nipps, who in his forceful and interesting manner reviewed the growth of educational institutions and the problems presented by the rapid development of the

State schools. One great problem, he said, was that of adequately meeting the religious needs of the men and women in such schools, and for the solution of this problem the General Secretaryship was created. He then told of the growth of the Association movement under the direction of these specially trained leaders, and called the attention of the men to the fact that they had not done their share in supporting this work in the School of Mines. This address led up to the question of whether or not the present General Secretary should be retained, and if so, what the students were willing to do to make that condition possible. A spirited discussion followed, during which Mr. Nipps presided, and at the close of the discussion the Cabinet had pledged themselves to raise $400.00 of a budget of $1,775.00 for the year 1911-12. A campaign will be conducted among the students in which every man will be given an opportunity to pledge something toward this work. Little doubt is entertained as to the success of the plan adopted by the Association leaders.

After tendering a hearty vote of thanks to Dr. and Mrs. King, and giving a "Skyrocket" for all those contributing to the pleasure of the evening, the banquet closed in a spirit of enthusiasm seldom seen in any school.

The Alumni.

PERSONALS.

'95.

Robert S. Stockton made a short visit to Golden during the latter part of March, and then left for Canada to assume the duties of his new position. He is superintendent of operation and maintenance for the Western section of the Canadian Pacific Railway, Irrigation Block, with headquarters at Strathmore, near Calgary, in Southern Alberta.

'97.

Dr. Royal P. Jarvis, of Knoxville, Tenn., has been examining some Georgia properties recently.

'98.

Emil E. Blumenthal of the Granite Bimetallic Mining Company, Phillipsburg, Mont., visited the school and presented the school, through Prof. Patton, with some fine ruby silver and other specimens. He is going through the larger cyanide plants of the State, with his assistant, investigating the methods used in an endeavor to solve the problem of successful treatment for the Granite Bimetallic low grade gold and silver tailings and ore.

'00.

Thomas B. Crowe, superintendent of the New Portland Mill, Victor, Colo., made a short visit to Denver and Golden about the middle of March.

'01.

George B. Clark, who bought out George B. Ebernanz, assayer and chemist, of Pueblo, Colo., last June, visited the School and the Assistant Secretary recently. He reports business as good. Before going into business for himself, Mr. Clark was with the A. S. & R. Co. as assayer and chemist for a number of years, the last years as traveling chemist. He has accumulated a great many valuable notes on short and accurate assaying methods, and we hope to have a series of articles from him on this subject in the near future.

'05.

Jay Lonergan has arrived safely in Peking, China, and finds his new work very interesting.

'06.

George A. Parks, Surveyor of Mineral Deposits, General Land Office, is one of the government's young engineers who is always on the move. As he expressed it, his "mail was forwarded around after him as long as they could find room on it for his changing addresses—then they dropped it in the waste basket." He paid a short visit to his folks in Denver and to the School during the latter part of March. He expects his address to be 219 Federal Building, Seattle, Wash., until May, and then Seward, Alaska, for a while. He promised to send in some photographs and a short article about the Alaska coal fields.

'07.

Donald D. Hollis, Mineral Inspector for the United States General Land Office, has been temporarily transferred from the Denver division to the Portland (Ore.) division.

'08.

Clarence Ireland has received the appointment of assayer and chemist at the Capital mine. The selection is to be most heartily commended and shows sound judgment on the part of Manager Edward Bauman. Mr. Ireland is a graduate of the School of Mines, but for three years devoted himself to learning the practical side of mining. He is now prepared to cope with the leading engineers.—Idaho Springs Gazette.

Hal G. Knight, superintendent of the Glacier Creek Gold Mining Company, of Porcupine, Alaska, left Denver for Alaska April 1st. He expects to remain in Alaska until fall.

Carl Eugene Lesher and Miss Lois Clara Quick were married in Golden March 2nd. The bride was one of Golden's best known and popular girls. The groom holds the position of Land Classifier, U. S. Geological

Survey, Washington, D. C. Mr. and Mrs. Lesher left immediately after the ceremony for Washington. They thot that all the wedding arrangements had been kept secret and expected to be married and gone before any of their friends found out about it. But —some of their friends gave them a fitting farewell. Armed with rice, old shoes and printed signs, with which they decorated the car, they boarded the car the couple took to Denver, and, carrying appropriate banners, accompanied the newlyweds to the Union Depot and saw them safely on the train for Washington. The Pullman was suitably decorated and everyone on the train promised to show them a good time all the way to Chicago.

'10.

H. G. Skavlem is assistant engineer and tester with the Hollingsworth properties, Cobalt, Canada.

Duane C. Kelso and wife are in Denver for a few weeks as a change from the snow banks of Telluride. He was married about the middle of his junior year and none of his schoolmates knew of it until he told them the day he graduated.

Prof. Allison has returned from a month's leave of absence spent at Panama. We hope to have an article from him in the near future on the subject of the Panama Canal.

COMMUNICATIONS.

WE HEAR FROM RUSSIA.

Kyshtim, Russia, Feb. 18, 1911.
Perm. Gov't via St. Petersburg.

Mr. Orville Harrington, Assistant Secretary,
C. S. M. A. A., Golden, Colo., U. S. A.

Dear Sir:

I beg to hand you under separate cover MS for an article promised Mr. Titsworth in my letter of Oct. 11, 1910. I have just been able to finish it, and hope it may reach you safely.

I am just in receipt of your letter of Feb. 8 and note what you say. It most certainly does look as though a few of you live spirits were managing to put some ginger into the long-dormant mutual admiration society, in the endeavor to make a real, live, useful Alumni Association out of it. I recognize that this can be no easy task, and you should be given all possible assistance and encouragement. It will give me great pleasure to aid you in any way possible, and as a beginning toward this I am instructing my bankers to forward to the treasurer my check in the sum of $15.50; covering life membership and initiation fee in the association.

It has been a great pleasure to me to read the numbers of the magazine as they arrive, and I hope it will be possible to continue the venture and expand it, since in my opinion about the only possible way to bind the association closely together, and make a useful force out of it, is through just such a medium.

I was particularly interested in reading that part of the editorial in the February number in which mention is made of my letter to Mr. Titsworth, and note that it says there that "Some have criticised H. H. Emrich's letter printed in the January number——." I am glad that some found it worth criticising, but I note that they seem to lack the backbone necessary to come out and let their criticisms be seen in print over their signatures. This is exactly what was expected when that letter was written. It was always noticed when I was attending the Mines that this class of critic was present in very great proportion. It was never noticed that there was a large and promising squad out, trying for the football team, the baseball team, the track team, nor was it possible to run a student paper, not only from lack of those willing to serve on the staff, but also from lack of support from the student body; even the school games were poorly patronized. However, it was always noticed that the Knockers' row, especially the private knockers, was always filled to excess. There were plenty willing to get all they possibly could out of the school, but very few willing to give anything to it. That this spirit has not left the student body yet is evidenced by the appeal made to the undergraduates further on in this same editorial. With these conditions it is to be expected that there will be a large number with this spirit among the alumni. May we all hope that this campaign will serve to show that it is not the spirit that should exist, either among the alumni or the students, more especially as the former are, and the latter hope to be, leaders, and as such should be progressives, in the strictest sense of the word.

Criticism of the right kind is a fine thing, and is what is necessary for any kind of progress; however, there seems to exist two classes of critics. First: Those who are not entirely satisfied with conditions as they see them and endeavor to better them, and, second, those who are not, and never will be, contented with anything, and who have no suggestions to offer as an improvement; these are commonly known as knockers. The former are constructive, the latter destructive.

It would seem as though a high-grade technical school, such as the Mines, should graduate 100 per cent. of the former kind, but there has always seemed to be a goodly proportion of the latter in the product. However, we have cause to congratulate ourselves that this is getting better, for I note that more interest seems to be taken in the magazine by the younger alumni as evidenced by the preponderating number of articles appearing by them.

You will undoubtedly publish this letter, and while I can hear the little hammers working when it appears, still I beg to say that as far as the School of Mines is concerned, I stand upon my record of past performances and hope the gentlemen who so kindly criticised me in private may be able to do the same.

Yours with best wishes for the success of the venture,

HORACE H. EMRICH.

(Mr. Emrich's article arrived too late to be included in this number, but will appear later.—Ed.)

(Extracts from a letter received from Chas. T. Durell, '95, Manager of the Headwaters Mining Company, Baguio, Benguet, P. I.)

It was with great pleasure that I received the first number of the Magazine, and there were many things to interest me in both it and the next number. Enclosed please find money order for subscription for two years. I was ever a great believer in hopes and dreams, and this is further confirmation. Away back in '95, when we were putting forth every effort to organize the Alumni Association, such things as a paper and an employment bureau were only mentioned in passing, and thought by most to be of the material of which dreams are made. There were so few of us that we had to have present possibilities and not future probabilities to embody in the constitution and by-laws, and hope that the new-born association would soon be strong enough to become an active factor in both the lives of the graduates and the Alma Mater. It is one of life's pleasures to see such things come to pass.

* * * We old ones have had a lot of "horse sense" and practical methods pounded into us that does not always agree with the theory of the thing. For instance, I knew a good many times as much the day I graduated as I did a couple of years afterwards. All, I presume, have had the wind taken out of them by a few downs before they can really commence to play the game.

5111 Regent Street, Philadelphia, Pa.,
March 14, 1911.

Colorado School of Mines Magazine,
Golden, Colo.

Dear Sirs:

It has been my pleasure recently to receive Nos. 5 and 6 of your Magazine, and also, through the courtesy of Mr. T. C. Doolittle, bulletins and scene books dealing with the Colorado School of Mines. The great changes which have been wrought in your city, in your Alma Mater, since my departure, are a credit to you and your coworkers. C. S. M. was a strenuous institution in 1905, yet in comparison with present, it was but a struggling infant.

I note with earnestness the limiting of students to specific branches of their profession, with a fair allowance for electives in other branches. This is certainly a big step in the right direction. I was once asked to lecture on mining. I did not know the first rudiments of the subject, but started to compile a list of bibliography which might be useful. It soon dawned upon me that a five-hour course of lectures for one year upon mining engineering was but a make-shift in a reputational line rather than an attempt to cover a subject that could not be covered by a course of thirty lectures weekly for two years. I did not deliver the lecture, but attended some instead. The subject is a large one, but with a "sound entering wedge" and persistent later reading and study, it may be grasped sufficiently to convey confidence in practical work.

Your magazine is a valuable asset to the C. S. M., and I congratulate you upon turning out such a satisfactory publication and upon the sacrifices which you are making in the interests of your Alma Mater.

Very sincerely yours,

CLAUDE W. FILKINS.

Butte, Mont., Feb. 25, 1911.

Orville Harrington, Asst. Secy. C. S. M. Magazine, Golden, Colo.

Dear Sir:

We consume about fifty yards of No. 10 canvas each month. No. 10 duck corresponds to about 12-ounce. Width is 60 inches. Can you let the Denver firm which handles canvas write us and give us their prices?

If they advertised in the C. S. M. Magazine, we would have their address without any trouble.

Yours very truly,

BUTTE & SUPERIOR COPPER CO., Ltd.
M. W. ATWATER.

(Recall his previous letter and the fact that we obtained a small advertisement, to appear later, on the strength of this letter. Nuff said.)

Moctezuma, Sonora, Mexico,
Mar. 13, 1911.

Orville Harrington,
Assistant Secretary Alumni Association,
Golden, Colo.

Dear Sir—I have been looking over a file of the C. S. M. Magazine that accumulated in my absence. I am in full sympathy with the movement it represents, and, as I find no record of my brother having attended to the matter, I enclose check, which kindly apply on his dues and mine for the current year and balance on subscription.

Most Alumni are busy men, whence arises much of the impression that they are unsociable and unfriendly. The fact is, most of them are glad to make each other's acquaintance and lend a helping hand. I have had it extended to me, sometimes I did not know it until long afterwards, and where opportunities offered I have filled positions

with C. S. M. men. Most of them have a real concern for the true interests of the School. It is a fact that some of them no longer, if they ever did, have any enthusiasm for the extravagantly wasteful college athletics, they can not see where the ninety per cent. who sit on benches and look on develop the strength to keep them on the hurricane deck of a bronco sixteen hours out of twenty-four or for any other physical test met every day by engineers.

But perhaps you will have concluded already that a chronic grouch is not entirely eliminated either by the climate of the Mexican malpais or of the Russian steppes. However, at bottom, all of us are willing to aid in anything that promises to raise the standard of the Alma Mater or the standing of the Alumni. The Alumni have done much in the past and, with the revival in interest and co-operation now being secured, much more may be expected in the near future.

Yours sincerely,

F. B. HYDER.

THE ROMANCE OF MINING.

What a compendium of interesting tales the history of mining would make! From the earliest times the mining industry has been clothed in a rosy mist of romance. The most remarkable feats of exploration, of travel and of mountaineering have been done in quest of gold.

The Editor recalls scaling a precipitous little pinnacle in the San Juan range of Colorado with the idea of standing where no white man had ever stood before. The climb was perilous in the extreme, but finally accomplished, and the exultation of having done something great was suddenly checked by finding a prospect hole on the top of the pinnacle. A prospector had not only scaled the pinnacle but had carried up his tools and done some work.

Think of the deeds of daring, of endurance and dogged perseverance brought out in the Klondike rush, or the perils of the desert overcome in the Nevada excitement; or, going back a generation, think of the heroes, by thousands, both men and women, who crossed the uninhabited continent to reach the gold fields of California; or, going back a dozen generations, recall the deeds of daring and adventure performed by the Spaniards under the impulse of gold and godliness.

In these days of prosaic, intelligent selfishness, when business affairs are cautiously weighed and measured out to decide a course which promises the maximum gain for the minimum risk, regardless of friendship, or enthusiasm, or patriotism, or sometimes of honesty, is it not refreshing to see an industry flourish which commands the maximum of risks, which cherishes friendship, lives on enthusiasm, holds dear its patriotism and abhors dishonesty? An industry which brings out the best there is in a man morally, physically and intellectually. —Mining Science, June, 1908.

THE TEAMSTER.

(A Mining Camp Ballad.)

With a five-ton copper load an' a rocky, rutty road,
An' a evil-minded bunch of mules to go it;
With a leather lash to sting as the sharpest turns I swing,
I haven't any picnic, an' I know it.
'Tis a long an' sudden drop—if I chance to go kerflop
There wouldn't be much left of me to grumble;
So I finds it very wise just to utilize my eyes,
For a half a mile is something of a tumble.

I haven't any kick at my chosen daily trick,
Which you can't exactly value till you've tried it,
But I'd like to have it said that it takes a steady head,
With a pretty fair to middlin' brain inside it.
When the road is hard an' steep an' the yawnin' gulch is deep,
An' the space you've got to travel in is narrow,
An' the mules is stubborn brutes, you can bet your shirt an' boots
That you've got to be some stronger than a sparrow.

So I drives 'em day by day down the rough an' crooked way,
An' altho it seems I does it helter-skelter,
You can notice, if you will, that I doesn't take a spill,
An' I get my load of copper to the smelter.
If my language isn't nice—well, you try it once or twice
When the leaders an' the others gets to fussin',
An' you'll find, the same as me, when you try to make 'em "Gee!"
That a mule was never driven without cussin'.

—Breton Braley, Saturday Evening Post.

There's many a man who might, no doubt,
Win something in life's race,
If he wouldn't wear himself clear out
And run his legs off, just about,
In seeking an easy place.

POSITION VACANT.

We have on our files a request for a superintendent for a shipping mine in Gilpin County. The man, to get the position, will have to invest in the mine or induce some relative or friend to invest. If any one of our readers wishes to investigate this offer we will gladly furnish full particulars.

NOTICE.

The Alumni Association has for some time been trying to locate the following graduates. Some of these have not sent in their address for several years. If any of the readers of the Magazine know the whereabouts of any of the following men, they will be helping the work along by sending what information they can to the Assistant Secretary at Golden:

Walter D. Abel, '06.
Walter J. Atkinson, '96.
Charles F. Breed, '01.
Harry F. Bruce, '00.
Herbert A. Canning, '97.
Bert Cole, '92.
F. C. Farnam, '09.
Louis D. Fry, '03.
Frank R. Hamilton, '98.
Leon P. Hills, '08.
George F. Hoyt, '96.
Gilbert E. Jewel, '93.
Fred G. Kelley, '99.
Oscar A. Lampe, '98.
N. W. Logue, '97.
William B. Middleton, '83.
Enrique A. Schuman, '97.
E. M. Smith, '05.
T. E. Stephenson, '06.
B. T. Wells, '04.
Charles E. Wheeler, '94.

The
COLORADO SCHOOL OF MINES MAGAZINE

Vol. I. GOLDEN, COLO., MAY, 1911. No. 8

Present Conditions of Mining and Metallurgy in the Ural Mountains.

Horace H. Emrich,
Manager Copper Refinery, Kyshtim Mining Works, Kyshtim, Russia.

Present conditions of mining and metallurgy in the Urals, as far as the writer has been able to see and learn, are easily summed up in a few words. From an American point of view there almost are not any conditions, the industry is so small. However, this is not due to lack of minerals, for the hills seem to be full of them, to be had for the searching. The heavy minerals, i. e., zircon, magnetite and garnet, can be found by panning in any stream, and very frequently one gets color also. In a word, the country is undeveloped, and offers a good opportunity for the mining engineer and metallurgist.

Let it not be assumed that one may prospect here as in America or Mexico, for the land is all owned; but expert mining and metallurgical opinion is in demand and is well paid for. Conditions are absolutely in no way similar to those in America.

A knowledge of Russian is a key to any part of Russia or Siberia, and a knowledge of German a very great aid until such time one may acquire Russian. To speak Russian correctly is exceedingly difficult; to pick up enough words to get along with is not hard when one is thrown in a position where he hears only Russian spoken.

There are numerous small iron works scattered along the range, built in the old days to make iron with charcoal and to take advantage of what small water powers there may be. At the present time most of these works are closed. As a rule, the iron ore is a limonite, and from what the writer has seen it would not be a surprise if it turned out to be from the gossan caps of copper veins, since in some places this is worked for gold extraction by the cyanide process.

With the wane of the iron industry, which is now practically controlled by a syndicate in South Russia, copper is coming to the front. There are several copper works along the range, but they all refine to ingot copper by fire, in small gas-fired furnaces, holding about five tons, the gas being made from wood.

The most modern copper plant is owned by the Kyshtim Mining Works Company, with whom the writer is now connected, with headquarters at Kyshtim, about eighty miles due south of Ekaterinburg. The latter city can be seen located on any map of the Ural region.

This company has just erected a smelter of two American copper furnaces of approximately 400 tons each of ore per day. The ore is highly pyritic and almost no coke is used in smelting. Basic-lined converters convert the matte.

The writer has just completed the construction of a refinery, embodying the latest American practice, of twenty-five tons daily capacity, which will treat the smelter product. At the present time this is about fifteen tons per day, and will reach twenty-five tons in about a year. There is only one other refinery in Russia, and that smaller, situated in St. Petersburg.

The Ural mountains are known to almost every one as the producers of practically the world's entire supply of platinum. As far as the writer is aware, very little else is known about them by Americans. As opportunities for mining men and Metallurgists are great, it might be of more interest to some, as it was to the writer, to know more of living conditions and of how to get here, than to give here mere detail of antiquated mining and smelting methods. It will, therefore, probably be best to devote the most space to impressions along these lines.

It has already been the writer's pleasure to answer a series of questions on this subject, asked of him by letter by a fellow alumnus.

Any American coming to Russia would very probably be engaged by some com-