



SEG - STUDENT CHAPTER – UNIVERSIDAD NACIONAL DE COLOMBIA – SEDE MEDELLIN
FIELD TRIP CRIPPLE CREEK AND VICTOR GOLD MINE AND EXPERIMENTAL EDGAR MINE –
COLORADO – UNITED STATES
(26-27 September 2018)



Figure 1 Group of participants' field trip Colorado - United States, Experimental Edgar Mine. Members (right to left), Nicolas Anacona, Sebastian Builes, Manuela Gonzalez, Isabel Casasbuenas, and Karenn Lara.

ITINERARY

<u>Day</u>	<u>Activities</u>	<u>Place</u>
21 September	Travel from Medellín to Denver - Colorado with stop in Miami	
26 September	Visit to Experimental Edgar Mine	Idaho Springs
27 September	Visit to Cripple Creek and Victor Gold Mine	Cripple Creek

MAP OF FIELD TRIP

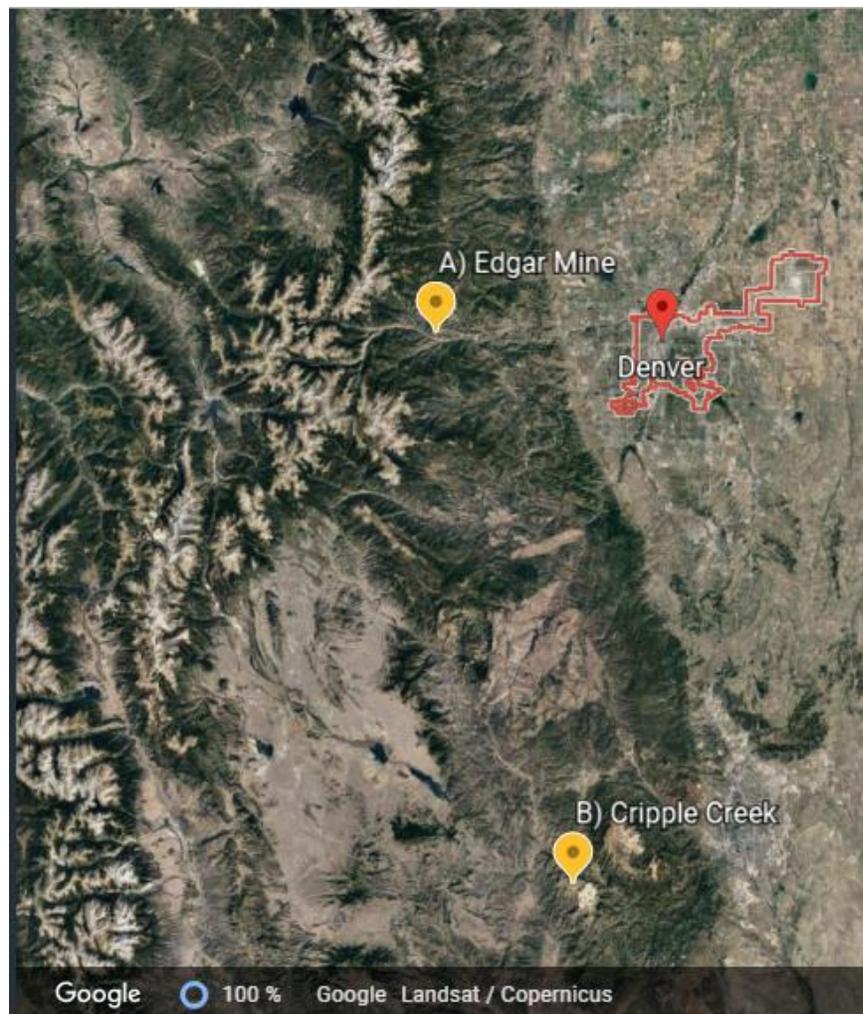


Figure 2 Experimental Edgar Mine, B) Cripple Creek Mine



<u>Place</u>	<u>North Coordinates</u>	<u>West Coordinates</u>
Experimental Edgar Mine	39,748	105,525
Cripple Creek and Victor Gold Mine	38,727	105.144

FIELD TRIP PARTICIPANTS

<u>Name</u>	<u>Type</u>	<u>Institution</u>	<u>e- mail</u>
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1. INTRODUCTION

During the 2017, the SEG Student Chapter of National University of Colombia – Medellín Campus, was planning to visit some mines icons in United States as Cripple Creek and Victor Gold Mine and the historical Experimental Edgar Mine owned by Colorado School of Mines. We take the opportunity to attend to SEG Conference in Keystone 2018 and visit these important mines as well. The field trip started in Denver, Colorado and continue to Idaho Springs. Professionals and wonderful people received us and gave us a tour through the Experimental Edgar mine. They explained us about the different operating



methods and tools used in the 1870's to produce silver, gold, and copper. On the other hand, we were in a classroom into the underground mine where its conditions were possible to receive academic classes.

The following day, we went to Cripple Creek and Victor gold mine owned by Newmont Corp in the southwest of Colorado Springs. We could observe the entire process of its operations in the open pit mine. The safety and security implements such as glasses, vests and helmets were required and gave for all of us. We could be in contact with the equipment used to extract and transport the material, like dump truck. Finally, we visited the processing plant we had the opportunity to view the amount of material that those equipment process in a few seconds.

2. REGIONAL GEOLOGY

The continue deformation of plate boulder in the western margin of North America has occurs during the Cenozoic around to 65 Ma. In this context, the Colorado Plateau located in the east of Basin and Range Province and the west of the southern Rockies is anomalous context of western of North America like its relatively high elevations, this surface consists of largely undeformed Paleozoic and Mesozoic marine rocks uplifted since the Cretaceous with little apparent shortening.

In the Proterozoic around to 1.78 Ga the continental crust of Colorado was formed by some insular arcs, across to the cost Archean Wyoming Craton, it has an area of 140000 square miles, it includes the area drained by Colorado Rivers.

It presents a combination of high relief and arid climate producing zones easily eroded by moving streams leaving behind bare rocks, the elevations on the plateau range from the 3000 to 14000 feet with an average of 5200 feet, the precipitation in Colorado Plateau is around to 10 inches per year

The Colorado Plateau is a crustal block integrated by undeformed rocks buy surrounded by high deformed Rocky Mountains and de Basin and Range Provinces, this plateau has like boundaries The Uinta Mountains of Utah and Rocky Mountain of Colorado, for the eastern limits it has the Rio Grande Rift Valley in New Mexico, finally for the southern, we can found the Mogollon Rim separating the Colorado Plateau of Fauld Basin and Range Province.

The Plateau has been divided in six sections, Grand Canyon, High Plateau section, Uinta Basin, Canyonlands section, Navajo Section and Datil section, this last section presents largely its volcanic origin.

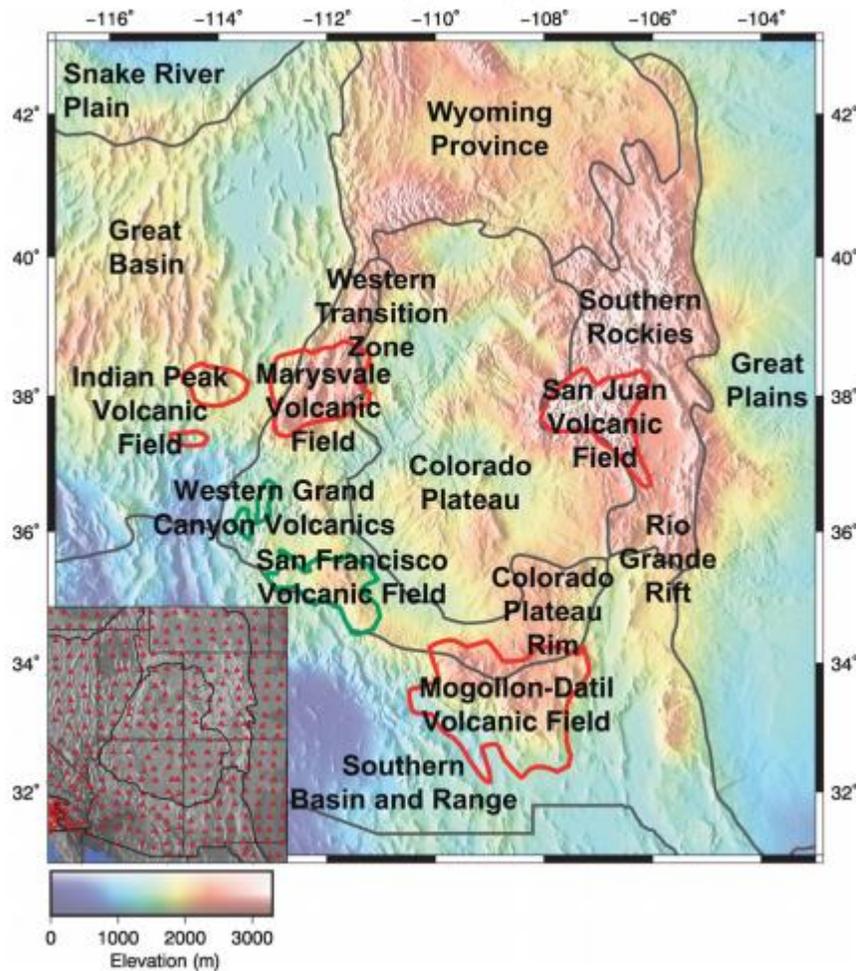


Figure 3 Colorado geology

3. STRUCTURAL GEOLOGY

Some of the main structures of the plateau is composed by broad flexures, folds like monoclines, vertical faults, some igneous lithology and volcanics and tectonic features, however the folds developed in Colorado plateau are broad and open flexures, like Kaibab Uplift, it forms a great arch with 160 km long and 40 km wide, areas of sedimentary rocks are separated by bends of strata along monoclinical folds, the monoclinical folds are formed thanks to faults among which are sedimentary rocks draping.

The plateau has various normal faults with north-south trending by tensional forces on the other hand the Hurricane Cliffs, west of Zion are the expression of the some of these faults, for the Grand Canyon its

orientation is defined by the Bright Angel Fault, currently we can understand the Colorado plateau as series of plateaus separated by north-south trending faults and monoclines, the formation of those faults and folds were produced by movement of crustal blocks in the Precambrian basement. In the lithology that is relevant in the zone are the intrusive laccoliths and extrusive igneous rocks those bodies of igneous lithology are injected along the bedding planes of sedimentary rocks.

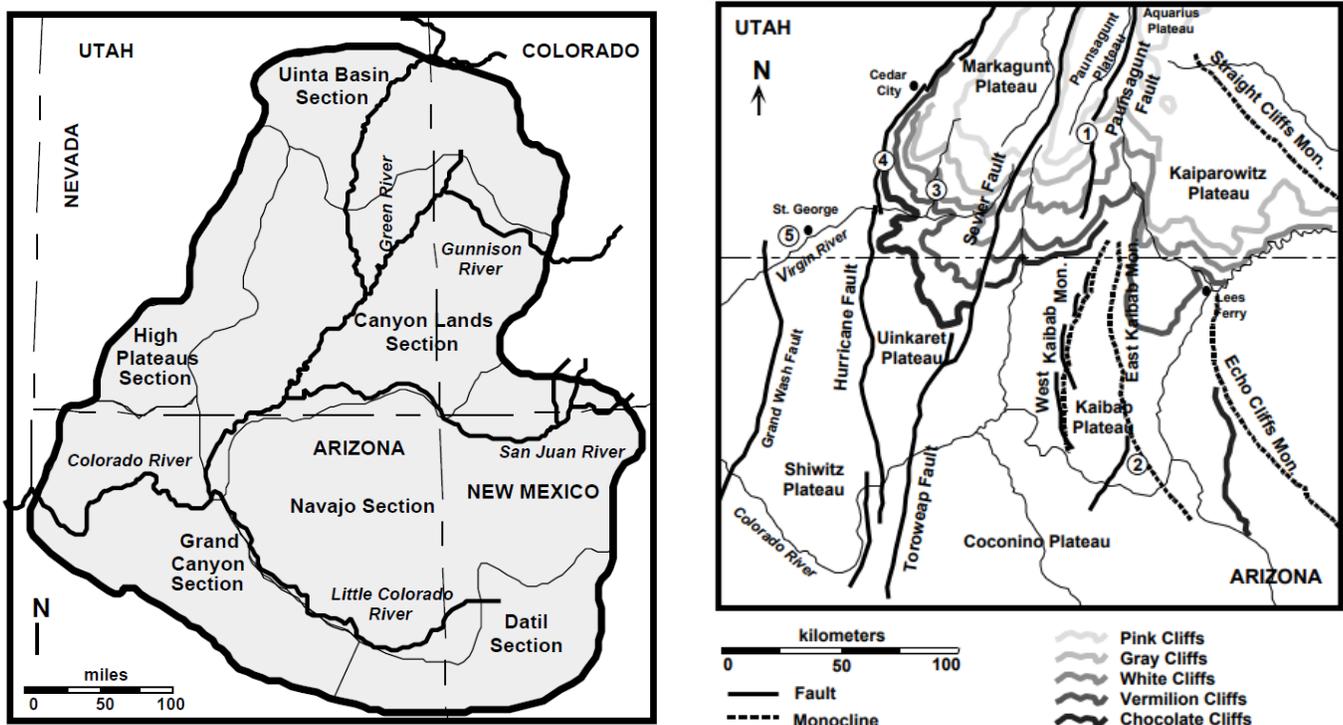


Figure 4 Structural geology of Colorado

4. GEOLOGY FOR THE MINES VISITED

a. Experimental Edgar Mine

The Experimental Edgar Mine is operated by the Mining Engineering Department of the Colorado School of Mines and is located in Idaho Springs, approximately 20 miles west of Denver, Colorado. It is used as an underground laboratory and classroom for topics such as underground mine, surveying, geologic



mapping, rock fragmentation and blasting, mine ventilation field studies, rock mechanics and instrumentation, and mine safety.

It is composed of Precambrian rocks which have been least three times of deformation between Precambrian and Tertiary, the characteristics rocks that we can found are quartz, plagioclase, biotite gneiss, Quartz Biotite, Hornblende gneiss and Biotite microcline pegmatites, on the other hand near to the Explorations Edgar Mine has dikes and porphyritic plutons as monzonite.

The mine is in the steeply dipping northwest flank of an anticline fold, additional this zone has small faults with dip to the north between 30 and 80 degrees.

This experience was very exciting because understanding that mining engineering must be taught in practice as the underground classroom is quite a challenge to replicate in our country.





Figure 5 Experimental Edgar Mine

b. Cripple Creek

During the Laramie Orogeny when the Rocky Mountains started to form was developed a zone of faults known as Florissant Lineament; the Eocene and Oligocene 38- 29 Ma and near to the final of Laramie Orogeny this zone had an activation known like volcanic area Thirty-nine Mile, the Florissant Lineament and the faults associated developed five principal volcanos, one of these volcanos found water and produced the collapse of this volcano and faults in the rock where it was located developing a breccia filled volcanic pipe, repetitive explosions formed two necks at Cripple Creek over 3000 feet deep.

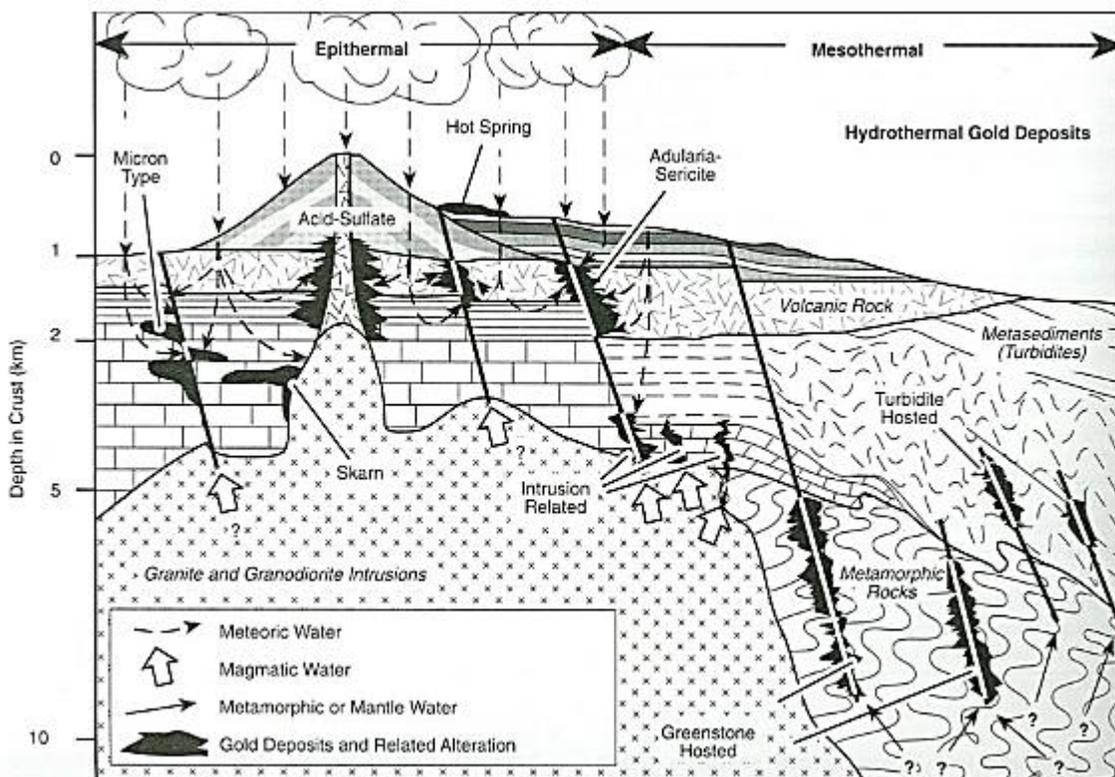
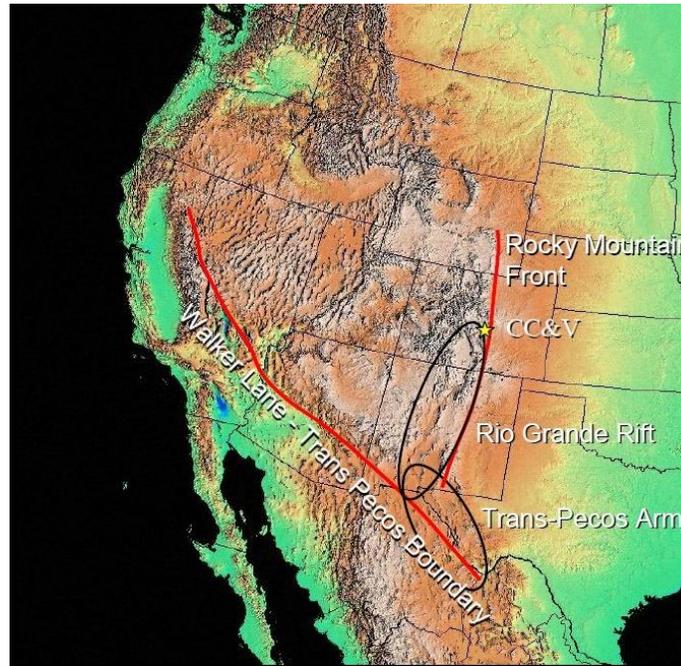


Figure 6 Epithermal process Cripple Creek

The deposit Cripple Creek is classified like a epithermal deposit, and it represents low pressures around to 50 – 300 grade Celsius, this process can be occur until 2 Ma, during this time the gold was precipitated with the tellurium and formed crystals in the available area, those solutions are transport to the surface thanks to the faults and weakness planes “The ore bodies occur as deposits of rich, narrow, gold-telluride veins with quartz, pyrite, and fluorite”.

The dense localization of gold suggests that the principal deep fractures are behind of those areas that were used as principal canals to gold solutions arrive to the volcanic complex, those faults have a north south orientation as well as Florissant guideline as the igneous alkaline rocks belt located since Canada to Mexico

The origin of the gold solutions hydrothermal now is a debate, however is possible those because its located, near to the Colorado mineral belt and the actions of intrusive and hydrothermal events could be the causes of the gold and tellurium liberation in the rock and after those processes were concentrated and precipitates, however other theory is relative with magma and transfers to hydrothermal solutions because of sulfurs.



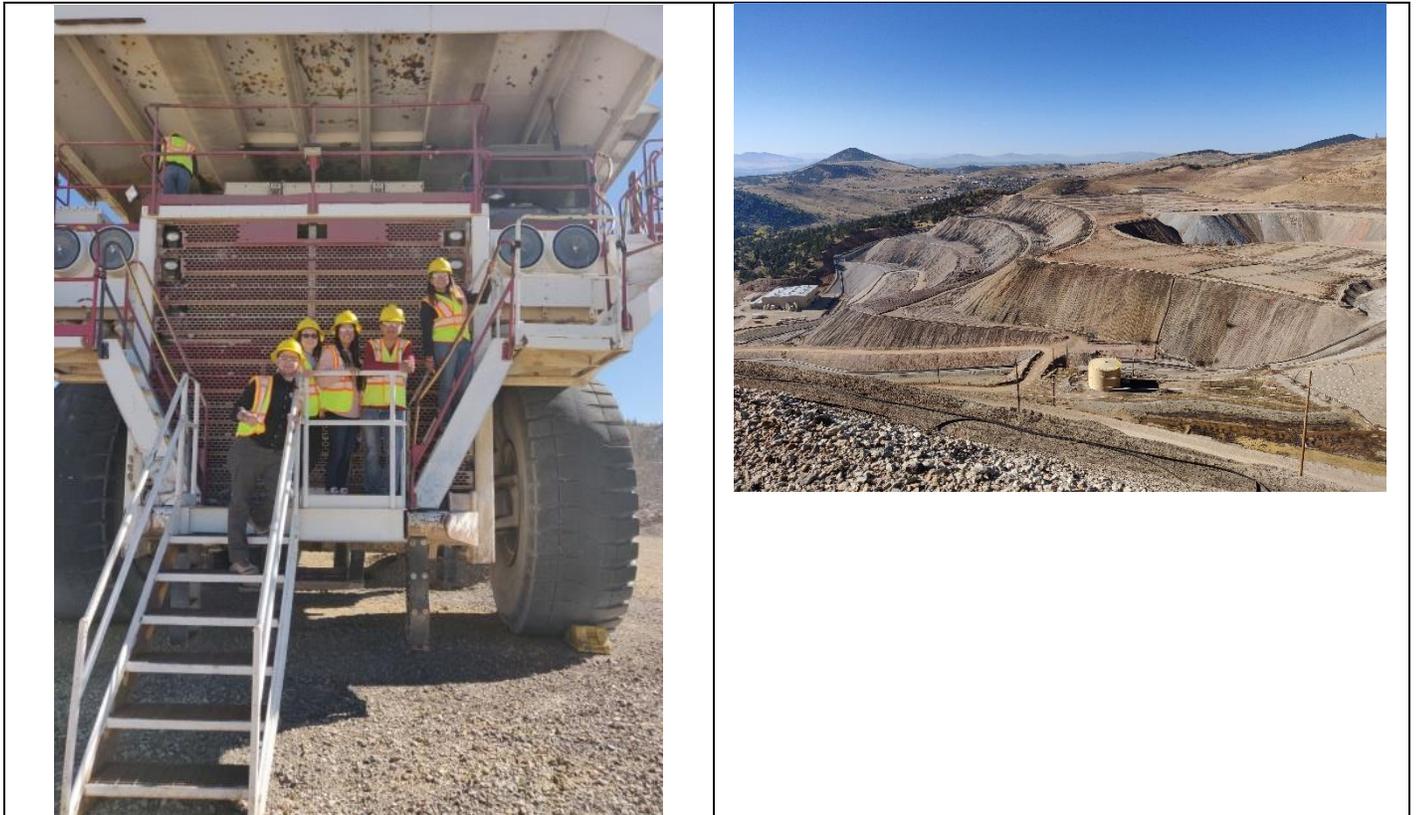


Figure 7 Cripple Creek Mine

5. ACKNOWLEDGEMENTS

This fieldtrip was carried out thanks to the funds received by the Society of Economic Geologists (SEG) to the SEG Medellin student chapter, which was awarded in Round I 2016 of Stewart R. Wallace Funding. The funds were initially requested to develop a field trip in Brazil. However, the student chapter did not have enough funds at that moment and logistical drawbacks did not allow carrying out the field trip. The money was not invested in that moment and the amount of 500 USD delivered to SEG student chapter were saved during two years. Therefore, it was only until 2018 that the student chapter could invest in the transportation to go to these mines in U.S.

6. REFERENCES



- Colorado Geological Survey . (s.f). *Edgar Experimental Mine*. Obtenido de <http://coloradogeologicalsurvey.org/colorado-geology/colorado-points-of-geological-interest/edgar-experimental-mine/>
- Colorado School of Mines . (s.f.). *Edgar Mine* . Obtenido de <https://tour.mines.edu/edgar-mine/>
- Geology Department, University of Akron. (1999). *GEOLOGY OF THE COLORADO PLATEAU*. 6.
- Gold Cube Association of America GCAA. (s.f). *BRIEF GEOLOGY OF CRIPPLE CREEK*. Obtenido de <https://goldcube.net/2016/05/01/brief-geology-cripple-creek/>