

**Ambrose E. Ring's Photo Record
of
AIME's 1916 Tour of Arizona Mines**

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PREFACE

This paper provides a photographic record of the status of mining in Arizona just prior to the U.S. entry into World War I. The photos document a cross country railroad and automobile tour of Arizona mines by 200-plus members of the American Institute of Mining Engineers (AIME) organization in September 1916. The photographer was mining engineer Ambrose E. Ring, the grandfather of co-authors Bob and Al Ring.

The paper begins with clarifying background and historical context:

- Biography of Ambrose E. Ring
- History of the AIME (now American Institute of Mining, Metallurgical and Petroleum Engineers)
- Status of U.S. and Arizona mining in 1916

The body of the paper covers each “stop” along the mining tour and includes a brief history of the both the “town” and mining operation that the engineers visited. The authors highlight a few photos from each stop, but include Ambrose’s entire record of 107 photographs at the end of the paper. For added context and interest, the authors sometimes supplement Ambrose’s photos with pictures from co-author Al Ring’s extensive collection of over 18,000 different Arizona postcards.

AMBROSE E. RING'S PHOTO RECORD OF AIME'S 1916 TOUR OF ARIZONA MINES

Introduction

Ambrose E. Ring

Ambrose Ely Ring was born in New York City on August 5, 1883. He spent his childhood in New York State and in June, 1905 graduated as a mining engineer from the Columbia School of Mines in New York City. Six months later Ambrose wed Grace Emily Harned and the newly married couple immediately moved to the Oro Blanco Mining District of south-central Arizona. Ambrose began his mining career working at the Oro Blanco gold mine, one of the original district mines, first located more than 30 years earlier.

Ambrose Ring spent his entire professional life from 1905 to 1949 in the mining business, most of it with the American Smelting and Refining Company (ASARCO) or its forerunner companies. Ambrose managed mines in Arizona, Missouri, Colorado, Idaho, and Utah. He was also the person in charge of mining camp law and order, emergency operations, and even day-to-day life.

Ambrose became an expert in evaluating mining prospects. ASARCO's Head of Mining, H. A. Guess, relied on Ambrose to assess the mines he managed, and to inspect potential mining properties in Australia and British Guiana. Over his career, which spanned some very difficult economic times, he closed down four major mines.

Ambrose retired in 1949 in Tucson, Arizona as Manager, of the Southwestern Division of ASARCO. He consulted with ASARCO until his death in 1952. Ambrose Ring left a magnificent photographic legacy from his mining activities and world-wide travels.

American Institute of Mining Engineers

The American Institute of Mining Engineers (AIME) was founded in 1871 to advance the worldwide mining and minerals community through information exchange and professional development. Through its technical publications and meetings, mineral professionals collect, disseminate and exchange information concerning the exploration for and extraction and processing of metallic, nonmetallic, and fuel ores and other materials produced through mining techniques for the public benefit.

Over the years the structure of the AIME has evolved and today the American Institute of Mining, Metallurgical and Petroleum Engineers is comprised of five separately incorporated units with a combined membership of more than 90,000 professionals:

- The Society for Mining, Metallurgy and Exploration (SME)
- The Minerals, Metals and Materials Society (TMS)

- The Society of Petroleum Engineers (SPE)
- Association for Iron and Steel Technology (AIST)
- The AIME Headquarters

Mining Overview in 1916

U.S. mining was a boiling caldron in the fall of 1916, when the AIME tour of Arizona mines took place. World War I had been raging in Europe since the summer of 1914. Requirements for copper from the European Allies were increasing rapidly. U.S. refining capacity could not keep pace with production of copper. The U.S. would declare war on Germany in the spring of 1917, and demand for copper would go even higher. Two more long years of world war would follow, greatly stressing the U.S. mining industry.

Overlaid on this, a dramatic change was occurring with the role of labor in mining. Technology had reduced the need for traditional mining skills. Safety, working conditions, and wage scales were issues. Ethnic tensions existed between American, European and Mexican miners. World War I raised feelings of nationalism and fear of sabotage. In Arizona, there was also concern about Mexican revolutionaries.

Labor unions gained strength and were active in organizing the mining camps' population. Some unions advocated violent confrontation with the mine managers. Only nine months after the AIME tour of Arizona mines, 4,700 miners in Bisbee went out on strike. As evidence of the high tensions, on July 12, 1917 1,186 strikers were forcibly deported from Bisbee by train to the desert of western New Mexico. In the same month, there was a copper miners' strike in Globe. Arizona's governor had to call in troops to preserve order.

Overview of AIME Tour

For the first time in its history, the AIME held its meetings within the state of Arizona. Such extraordinary developments in mining and metallurgy and so many new departures had been made in mining, concentration and smelting in Arizona in recent years that extraordinary means had to be taken to cover the more important points of interest. Even so, with great regret the main party was obliged to omit such interesting places as the United Verde Copper Co. and the United Verde Extension Mining Co. at Jerome, the Ray Consolidated Copper Co. near Hayden, the Clifton-Morenci District, and new developments of the Gold Road-Oatman District.

Railroad trains and automobiles were used to provide maximum coverage during daylight hours. Attendance at the multiple sites, meetings, and banquets varied between 150 and 300 persons. Technical sessions were mixed in with all the other activities. In all, over 60 papers were presented and later printed in the meeting transactions.

A special train left New York on September 14th with a group of AIME members and stopped in Chicago and Kansas City to pick up additional members who had assembled from all over the country. The train arrived at El Paso, Texas on the afternoon of September 17th.

The tour included the following sites:

Fort Bliss/El Paso: National Guard camps containing 50,000 militia from different U.S. states. Smelters of the American Smelting and Refining Company (later ASARCO).

Santa Rita: Chino Copper Company's open-pit copper mine and the Empire Zinc Company's mill.

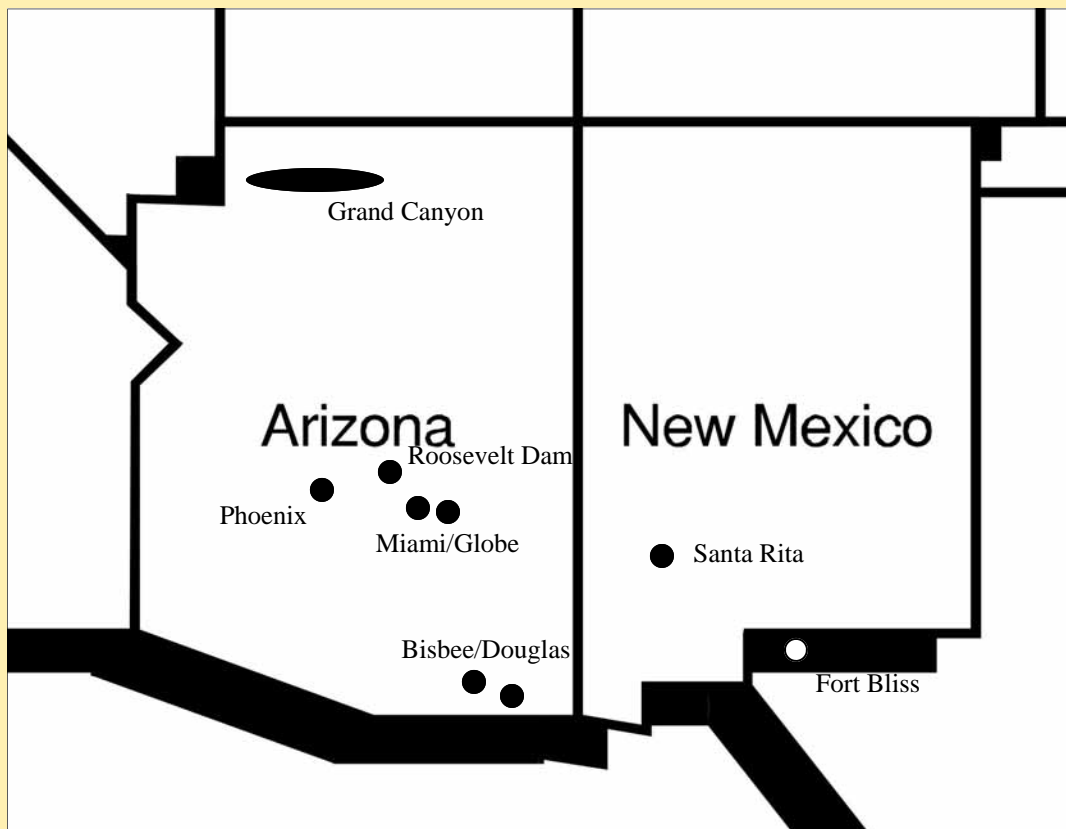
Douglas/Bisbee: Calumet and Arizona plant, smelter, and mine shafts. Copper Queen tunnels, shafts, and surface buildings.

Globe/Miami: Old Dominion Copper Mining and Smelting Company works, Inspiration Consolidated Copper Company mine, International Smelting Company reduction works, Miami Copper Company mine and mill.

Roosevelt Dam/Apache Trail: Sightseeing along 70-mile scenic mountainous road between Roosevelt Dam and Phoenix.

Grand Canyon: Sightseeing and hiking by a reduced complement of AIME members.

The AIME tour left the Grand Canyon on September 25th and returned via Albuquerque, Kansas City, and Chicago, reaching New York on September 28th.



These are the sites in Texas, New Mexico, and Arizona that the AIME visited on their tour of mines in 1916. (Map by Al and Bob Ring, 2008)

El Paso/Fort Bliss

Background

Fort Bliss is a United States Army post in El Paso County, Texas. The original post was created in 1849 to guard settlers from Indian and Mexican raids. In 1854 the post was officially named Fort Bliss in honor of Lieutenant Colonel William Wallace Smith Bliss, Zachary Taylor's adjutant general during the Mexican-American War, and later his Secretary, when General Taylor became president of the United States.

When the AIME tour visited Fort Bliss in September 1916, General John J. Pershing was gone from the Fort with the Army 8th Brigade on his 1916, 1917 Punitive Expedition into Mexico in search of the outlaw Pancho Villa. At the time a revolution was underway in Mexico. In March 1916 Pancho Villa raided Columbus, New Mexico and General Pershing was assigned to bring Villa to justice. For over almost a year, Pershing kept Villa on the run, but never captured him. Busy with preparations World War I, the U.S. restored diplomatic relations with Mexico through diplomatic negotiation and withdrew troops from Mexico in early 1917.



At the time of the AIME visit in September 1916, there were over 50,000 National Guardsmen living in these tents at Fort Bliss. (Photo by Ambrose E. Ring, 1916)

A second response to Villa's raid was that U.S. President Woodrow Wilson mobilized the National Guard to patrol the entire southwest border with Mexico. In September 1916, Fort Bliss was crowded with National Guard troops.

Fort Bliss evolved from a cavalry post to responsibilities for armored vehicles, and anti-aircraft and missile defense, and, with its extensive weapons testing ranges, is now the largest military base in the continental United States.

AIME Tour

On September 17th, using automobiles, the AIME tour visited the National Guard camps, containing about 50,000 troops from several states. Later that day, the AIME group visited the El Paso smelter of the American Smelting and Refining Company, seeing a lead smelter which had been transformed to a copper smelter to meet wartime requirements and also a Peirce-Smith copper converter 13 feet in diameter.

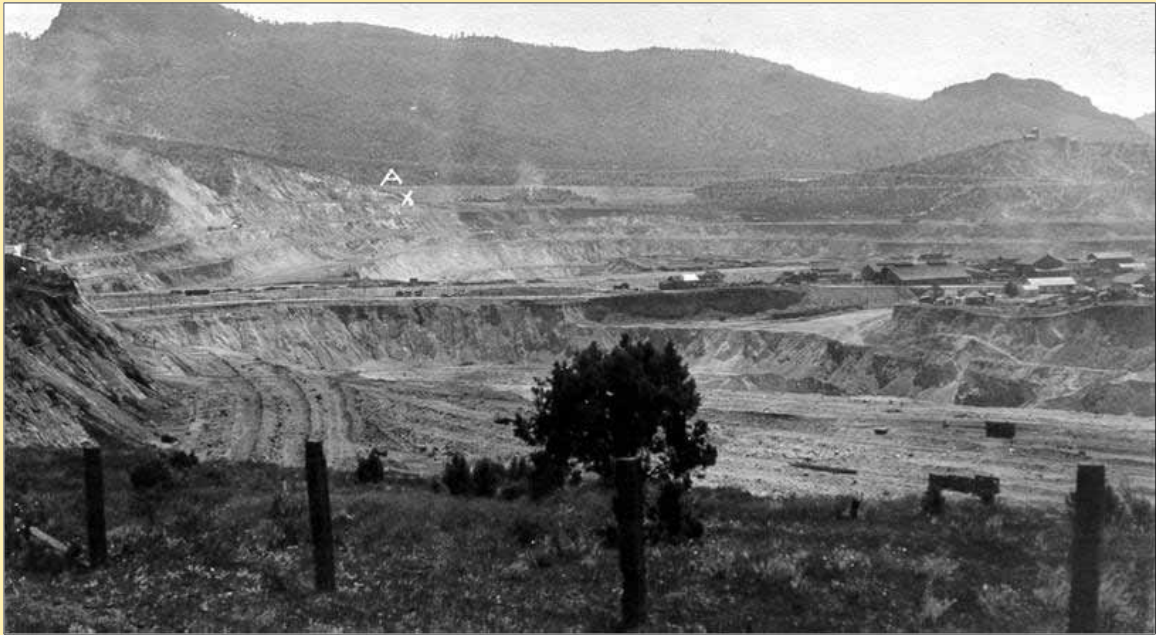
Santa Rita

Background

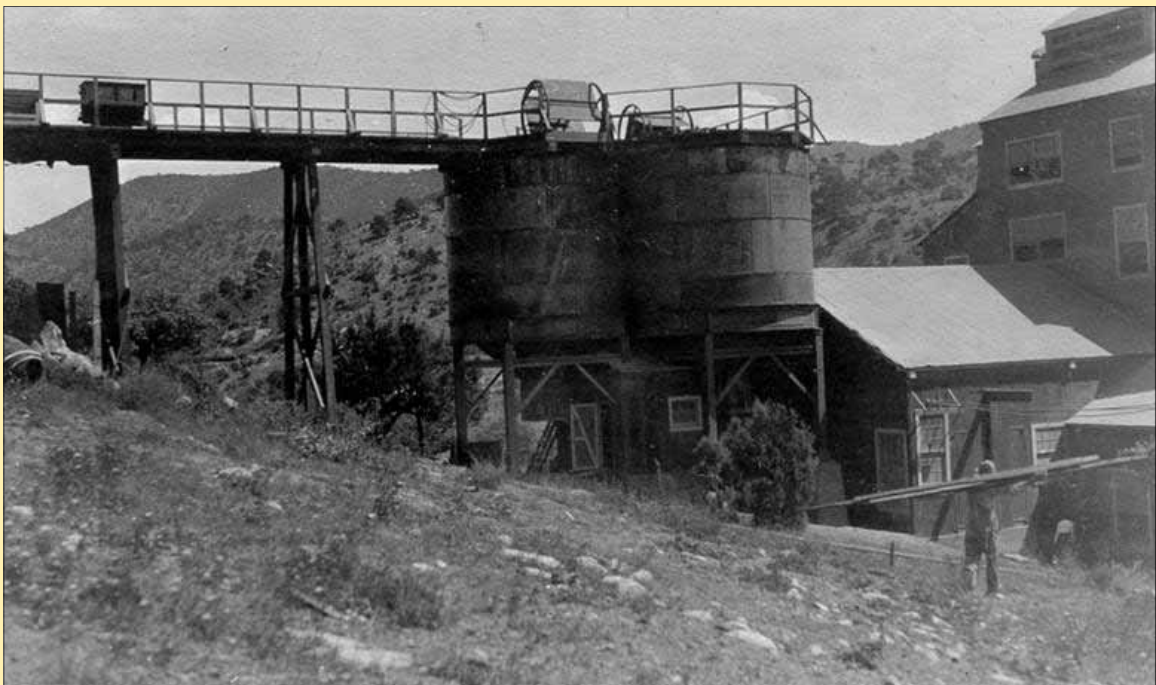
Copper mining in the Santa Rita area – about 15 miles east of Silver City, New Mexico – probably began during the Spanish colonial era (1580-1700). In 1803 Chihuahua banker and businessman, Francisco Manuel Elguea, founded the town of Santa Rita to support development of the mine to supply copper to the Mexican government for coinage. Elguea sank primitive shafts and established a penal colony at Santa Rita to provide labor for the mine. The copper was taken to Chihuahua by mule train for smelting and then on to Mexico City.



The Chino Copper Company started the great open pit copper mine at Santa Rita, New Mexico in 1909. This is the west pit. (Photo by Ambrose E. Ring, 1916)



This is the Chino Company's east pit at the Santa Rita copper mine. (Photo by Ambrose E. Ring, 1916)



At the Empire Zinc Company in Hanover, New Mexico, AIME members viewed these circular storage bins of the Rowland-Wetherill magnetic separator that treated ore containing lead and zinc. (Photo by Ambrose E. Ring, 1916)

Active mining continued off and on, depending on relations between the Apache and the miners. After the Mexican-American War and the Gadsden Purchase in the mid 1800s, Santa Rita came under the control of the United States.

In the early 1900s, mining engineer John N. Sully concluded that increased mining at Santa Rita could be very profitable. In 1909 he attracted backers, formed the Chino Copper Company, and began to convert the Santa Rita underground mine to an open pit. Operations proved successful, with the company applying all the modern techniques of mining. A mill was erected at nearby Hurley in 1911, a smelter in 1939, and a refinery in 1942. After years of company mergers and consolidations, Chino became part of Phelps Dodge and remains in operation today.

Santa Rita's population initially grew along with the mine. By 1915 the population was 2,500 and by 1920 it reached 6,000, where it remained until the 1950s, when significant layoffs started. But as the great open pit grew in size, the town was forced to move several times, the final time in 1957. The town site was finally abandoned in 1967.

AIME Tour

When the AIME tour train arrived at Santa Rita on the morning of September 18th, the members were awakened by a miners' salute, consisting of a series of blasts at the mine of the Chino Copper Company. The party boarded an observation train elaborately decorated for the occasion and was taken around the open-cut workings. The mine was estimated to contain 90 million tons of porphyry ore averaging about 1.75 per cent copper. This property was said to be the first in the Southwest to be mined by steam shovel, and in the year 1915, produced an average of over 200,000 lb. of copper per day.

After viewing the open pit, AIME members were transported 30 miles in a fleet of automobiles to Hanover, where the mine and mill of the Empire Zinc Company were located. Members were particularly interested in the Rowland-Wetherill magnetic separator, treating an ore containing zinc and lead.

Optional excursions that day included a visit to workings of the Chino mine and also the large preliminary crushing plant, a first view of flotation work on a large scale, as well as an opportunity to see tailing dams constructed to conserve both the waste water and the tailings themselves for possible future processing.

Douglas/Bisbee

Background

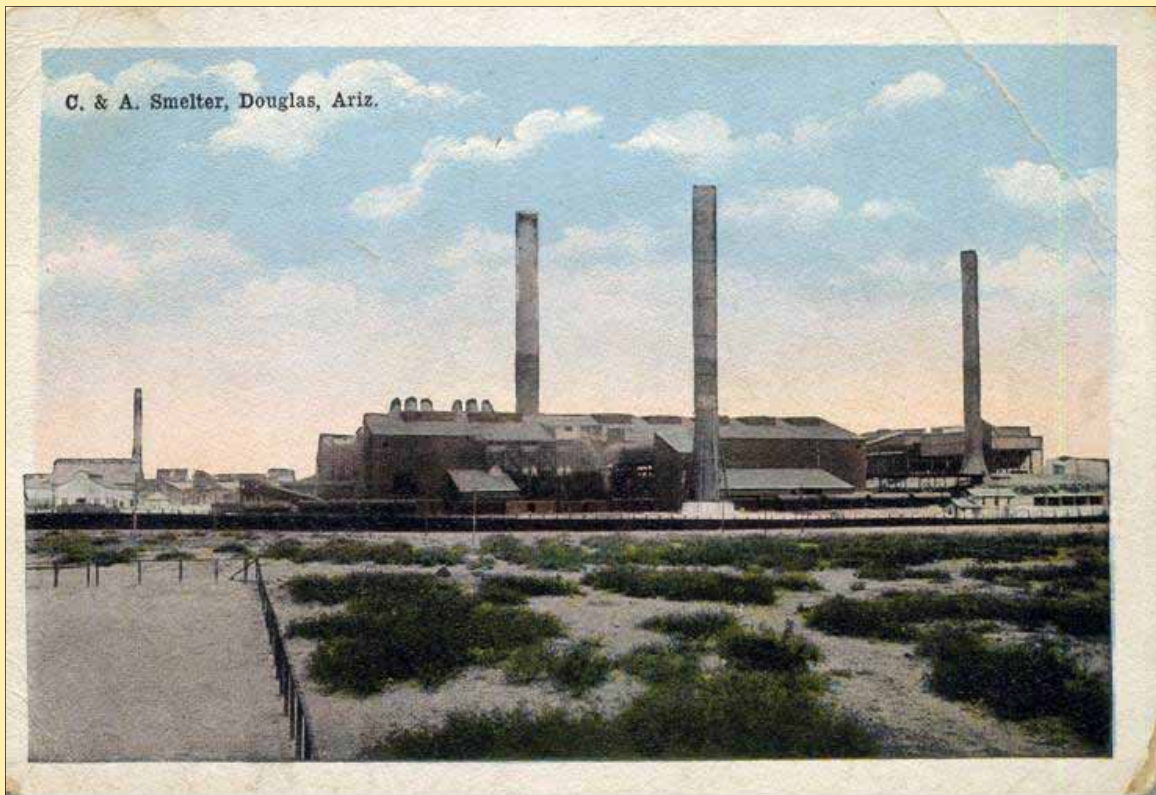
Bisbee was founded as a copper, gold, and silver mining town in 1880, and named after Judge DeWitt Bisbee, a financial backer of the famous Copper Queen Mine, opened in 1877. Once known as "the Queen of the Copper Camps," the mining camp proved to be one of the richest mineral sites in the world, producing nearly three million ounces of gold and more than eight billion pounds of copper, plus the silver, lead and zinc that came from the rich Mule Mountains. By the early 1900s, the Bisbee community was the largest city between St. Louis and San Francisco, reaching a population of over 20,000 people.

In 1885 Phelps Dodge organized the Copper Queen Consolidated Mining Company, which quickly became the dominant mining company in Bisbee. Canadian citizen and mining pioneer Dr. James Douglas was made president of the Company. From 1908 to 1916, Douglas served as president of the parent Company, Phelps Dodge.

In 1901 the only serious rival to the Copper Queen, the Calumet and Arizona Company, opened several mines in Bisbee. In 1902 Calumet and Arizona built a smelter in Douglas, Arizona, a small town just 25 miles to the east of Bisbee. The Copper Queen followed their rival's lead and built their own smelter in Douglas in 1904. They operated that smelter until 1931, when Phelps Dodge bought the Calumet and Arizona Company and took over their smelter. That smelter then became the Douglas Reduction Works and operated until 1987.

Douglas, Arizona – incorporated in 1905 and named for the Copper Queen's president James Douglas – is located on the U.S.-Mexico border, across from the city of Agua Prieta, Sonora Mexico. The town had an early history of frontier violence, rivaling Tombstone, but matured into a steady role of supporting local mining and cattle ranching, reaching a steady population of some 15,000 people.

When the AIME visited Douglas and Bisbee in September 1916, mining operations were still being conducted underground, using deep shafts to reach the ore body. This would soon change. In 1917, Phelps Dodge began open-pit mining in Bisbee with the Sacramento Pit, which lasted until 1931. Subsequent operations at Bisbee's huge Lavender Pit extended from 1951 to 1974.



The Calumet and Arizona Company opened this smelter in Douglas, Arizona in 1902. (Postcard courtesy of Al Ring)



The Copper Queen Company's Douglas smelter operated from 1904 to 1931. (Postcard courtesy of Al Ring)

After the Lavender Pit closed, the population of Bisbee quickly decreased from its peak of 35,000 to 5,500. The sudden flood of real estate on the market and crash in housing prices, coupled with an attractive climate and picturesque scenery, led to Bisbee's subsequent rebirth as an artists' colony. Today, the original city of Bisbee is known as "Old Bisbee" and is home to a thriving downtown cultural scene.

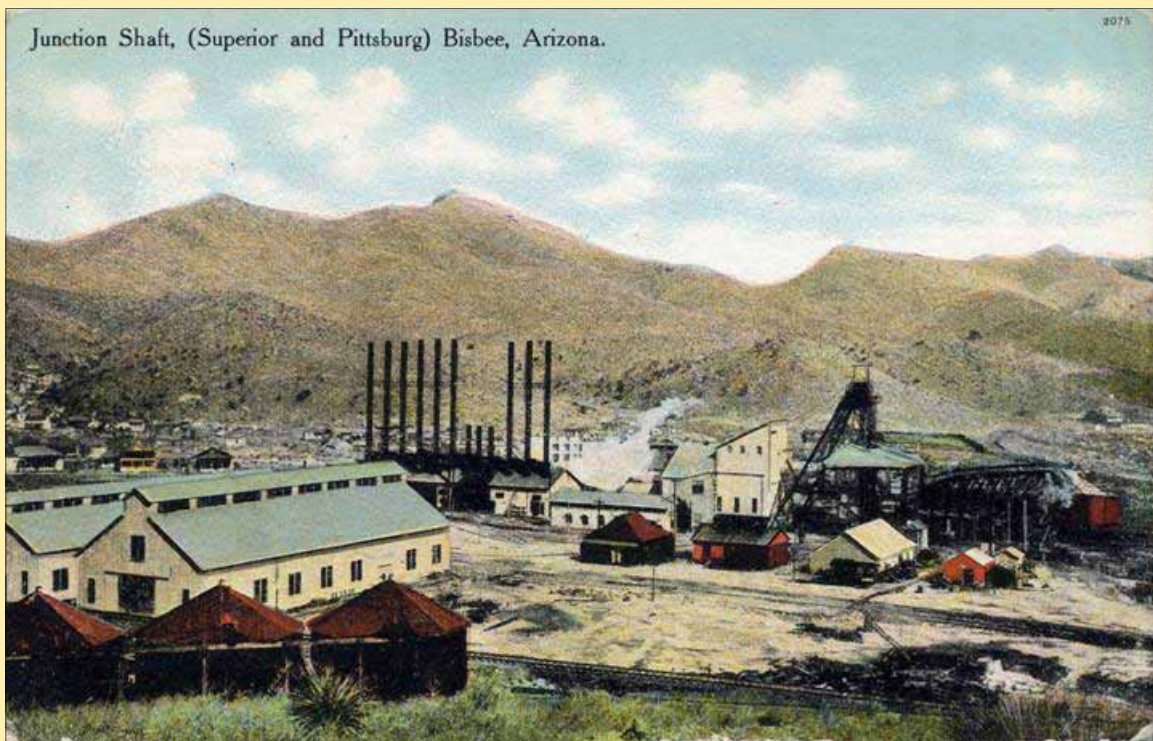
AIME Tour

On the morning of September 19th, the special AIME train of 13 cars arrived at Douglas. A fleet of automobiles then took the AIME members to visit the smelters of the Copper Queen and Calumet and Arizona companies.

The short trip to Bisbee was made that night by train. AIME members were given a choice of four different trips: 1) underground inspection of the Calumet and Arizona's Junction shaft and then to the Briggs mine and the Tintown vein, 2) Neptune tunnel of the Copper Queen mine, 3) the Sacramento main shaft, or 4) various Copper Queen surface operations.



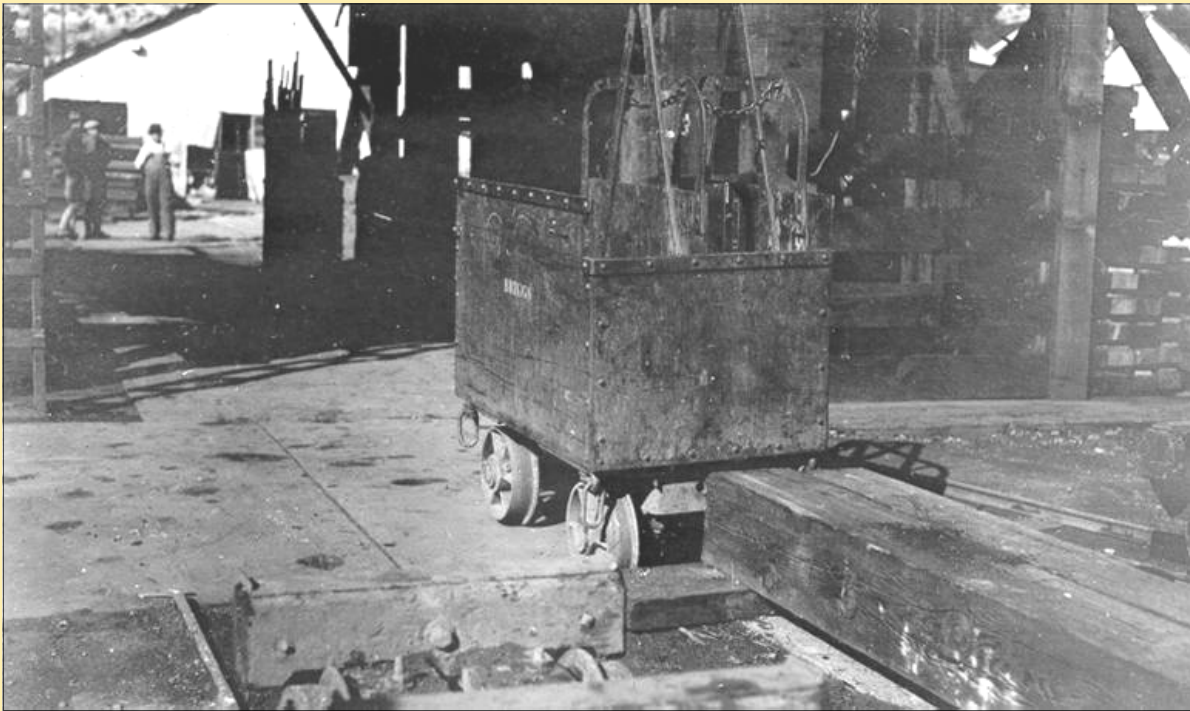
This spider-like apparatus is the casting machine at the Copper Queen smelter. (Photo by Ambrose E. Ring, 1916)



These buildings supported operations at the Calumet and Arizona Company's Junction Shaft in Bisbee, Arizona. (Postcard courtesy of Al Ring)



These cages at the Junction Shaft were used to lower groups of miners to the working levels below ground. (Photo by Ambrose E. Ring, 1916)



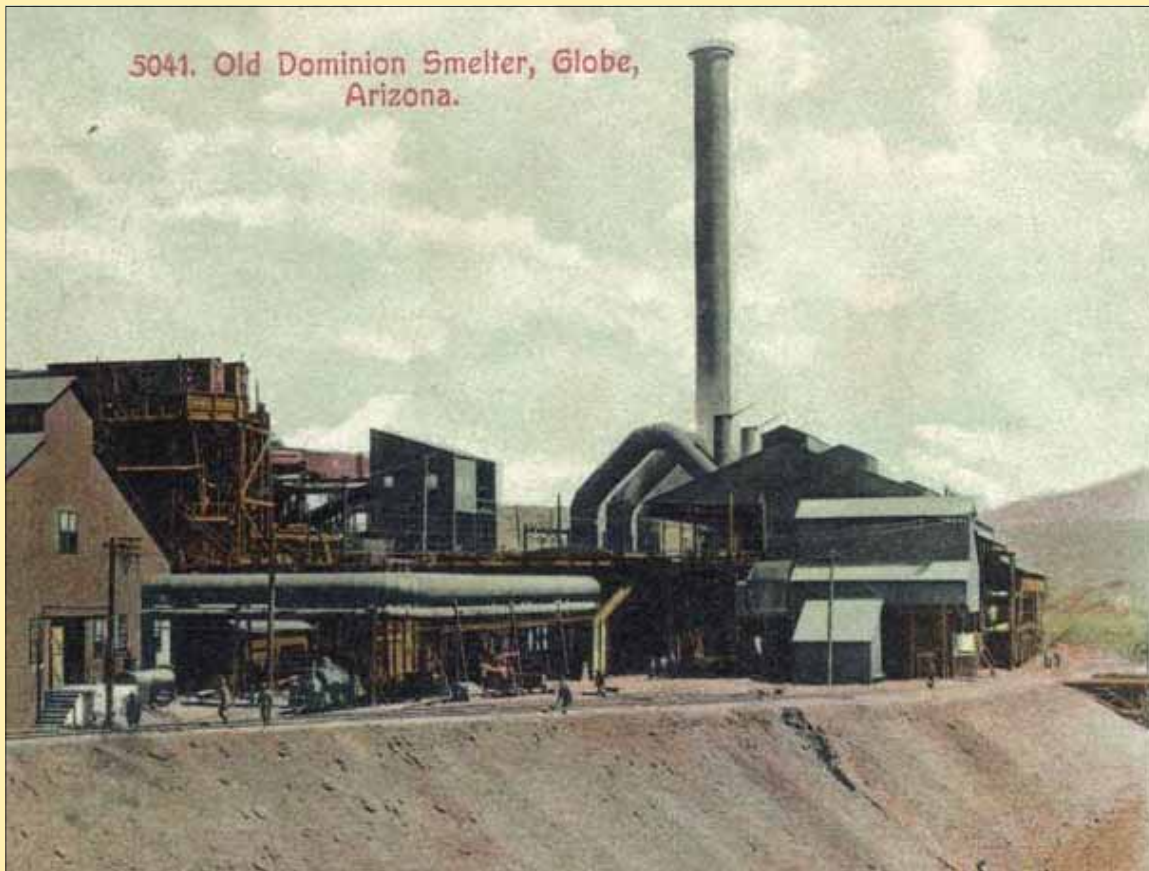
Steel cars like this one at the Briggs shaft in Bisbee were used to transport ore on rails in the tunnels below ground.. (Photo by Ambrose E. Ring, 1916)

Globe/Miami

Background

Spanish conquistadors and later, mountain men exploring the Pinal Mountains in the 1820s and 1830s, realized that there was mineral wealth there, but the Apache were far too numerous to do serious prospecting. Initially looking for gold, prospectors staked the first claims for silver mines in 1870. Silver mining expanded quickly and prospectors and miners poured into the area, about 80 miles of Phoenix. The town site of Globe City was laid out in 1876. By 1881 Globe had grown sufficiently to become the seat of a new Arizona county – Gila County. But silver soon began glutting the market and prices fell, so Globe turned to copper mining. The Globe area ceased mining silver altogether by 1890.

Copper mining at the Old Dominion vein began in 1882 and after 13 years of mining company reorganizations, in 1895 the Old Dominion Copper Mining and Smelting Company was formed to continue mining copper in Globe. Eventually acquired by Phelps Dodge, the Old Dominion Copper Mining and Smelting Company operated in Globe until closing in 1931.



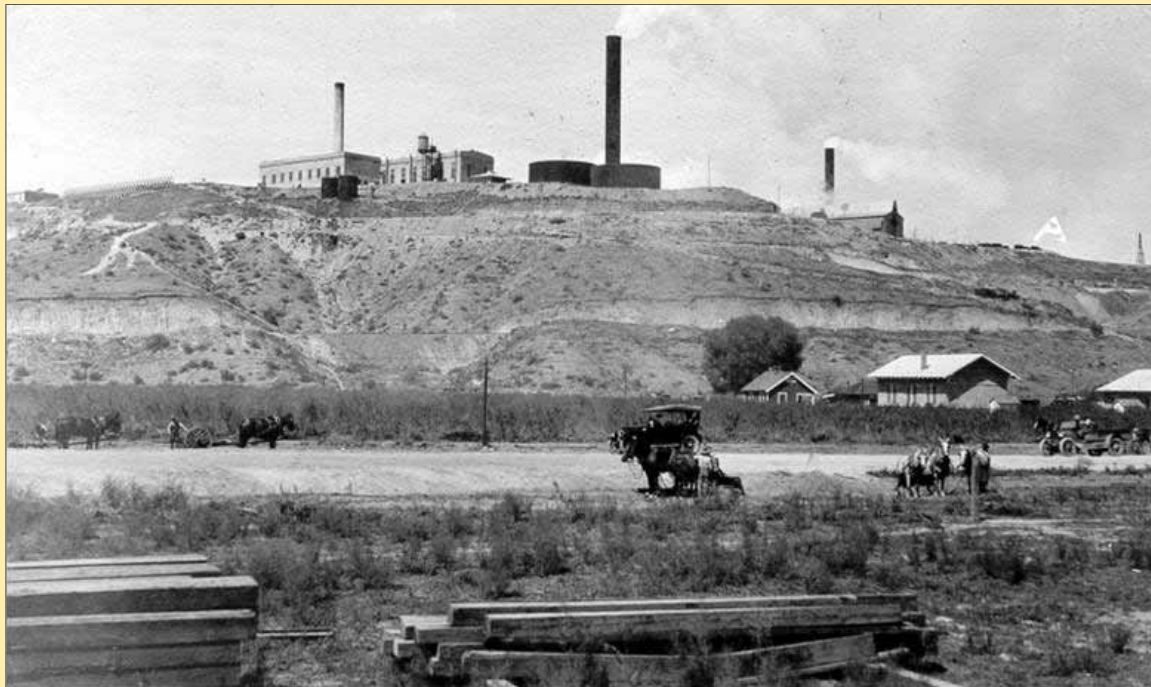
*This is the smelter of the Old Dominion Copper Mining and Smelting Company located in Globe, Arizona.
(Postcard courtesy of Al Ring)*

Additional huge copper deposits were discovered a few miles west of Globe; by the first decade of twentieth century, two very successful mining companies - Inspiration Copper Company and Miami Copper Company – began to develop large operations. To establish housing close to the mines, local miners founded the town of Miami in 1907. Only seven miles apart, the communities of Globe and Miami have had a friendly rivalry since then. After the mines near Globe closed in the 1930s, the mining operations in Miami under the Phelps Dodge umbrella have supported the real growth in the area.

Before World War II, copper was mined underground in the Globe/Miami area. After World War II, open pit mining began in Miami, enabling the area to become one of the richest mineral districts in the U.S.

AIME Tour

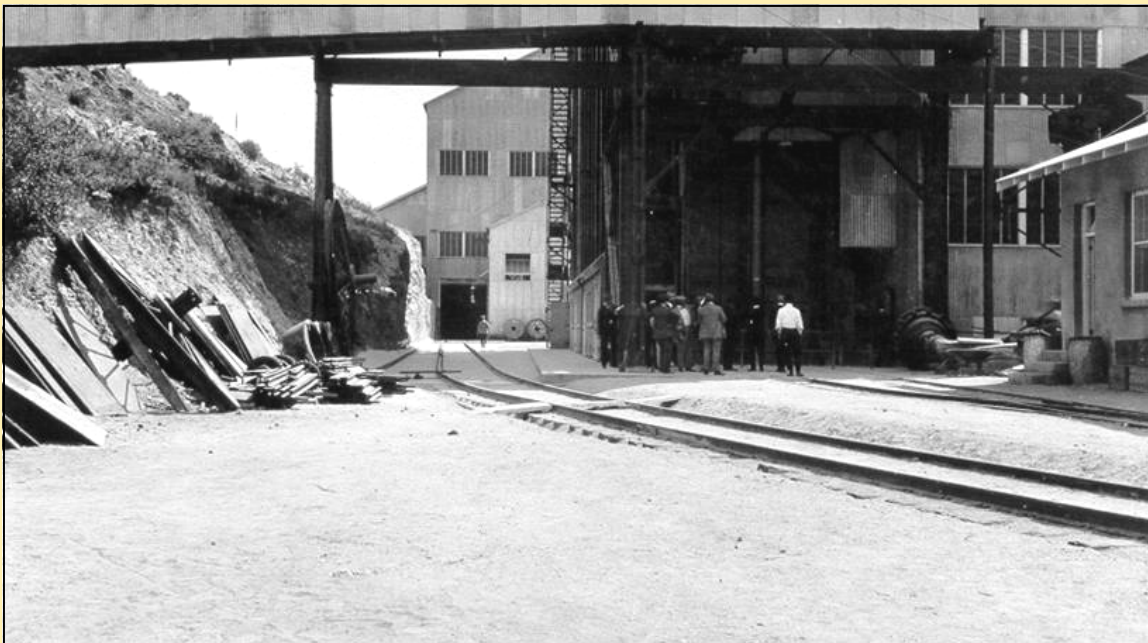
After an overnight train trip from Bisbee to Globe, on September 21st ASME members were transported by automobiles to the Old Dominion Copper Mining and Smelting Company's works. The next day on September 22nd the special train conveyed members to the mine of the Inspiration Consolidated Copper Company and the reduction works of the International Smelting Company. That afternoon the visitors were taken to the mine and mill of the Miami Copper Company.



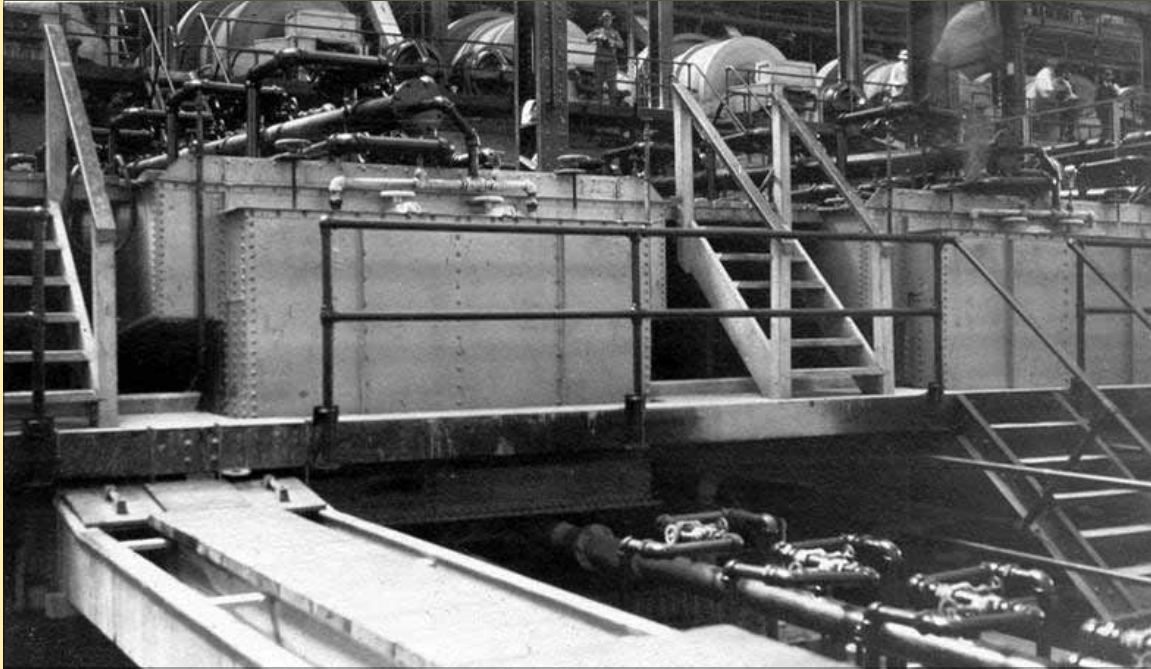
High on the hill in background is the smelter of the International Smelting Company in Miami, Arizona. (Photo by Ambrose E. Ring, 1916)



This massive building housed the Inspiration Consolidated Copper Company in Miami, Arizona. (Postcard courtesy of Al Ring)



This is the entrance to the vertical shaft that provided entrance to the mine at the Inspiration Consolidated Copper Company. (Photo by Ambrose E. Ring, 1916)



These huge flotation machines of the Inspiration Mill helped chemically separate and concentrate copper from the ore mined at the Inspiration mine. (Photo by Ambrose E. Ring, 1916)

Roosevelt Dam/Apache Trail

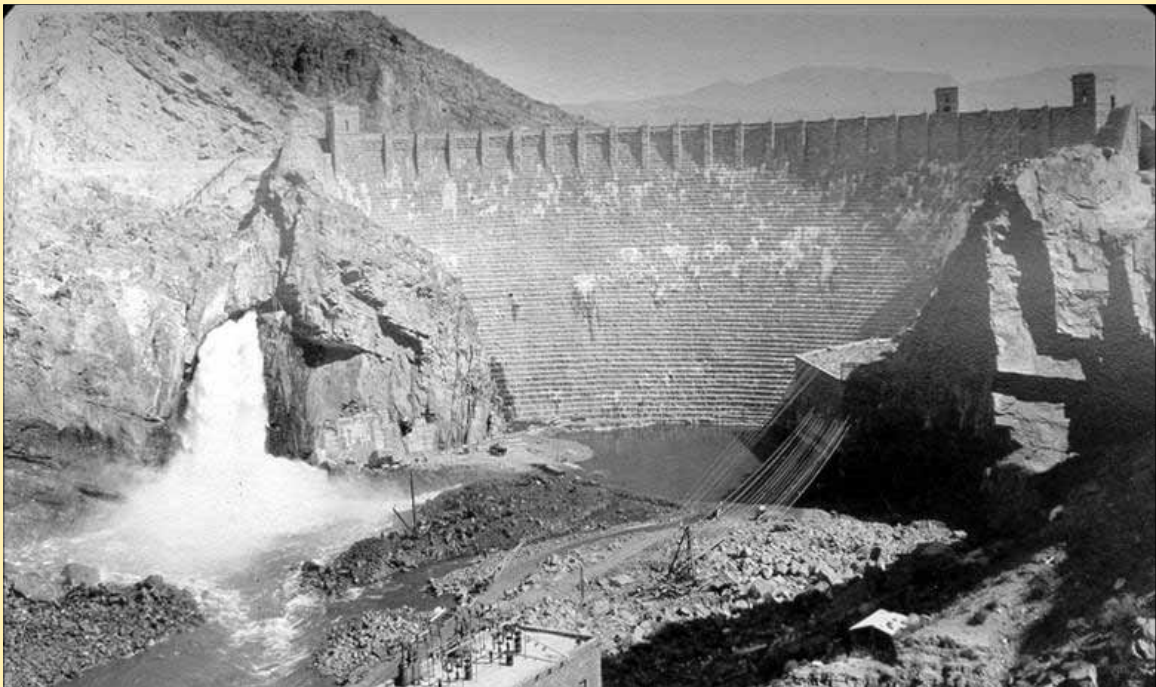
Background

Roosevelt Dam was built between 1905 and 1911 along the Salt River, 76 miles north-east of Phoenix, Arizona, to provide reliable water and power to the rapidly growing Phoenix area. The dam was part of the Salt River Project, one of the first federal projects authorized under the Federal Reclamation Act of 1902. The cyclopean-masonry gravity arch dam was the highest masonry arch dam in the world at the time and was among the last of the stone masonry dams built. After several modifications, the structural height of the dam is now 356 feet. Roosevelt Lake was formed from the drainage area of 5,830 square miles behind the dam. On March 18, 1922, former President Theodore Roosevelt dedicated the dam named in his honor. In 1963 it was designated a National Historic Landmark, and in 1970 the American Society of Civil Engineers designated the dam a Nation Historic Civil Engineering Landmark.

The still largely unpaved road between Roosevelt Dam and Phoenix is called the Apache Trail. Built in 1906 to help carry supplies for the building of Roosevelt Dam, the road is now one of the most adventurous and scenic tourist routes in the American Southwest. For 62 miles, between the dam and Mesa, Arizona, the Apache Trail travels through the gorge of the Salt River, and then ascends through twists and turns to a mesa through heavily eroded gorges.



Roosevelt Lake formed behind Roosevelt Dam which can be seen in the background. (Photo by Ambrose E. Ring, 1916)



Water rushes through the spillway of the Roosevelt Dam. (Photo by Ambrose E. Ring, 1916)



This view of the Apache Trail heading out of Fish Creek Canyon highlights the numerous and varied desert plants. (Photo by Ambrose E. Ring, 1916)



Another view of Fish Creek Canyon shows the Apache Trail twisting and turning along the mountainous terrain. (Photo by Ambrose E. Ring, 1916)

AIME Tour

Early on the morning of September 23rd, the Institute party started in automobiles for the Roosevelt Dam and the exciting trail to Phoenix. Ancient cliff dwellings could plainly be seen from the road. As the AIME Transactions of the Arizona Tour later stated, “As the party emerged from the mountains and came out into the Western Plain with the sun approaching the horizon, the scenery was indescribably beautiful.”

Grand Canyon

Background

The Grand Canyon is a colorful steep-sided gorge carved by the Colorado River in northern Arizona. It is largely contained within the Grand Canyon National Park - one of the first national parks in the United States. President Theodore Roosevelt was a major proponent of conservation of the Grand Canyon area, and visited on numerous occasions to hunt and enjoy the scenery.

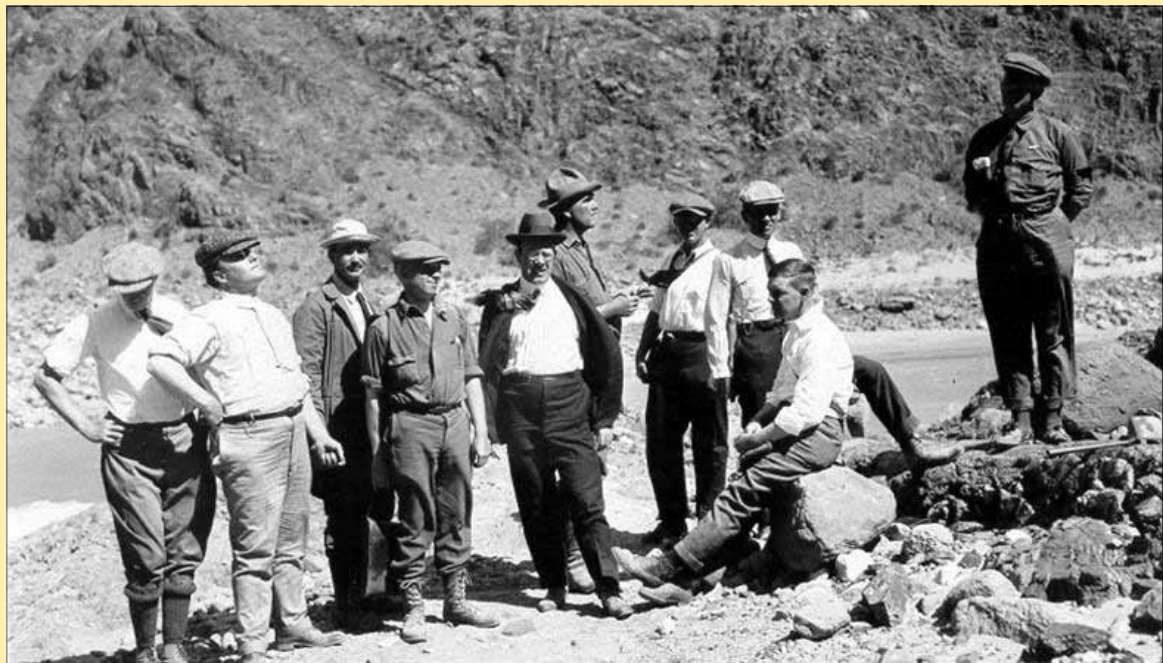
The canyon, created by the Colorado River over 6 million years, is 277 miles long, ranges in width from 4 to 18 miles, and attains a depth of more than a mile. Nearly two billion years of the Earth’s history have been exposed as the Colorado River and its tributaries cut their channels through layer after layer of rock, while the Colorado Plateau was uplifted.



Arizona’s Grand Canyon exposes nearly two billion years of the Earth’s history. (Postcard courtesy of Al Ring)



When they visited the Grand Canyon, AIME members stayed at the El Tovar Hotel, built in 1905. (Photo by Ambrose E. Ring, 1916)



After hiking down from the Grand Canyon's south rim, this group of AIME members stopped along the Colorado River for a photo op. Ambrose E. Ring is third from the left. (Photo by Ambrose E. Ring, 1916)

During prehistory, the area was inhabited by Native Americans who built settlements within the canyon and its many caves. The first European known to have viewed the Grand Canyon was García López de Cárdenas from Spain, who arrived in 1540.

The Grand Canyon was largely unknown until after the U.S. Civil War. In 1869, Major John Wesley Powell, a one-armed Civil War veteran with a thirst for science and adventure, made the first recorded journey through the canyon on the Colorado River. He accomplished this trek with nine men in four small wooden boats, though only six men completed the journey.

AIME Tour

After several hours visiting and meeting with local members in Phoenix, the AIME party started for the Grand Canyon on their special train, which had met them in Phoenix. The group was much smaller now, various members having left for their homes in different parts of the country. The remaining members spent most of September 24th and 25th visiting different points on the south rim or on a trip down to the bottom of the Grand Canyon. Finally on the evening of September 25th, three special train cars departed for the East.

Conclusions

The detailed record of the AIME Tour of Arizona mines in September, 1916 - including copies of all the papers presented at the technical sessions - was documented in the *Transactions of the American Institute of Mining Engineers, Volume LV*, published in 1917 by York Pennsylvania's Maple Press.

Today, the old Arizona copper mines in Bisbee and Globe are long closed. However, the copper mines of Chino, New Mexico and Miami, Arizona are still active under Phelps Dodge, now a subsidiary of Freeport-McMoRan Copper and Gold, Inc. Phelps Dodge also owns and operates a copper mine at Tyrone, New Mexico and three additional Arizona copper mines at Morenci, Bagdad, and Sierrita.

The American Smelting and Refining Company (ASARCO) currently operates three copper mines in Arizona: the Mission mine at Sahaurita, south of Tucson; the Silver Bell mine northeast of Tucson; and the Ray mine near Hayden.

Two other copper mines are active today in Arizona: the Pinto Valley mine, in Miami, owned and operated by BHP Billiton; and the Mineral Park mine, south of Kingman, by Mercator Minerals.

In 2006 Arizona was the leading copper-producing state in the U.S., yielding a record five billion dollars worth of copper. Byproducts of copper mining include gold, silver, and molybdenum. Arizona is the nation's second-largest producer of the metal molybdenum.

Additional information on mining in Arizona and further information on Ambrose E. Ring can be found on the authors' website, <http://www.ringbrothershistory.com>.

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