ASPECTS OF PHYSICAL GEOGRAPHY IN RELATION TO ORE DEPOSITS.

March 28th, 1935. -o- By S. F. Hunt.

Mr. Chairman, distinguished Dean Fulton, Associate Professors, Members of the Crucible Club, Ladies and Gentlemen.

A week ago when I began to consider the nature and purpose of this discourse, the time element, constant changes and advancement in all branches of technical learning, beset me with the realization that I was above all, a back number. Something more than 50 years ago, when a student of geology and kindred subjects, the geologists were at odds as to whether the earth was 40 or 60 million years old, and all of them were at war with biblical cosmogeny. These builders of geologic learning were Sir Roderick Murchison, Sir Charles Lyell, William Logan of Canada, and Sir Archibald Geikie whose textbooks were mine to study. No American of note had written a treatise on geology except James D. Dana and his great work cost $10, which was $10 and 10 cents more money than my personal accounts indicated.

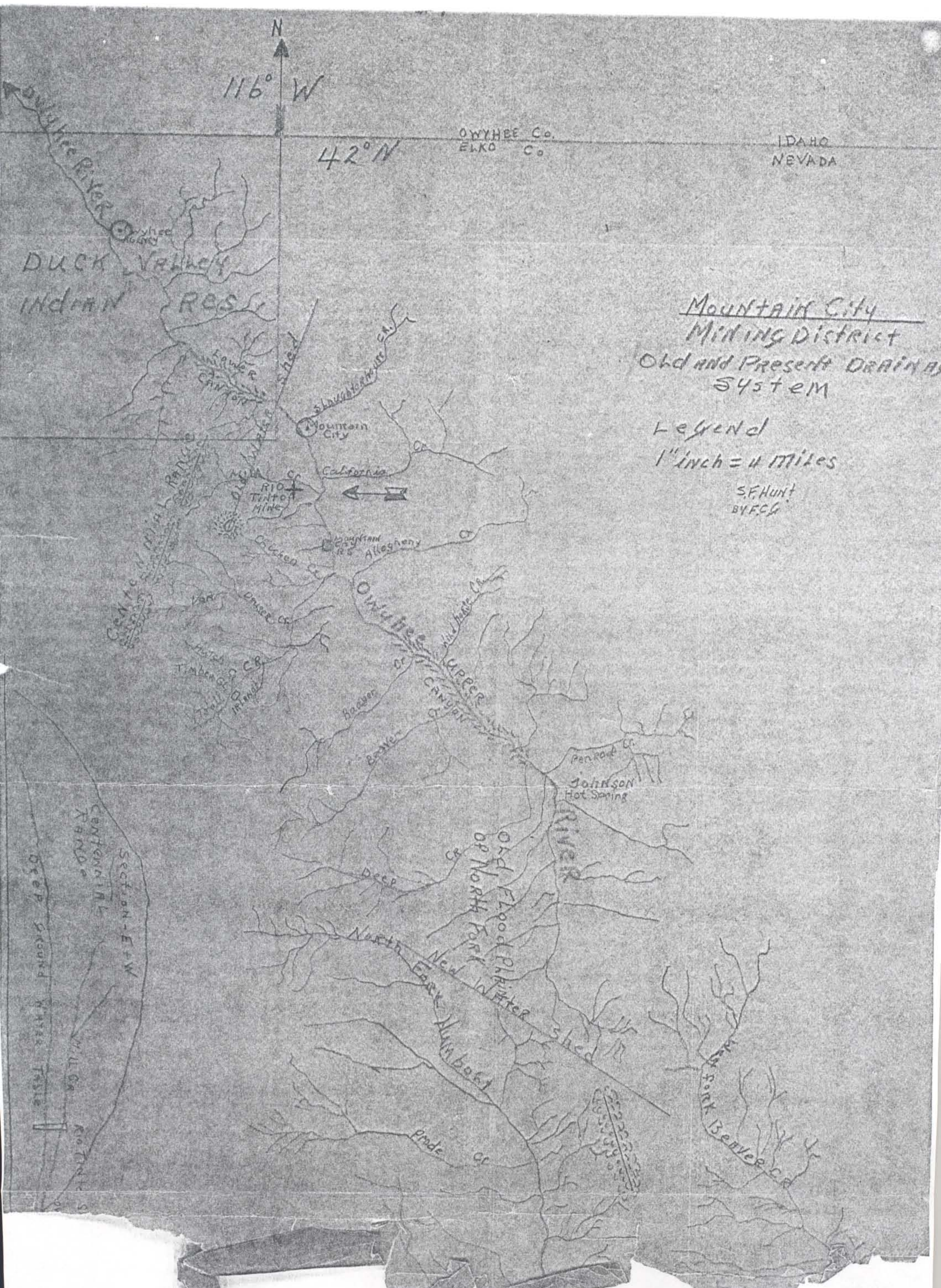
Since that antediluvian time it has remained my purpose to try to keep abreast of the rapid advances in geologic subjects. For instance our old work was Parper's "Physical Geography". About 25 years ago this study was renamed "Physiography", and the other day, when Fred got the last word on this time-old study, it comes forth in a brand new attire, under the pompous name of "Physical Geology", and informs us that the earth is now two thousand million years old. If these are up to date figures, then

I am only one billion, four hundred and fifty million years behind the times, which you must freely admit is not so bad after all. Though with your modern teachers present, it would be a matter of presumption on my part to attempt a discourse along modern technique, and besides it would be impossible for me to do so even though I tried.

So with this understanding, let us proceed with our discussion of the "Aspects of Physical Geography in Relation to Ore Deposits." A month ago when I was present to listen to the able address of Manager Buehler concerning the huge deposit of lead-zinc ore in Pioche District, my feeling of sympathy and sorrow was aroused because the Snyder Brothers were not in financial position to avail themselves of Boulder Dam power. Not so with our Rio Tinto at Mountain City. We had developed and put the mine on a producing, shipping and paying basis, with copper at only .06 cents a pound, before any mine buyers ever saw this Nevada bonanza. Being the only miner in the Rio Tinto Company and a hospital invalid, something had to be done, so the control went to a corporation, which immediately consigned this wonderful property to an undeserved oblivion where it still remains. But what are the physical facts leading to Rio Tinto discovery is the important thing at present?

The Rio Tinto lode did not outcrop at the surface. All the early mining around Mountain City was for silver veins in the granite near town and for placer gold in adjacent gulches and streams. In 1872 the brothers James and Samuel Tibbets dug a placer ditch starting about 300 yards above where the lode crossed then called Rough Mountain Gulch. They carried their trenches

across the lode, showing it to be 50 or more feet wide and worthless, as the brownish gossan exposed carried no gold, silver, nor other metallic value except iron. Later on the gulch was located as a sheep claim and held for many years as summer pasture land. The owner performed his annual work on the west side of the gulch in a soft shale tunnel, which reached into the gossan, but was caved to the surface, when my search for something good in the way of a lease brought me to this point in September, 1919. My 25 years' experience with copper convinced me that a bonanza sulphide copper deposit rested at permanent water level, just below the vadose zone of water circulation. My location of Rio Tinto was delayed until November because my physical geography was stumped in an attempt to determine nearly how deep it would be to the deep ground water sulphide zone. So it became my turn to attack a peculiar physiographic problem which kept me puzzled and going for more than a year. My audience will best understand the features by maps and diagrams on the blackboard.


Mountain City
Mining District
Old and Present Drainag
System
Legend
1" inch = 4 miles
S.F. Hunt
BY F.C.G.
N
116° W
42° N
OWYHEE Co.
ELKO Co.
IDAHO
NEVADA
Owyhee River
Duck Valley
Indian Res
Lower Canyon
Water Shed
Slaughterhouse CR.
Mountain City
California
Cr
Mill Cr
Rio Tinto Mine
Mountain City R.S.
Allegheny
Chicken Cr
Van Duser Cr
Owyhee
Upper Canyon
Badger Cr
Beaver Cr
Penrod Cr
Johnson Hot Spring
River
Deep Cr
Old Flood Plain of North Fork
North New Water Shed
North Fork Humboldt
Pratt Cr
Fork Beaver Cr
Centennial Range
Section E+W
Deep Ground Water Table

Thus we discovered that the original divide, between the two old consequent rivers two miles northwest of Mountain City has been shifted about 25 miles south by a broad, low upwarp which enabled the Owyhee River to march across the low north divide and behead the upper Pliocene drainage basin of the North Fork of the Humboldt River. The two old consequent streams are now nearly connected by a subsequent stream flowing north. So the problem to solve was at what depth below the outcrop the old North Fork water table stood and at what depth below that table stands the present deep ground sulphide zone. After a number of surveys from two perennial springs and the Owyhee River bed, none of which checked out very closely, and along with plenty of guessing, my final decision was, the sulphide zone rested at a vertical depth of 185 to 200 feet. Luckily for me the sulphide came in at 192 feet, which was 15 feet below the old North Fork water table and 23 feet above the present ground water zone. Hence the present water table lies only 37 feet below the old. Thanks to Pluto, God of the underworld and giver of wealth.

Perhaps other parts of Nevada have been deformed by recent geological diastrophic movements. But as such, they are of no particular concern unless they have likewise deformed important mining regions to confusion and loss. Nevertheless, many useful lessons may be learned from the Mountain City upwarp alone.

First, the formations in place at the youthful beginnings of the North Fork and Owyhee Rivers delimit and establish their co-existent ages. About 200 feet above their narrow, rocky valleys and newly trenched canyons, there extends upward for 2,500 feet an old worn mature topography. The most recent of the dis-

sected formations are Miocene volcanic tuffs capped with basalt; and these lavas are eroded 500 feet below their original tops.

Second, the Mountain City granite batholith has an east and west length of 30 miles and a north and south width of one to four miles. About 1,000 feet above the present river bed this intrusive formation in Paleozoic limestone has undergone a long period of denudation preceding Tertiary time, because there are 200 feet of Eocene sandstone lying in horizontal position above the granite. The exact date and age of this higher and older interval of erosion is not decipherable but must belong to the Paleocene epoch following the Laramide Revolution of Upper Cretaceous time. It therefore places the intrusion of Mountain City granite as a part or feature of the Laramide Revolution or possibly even earlier. Now along the south side of the granite, where it dissects the north dipping, Mississippian limestone a mile and a half north of the Rio Tinto, a sparse showing of contact metamorphic minerals, such as garnet, epidote and specularite appears. To the south it is plainly evident that the granite thrust southward buckled and deformed the bordering limestone and the Cambrian slate and quartzite formations, still farther south in which the Rio Tinto ore bodies occupy a regional unconformity. There are no contact metamorphic minerals in or near the Rio Tinto ore deposit, and its dip and slight deformations result from the fact that the deposit antedates the granite intrusion. Just how long before is undetermined, but my belief is that the ore deposit was mainly formed at the close of the Jurassic or during the Nevadian Revolution. It has therefore undergone 5,000 feet of surface erosion, denudation and weathering since the beginning of Cenozoic time. This is

the lesson physical geography teaches me.

My younger geological friends inform me that the new cultural members of the U. S. Geological Survey have decided and stated that most, if not all, the major ore deposits in the Great Basin region, are of Tertiary deposition. Admitting myself to be only one billion four hundred fifty million years behind the times, I frankly do not believe a word of it. The Richmond-Eureka Mine at Eureka, Nevada, which has produced eighty millions, is quite as old as Rio Tinto; so are the zinc-lead deposits of Pioche. The Raymond-Ely fissure in the Lower Cambrian quartzite in Pioche is oxidized 1,000 feet deep. The Bullion Beck-Eureka Hill deposits in Eureka, (Tintic District) Utah, are oxidized to 2,400 feet in depth, beneath a Miocene flow of pyritic "Packard rhyolite".

Unfortunately some 20 years ago ~~when~~ When Butler and Lindgren made a re-examination and report of the Tintic District, they at that time, with a motley melange of followers, were obsessed with the big growl between Lindgren's sloppy wet notion of ore deposition as against Spurr's.

Bone dry preachings of vein dykes and ~~red~~ Red hot protore magmas. But had Butler and Lindgren taken pains to read what George W. Wharton and George Otis Smith had written 30 years before this assignment, much misleading foolishness would have remained unprinted in the U. S. Geological Survey. The great ore deposits of the Tintic District, which have yielded over 300 million, belong in age to Rio Tinto, Richmond-Eureka and Raymond-Ely in Nevada, and all are in Cambrian rocks. So none of them are more recent in deposition than Laramide.

Pardon me, but it appears that we are getting far afield,

why not return to Reno? the city of airing connubial infelicities, and start a family row of our own, over the Comstock lode. Forty or more years ago, I read, was it Reichthoven and Becker's description of Comstock Mines? And besides having spent three days in the last 40 years on the Comstock, I feel amply prepared to argue a point with you younger practitioners. My contention is that the Mount Davidson footwall granite or greenstone along with the hanging wall country down to the mouth of Six Mile Canyon, is all one batholithic intrusion. That it was intruded through Paleozoic formations during the Nevadian Revolution at the close of the Jurassic period. That the Comstock deposits are of Laramide and not of Tertiary age. The Mount Davidson batholith is of Nevadian Mid-Mesozoic age. It is not an extrusion but an intruded batholith, ranging from five to 10 miles wide east and west and from far southeast of Carson City to again far north of the Peavine District, north of Reno. It has a north and south length of over 100 miles, and is entirely different in its surface aspects and mineralogical composition to any of the many Tertiary extrusive volcanics in Nevada foothill regions.

Recently a friend called my attention to a statement in some paper, that the U. S. Geological Survey had appropriated $10,000 this year for making a resurvey of the old Comstock District. May I be permitted to suggest that one-fourth of this amount, or $2,500 of it, be expended in making a further aerial survey or reconnaissance of the region extending over the entire Mount Davidson batholith, from Peavine District to Yerrington and beyond.

If it is possible to get a few members of the Crucible Club on this work, it will beat all the football kicking and horseplay athletics that an indulgent faculty permits.