Gabbs Magnesium, 1942: A Personal Experience

By Eugene Michal

In the late 1920s prospector Harry Springer, working a tungsten claim fifty miles east of Walker Lake in central Nevada, near what is now Gabbs, Nevada, noticed a strange, bony weathering in what he believed was limestone. He sent a sample to a Union Pacific geologist for evaluation. The geologist identified it as brucite, a natural magnesium hydroxide.[1] Harry Springer's brucite was valuable for the manufacture of refractories for steel mill furnaces, and was mined starting in the late 1930s.

Several years after this discovery of brucite, the Standard Slag Company, exploring the brucite deposit, discovered large reserves of the magnesium carbonate magnesite in the adjacent formations. The U. S. Geological Survey took note of this, and in 1933 estimated the reserves of magnesite in the millions of tons. Due to the remoteness of the area and lack of market for the material, there was no commercial incentive to develop the deposit at that time.

All of this changed with the onset of World War II. The war brought about an urgent need for magnesium metal, both for airplane structures and for incendiary devices, and the Gabbs ore body was the largest known domestic source of magnesium. Further study had expanded the ore reserves to twenty-seven million tons, and indicated that the ore could be purified by milling, the carbonate calcined to oxide, the oxide converted to chloride, and the chloride electrolyzed to magnesium metal. Thus, an overall plan evolved for purification and calcination to be carried out at Gabbs, the oxide shipped by rail to Henderson, Nevada, and the chlorination and electrolysis carried out using power from the Boulder Dam.

Accordingly, a government agency, PLANCOR 201 (Defense Plant Corporation Project 201), was authorized to engage private contractors to develop the Gabbs townsite for the anticipated influx of workers, and to begin constructing a mill and calcining plant. In simple language, PLANCOR 201 would pay all of the bills, but private contractors would do all of the work to bring the facilities on line.

Basic Magnesium, Inc., was organized as the technical operating entity, both for the mine and metallurgical plant at Gabbs and for the electrolytic production facility at Henderson. It was a government-owned but privately-operated corporation, a subsidiary of two firms: Basic Refractories, Inc., an Ohio firm and manufacturer of steel furnace refractories; and Magnesium Electron, Ltd., an English corporation with expertise in electrolytic reduction.

The Town

In May 1942 the Gabbs camp was a beehive of activity. The town was formerly little more than a gas station and a grocery store on a dirt road, but by 1942 it had expanded to include a dozen or two wood-frame houses for married men and executive personnel, and below them, on the alluvial slope, a tent city for contractor labor. The town had a single gas station, a laundry, barber shop, and miscellaneous other private businesses. Above the town and nearer the mine site were separate dormitory buildings for

single men and women, as well as an employee dining hall and recreation center. There was no public bar or gambling house in town, and the sale of liquor was strictly prohibited either in town or in the barracks, as befitted the war effort. These entertainments and others were found in Luning, some twenty-six miles south on the Tonopah to Reno highway, twenty-four miles east of Hawthorne.

I had no problem finding a job at Gabbs—labor was scarce and the employment office was happy to see any applicant. I had just completed my junior year at the Mackay School of Mines, had a draft deferment to finish school, and needed money to complete my education. I applied to Basic Magnesium rather than to the construction contractor (although they probably paid better), because I wanted to be part of the mining operation. I was given the title of Junior Engineer, at $185 per month, and immediately sent to the Mine Department. My assignment was to be a sampler on the wagon drills in the open pit.

Basic Magnesium had a separate campsite for its employees. It was located at the former site of the community of Brucite, about a mile southeast of Gabbs near the former brucite mine (then inoperative). I shared a wooden-floored sleeping tent with a geologist from Ohio and a prospector-turned-miner who still bore all the scars and abrasions of decades on the hunt. The geologist was a sophisticated young fellow whose hobby was tropical fish, and he maintained a fish tank in the tent. The principal problem with his hobby was that in the summer the water in the tank got too hot for the fish! The days were usually in the 90s and the tent was hotter than that. Each evening when it cooled off a little, he would take water out of the tank and pour it back and forth in buckets until evaporation cooled it off. He did manage to keep the fish alive. I watched this procedure with some interest, but usually I would walk over to the recreation hall to play pool or snooker with some of the younger fellows until bedtime.

Our prospector-miner tent mate had brought his donkey with him to Gabbs. The animal occupied a small corral behind the tent and affectionately brayed at each of us as we came off shift. He was probably just hungry, as hay was scarce in Gabbs and he got only a meager ration. Nevertheless, we and all of our near neighbors took a liking to him and stroked his ears and patted his behind regularly from time to time. But that wasn't all he wanted. His master had taught him how to drink beer from a bottle. Every morning about 5:30 he began to bray furiously, as it was time for his bottle. That was OK, as we had to get up anyway. The old man had a case of beer under his bed, and would uncap a bottle, take it out to his donkey and feed it to him just as one would feed a baby. The donkey partook with enormous sucking and licking sounds. This was hilarious to a new arrival in camp, but we soon got used to it.

At 6 a.m. a stake truck came rumbling down the street honking its horn and men came streaming out of the tents to hop aboard for a ride to the mess hall about half a mile away. If you didn't meet the truck, you walked. The mornings were always cool, cloudless, and invigorating, bringing life to the familiar poem:

> Morning on the desert
> and the air is like a wine
> and it seems that all creation
> has been made for me and mine
> –anon

The jackass has finished his bottle! Run for the truck! We were dumped off in front of the mess hall, where a gang of about two hundred soon assembled. When the doors were flung open the mass surged inside, where plates of fruit, bacon and eggs, pancakes, buttered toast, and cups of hot coffee awaited. The same scene played out at dinner. Brown-bag lunches were picked up upon exiting the morning meal.

The servers and attendants were young ladies, many of whom were in Gabbs in the company of their parents. Of course they were closely chaperoned in their off-hours, but with proper introductions and after passing a litmus test, dating was possible. The men all looked forward to seeing the girls at meal time, when one's imagination could roam. A few older ladies occupied the separate women's dormitory. Saturday night dances were well attended. The band played:

> Love them All, Love them All, Love them All
> The Long and the Short and the Tall
> Love all the Blondies, and all the Brunettes
> Each Man is Happy to Take What he Gets
> -Twelve O'Clock High

After dinner, it was off to the recreation hall, where there was pool, billiards, snooker, card games, a reading room, and an occasional movie.

The Mine

At my post in the pit, I was assigned to the wagon drills to collect samples of drill cuttings for chemical analysis. Not all of the rock was magnesite; it had contaminants of dolomite—a mixed calcium and magnesium carbonate—and silicate minerals, both of which had to be removed in the milling process. The millmen had to know what to expect from the mine, and the miners had to know what was ore for the mill and what should be hauled to the waste dump. Thus the necessary samples.

The wagon drill was a heavy drill mounted on two wheels like a cannon. It drilled two-inch diameter holes, horizontally, from the toe of the bench five to fifteen feet deep into the face. The pit benches, fifteen feet high, were blasted by drilling six-inch diameter vertical holes about twenty feet deep from the top of the bench, and filling them with a column of dry, granular explosive called Hercomite.

Hercomite was a very "permissive" explosive—it could be pounded on and kicked around with considerable abandon without detonating. It was set off using an initiator embedded in the mass. This consisted of three sticks of gelatin dynamite (a little less permissive) tied together with string. Inserted into one of the sticks was a blasting cap (not at all permissive) attached to an electric wire extending out of the hole for connection to the familiar black box magneto with the T–shaped handle. When the chief blaster rammed down the handle on the magneto the electrical impulse exploded the cap, which exploded the gelatin, which exploded the Hercomite.

After the holes in the bench were detonated, there were inevitably places where the rock had not been thoroughly broken, leaving "horses" of relatively solid rock. These had to be drilled by the wagon drills from the toe of the bench and blasted in a secondary operation.

My job was to position a canvas bag, suitably perforated with a hole for the drill rod to pass through, around the neck of the drill hole in such a way as to channel the drill cuttings into the bag, and to collect and label the samples for the analytical laboratory. The drills were operated by compressed air, and air was continuously passed down a hollow tube in the center of the drill to blow out the cuttings. This caused a great deal of airborne dust which blew out of the canvas bag, as only the coarser sands could be caught. This kind of airborne dust was well known to be the miners' nemesis, contaminating the lungs and leading to silicosis, disability, and usually death by pneumonia.

The dust in the magnesite pit, however, was not considered as dangerous as that in most hard rock quartz mines, as it was thought that the human system could somehow dissolve and assimilate limestone or dolomite dust. Nevertheless, because of the sheer discomfort of work-

ing in a cloud of dust, we were supplied with nose-shield respirators. By the end of every shift, I was white from head to toe like a junior Santa Claus, because my job put me right next to the cloud emanating from the drill hole.

(I should say at this point that such a procedure would not be tolerated today because of occupational health considerations, and that drilling would be done with water injected into the hole. In fact, at most mines sampling is now done at the time of drilling the vertical bench holes, not at the wagon drills. In most open pits wagon drills are now a rarity, having given way to more careful blasthole planning and mobile hydraulic rock breakers.)

One day, while tending the sample collection bag, I noticed a change in the nature of the cuttings coming out of the hole. I took a little of it in my hand and examined it closely. It was fortunate that I had had some prior experience with Hercomite, as I recognized it immediately. We had drilled into a "missed hole," one that had not exploded, probably because the explosion from an adjacent hole had cut the wire to this one. I immediately jumped back and shut off the air to the drill.

The driller, who had not been too attentive, jumped up shouting: "Hey, what's going on?" He sobered up right away when I showed him the Hercomite, and we gingerly removed the drill from the hole and called the chief blaster. He was very nonchalant about it, called over a couple of men from his crew, and they began with pick and shovel and steel bar to break and pry the rock apart to clean out the hole, while we moved on to another location to resume drilling. After a couple of hours they had rescued the "plum" out of the pudding—the dynamite sticks and the cap with the wire still attached. We had come within a foot or two of hitting it with the drill bit. I looked this over rather carefully, and after hearing a few stories concerning the blaster and his routinely careless handling of explosives, I decided that since I was studying metallurgy not mining, I should really have a job in the mill. That was no problem; they needed help there, too.

The Mill

My first day on the job in the mill, I was sent to the office of the assistant mill superintendent. He was an all-business type of guy. He was to be my boss. He really ran the mill. I never saw the mill superintendent; he was too busy with government red tape and visiting inspectors, I presume. The assistant super said to me: "Well, Michal, so you want to be an engineer? Well you know, you have to start at the bottom to succeed. I want you to be in here every morning at 7 a.m. to clean my office, dust my desk, empty the waste baskets, hose down the floor, and put a fan on it so it will be dry when I get here at 7:30. Then I'll tell you what to do for the rest of the day!" I said "yes sir, yes sir," and we got along first-rate after that. I liked a man who took a positive, unambiguous approach, and many times when I was within earshot I would hear him reprimanding an errant millman.

His concern about the dust and dirt on his floor was real. The assistant superintendent's office was immediately adjacent to the mill; people were routinely tramping in and out with muddy boots, and clouds of dust from construction operations flew through the air. The problem with the mill was that it was wide open to the desert sky and could not be enclosed for good reason: the mill water was steaming hot.

The mill water, in fact most of the piped water in Gabbs, came from wells in the valley which gave only hot water—water at 185 degrees—much hotter than most people run their hot water heaters at home. It was pumped up to a tank on the hillside above town where it was supposed to cool off. Actually, so much water was being used and the tank was so large that the water cooled very little. Imagine not being able to take

a bath until you cooled off your bath water! That's what we had to do. I heard that there were some cold water wells below town, but the only cool water I ever found was in the drinking fountains.

The mill was the largest consumer of hot water; the piping was hot, the ball mills were hot, as were the flotation machines, the dryers, everything. The three or four rake classifiers, which followed the ball mills, were about ten by twenty feet in size. They were all open to the air and emitted an enormous cloud of steam into the desert sky. That's why the mill building couldn't be enclosed.

My duties mainly involved supporting the staff of research metallurgists who were developing the process for flotation purification of the magnesite. The magnesite rock in the pit had lenses of dolomite running through it and it was not possible to mine completely around them. Also, it had inclusions of (hypogenetic) silicates distributed randomly in the ore. These two impurities were defined by chemical analysis as "lime" (CaO) and "insol" (silicates). The role of the mill was to grind the ore sufficiently fine to liberate each of these constituents from the magnesite, and then float the purified magnesite away in a froth to become the concentrate.

The purified froth came surging off of the flotation machines in a continuous stream, like a cascade of vanilla milkshakes pouring into the collection trough. The product was filtered, dried, and calcined at a red heat to drive off the CO_2. The purified calcine was shipped by truck to Luning, and then by rail to Hazen, Nevada. From there it crossed northern Nevada to Salt Lake City, where the rail cars were routed south toward their destination, Las Vegas. A thousand mile trip, even though Las Vegas was only about three hundred miles by highway from Gabbs.

The research metallurgists were desperately trying to find the best combination of reagents to add to the milling circuit to make the magnesite float and depress the lime and insol. No holds were barred; everything was being tried, and every morning the night's analytical results were perused with great expectations. Nothing seemed to work as well as the metallurgists would have liked. One man brought in his wife's bottle of Clorox and poured some of that into a test. Presto! The results looked promising, and within a week a truck arrived from California with hundreds of gallon bottles of Clorox on board, and men stood near the classifiers pouring bottle after bottle into the mix. In the long run, this was not the answer they wanted, either. I never heard whether they found a good answer, but apparently what we were making was good enough. The first shipment of calcined product left Gabbs in August 1942.

I did the sample preparation for the research team. When they finished a test, I collected the products, filtered and dried them, screened them, and put them in proper sample envelopes. These samples were typically produced during the day, and near the end of the shift I was presented with a pile of wet samples which had to be dried and processed. Naturally, this took time. I routinely put in two or three hours overtime every day, paid at time and a half.

I loved this job, until one day a great explosion of cursing came out of the super's office. "What the hell is going on here? This kid is making more money than I am!" Of course that wasn't true, but it brought home the point. I and the head of the lab were summoned to a consultation, whereupon we all agreed that Michal could have some overtime pay, but that we would all make an effort to keep it to a minimum.

The Explosion

One evening, while we were gathered in front of the mess hall waiting for it to open, we were startled by an explosion a quarter of a mile down the hill. It came from the vicinity of a highway

road cut being made through a gravel ridge. Our chief blaster from the mine had been in charge of explosives, and was loading a hole which had been "sprung" with an earlier blast. Springing consisted of placing a lighter charge of dynamite at the bottom of a drill hole and detonating it to "spring" the ground out, creating a cavity to hold a larger quantity of explosive for the final shot.

It is customary to wait some hours for the preliminary shot to cool off before adding the explosive for the final shot. He hadn't waited long enough. He poured in the explosive and was tamping it with a long pole when it detonated. Reports were that the pole penetrated his midsection and threw him ten feet in the air, like a shot out of a cannon. I was glad I had left the mine. I'm sure his successor was a much more careful man.

Closure

PLANCOR 201 was a great success in its time. During the period from 1942 to 1944, it was the world's largest magnesium producer. Eighty-one thousand tons of magnesium metal were produced from 920,000 tons of ore mined at Gabbs. With the end of World War II, the need for the metal subsided and, in view of the reluctance of any private company to take over operations, the Gabbs oxide plant and the electrolytic refinery at Henderson were closed.

As time went on, the preferred source of magnesium metal became sea water, from which magnesium hydroxide was precipitated by adding lime. This precipitate was preferred over the partially purified Gabbs oxide for chemical uses, since it contained almost none of the deleterious "insol," and the lime content could be kept under better control. But the mining and shipment of raw brucite and magnesite from Gabbs has continued on a reduced scale for many years, and these products have been important in the manufacture of high-temperature steel mill refractories.

Note:

1 Victor E. Kral, "Mineral Resources of Nye County, Nevada," *University of Nevada Bulletin* XLV, no. 3 (Jan. 1951): 102.