



CONTACT INFORMATION

Mining Records Curator
Arizona Geological Survey
1520 West Adams St.
Phoenix, AZ 85007
602-771-1601
<http://www.azgs.az.gov>
inquiries@azgs.az.gov

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10/11/88

ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES FILE DATA

PRIMARY NAME: FANNIE GRANDE

ALTERNATE NAMES:

CASA GRANDE COPPER
FRANCISCO GRANDE
HANNA GETTY

PINAL COUNTY MILS NUMBER: 445

LOCATION: TOWNSHIP 6 S RANGE 5 E SECTION 18 QUARTER C
LATITUDE: N 32DEG 54MIN 01SEC LONGITUDE: W 111DEG 52MIN 26SEC
TOPO MAP NAME: CASA GRANDE WEST - 7.5 MIN

CURRENT STATUS: EXP PROSPECT

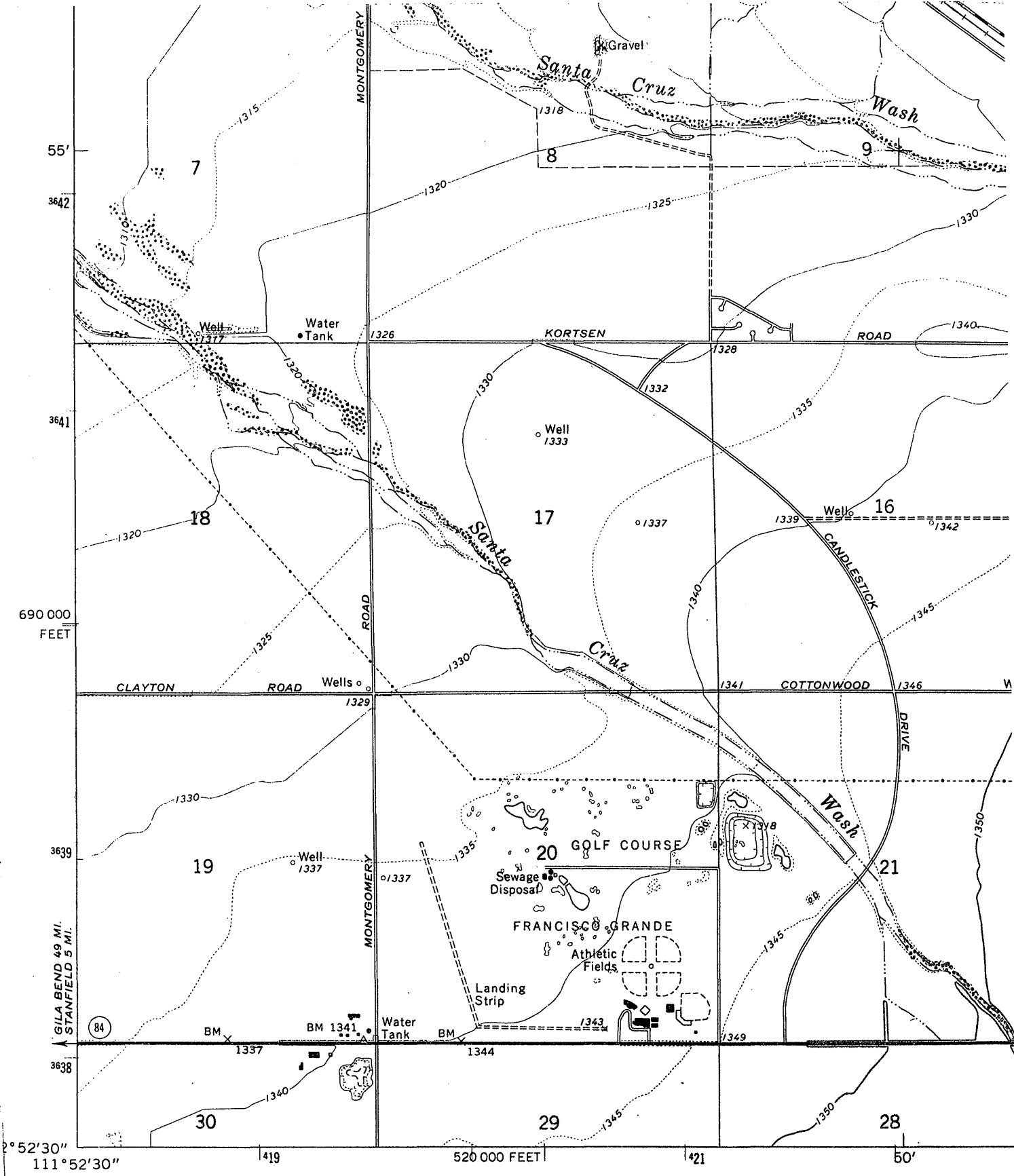
COMMODITY:

COPPER SULFIDE
COPPER OXIDE

BIBLIOGRAPHY:

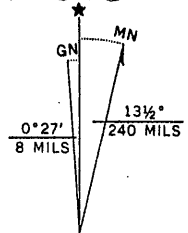
ADMMR FANNIE GRANDE DEPOSIT FILE
BLM AZ MINING CLAIMS LEAD FILE 47300
USBM INFO
HANNA INC. ANNUAL REPORT 1977

*ALSO SEE SANTA CRUZ (A) PINAL
ADJACENT PORTION OF DEPOSIT*



Mapped, edited, and published by the Geological Survey
 Control by USGS and USC&GS
 Topography by photogrammetric methods from aerial
 photographs taken 1963 and planetable surveys 1965
 Polyconic projection. 1927 North American datum
 10,000-foot grid based on Arizona coordinate system, central zone
 1000-meter Universal Transverse Mercator grid ticks,
 zone 12, shown in blue
 Red tint indicates areas in which only landmark buildings are shown
 Fine red dashed lines indicate selected fence lines

765 RSE Dec 18



UTM GRID AND 1965 MAGNETIC NORTH
 DECLINATION AT CENTER OF SHEET

HMC

↓
K Steff
a DB

JANNIE GRABER

**SANTA CRUZ
IN SITU COPPER
MINING RESEARCH
PROJECT**

March 1998

Dear Friend,

As you probably know from newspaper accounts, the Bureau of Reclamation and the Santa Cruz Joint Venture ceased operations at the Santa Cruz well field following President Clinton's line item veto of the project funding in October 1997.

The end of active in situ mining signals the beginning of another process -- closure of the mine. The closure process could last from four to six years depending on requirements by the Arizona Department of Environmental Quality.

Following cessation of injection in December, the Santa Cruz Joint Venture continued pumping from the well field to remove copper bearing leach solutions. This pumping continued until mid-February. As solutions were removed, the fluids remaining in the leach zone become less acidic, causing metals remaining in solution to be redeposited in the ore body through precipitation.

The Bureau of Reclamation, the federal partner in the project, will be involved in developing a closure plan with the private partners. Cost of closure could reach \$500,000 and will be shared on the same basis as the project itself, a Federal share of 75% and private share of 25%. Money for the federal share is available from carryover funds from the previous years.

Despite early closure, the environmental and technical goals of the project were met. Thirty-five thousand pounds of copper were recovered, demonstrating that copper can be mined using this technology. Numerous technical problems concerning in situ mining were resolved. No effects were observed in the monitor well system after nearly two years of injection of acid, demonstrating the environmental safety of the process.

The final year of the project was expected to provide data on the economic feasibility of in situ copper mining, the project's final goal. Because of early curtailment, this goal will not be met.

All results of the research will be available to the industry and the public through the Federal Technology Transfer program.

The property and the plant will be maintained during this low cycle in the copper market. A decision to go forward with a commercial scale in situ project at the Santa Cruz site will depend on completing the research on the economics of in situ copper mining.

On behalf of the partners in the Santa Cruz Joint Venture, I want to thank you for your support and interest in the project during its ten year life. The support of the community was an important factor in our success.

Santa Cruz Joint Venture
A Joint Venture between ASARCO Santa Cruz, Inc. and Freeport Copper Company
P.O. Box 5747 • Tucson, Arizona 85703-0747
1150 N. 7th Avenue • Tucson, Arizona 85705-6606
(602) 792-3010 • Facsimile (602) 792-3934



David Skidmore
Project Manager

HMC

FARMIE GRANDE DEP. 1 P. 11/16/60.

Santa Cruz In Situ Copper

The Santa Cruz Joint Venture, (SCJV) a \$22 million dollar cooperative demonstration program, has been informed by the Arizona Department of Environmental Quality (DEQ) that they intend to issue an Aquifer Protection Permit for the Santa Cruz Project. The announcement comes after a two and one half year study of the application by the DEQ. The announcement by SCJV was made at a breakfast meeting briefing in Casa Grande on September 7, 1994. The next stage in the process is a public hearing in Casa Grande on September 14 on the draft Environmental Assessment (EA) and closure of written comments before September 26, 1994. The project is managed by a joint venture between ASARCO and Freeport Copper Company and the U.S. Bureau of Mines. Funding for the project is shared by the partners.

The deposit was initially discovered by ASARCO geologists in 1964 when they reinterpreted the geology of the Sacaton deposit and found that it was a faulted segment of the main deposit. The main deposit they conjectured was probably located a few hundred yards to the southwest of the Sacaton deposit. Initial drill results indicated a typical Laramide porphyry system that was too deep for open pit and too low grade for underground mining methods. ASARCO then dropped the property which was later acquired by J. David Lowell and Associates for Coastal Mining. Coastal drilled the property extensively in the mid 1970's but later sold their interests back to ASARCO and Freeport Copper Company. The Arizona Department of Mines and Mineral Resources list the reserves as 352 million tons at 1.00% copper. Representatives of the joint venture confirmed that the grade of the deposit ranged from 0.5 to 1.5% copper.

ONLY A PORTION OF DEPOSIT.

The current program will be a pilot plant to determine the technical, economic and environmental feasibility of in situ copper leaching. The pilot plant will consist of one injection well which will introduce a diluted sulfuric acid solution into the copper bearing formation 1500 feet below the surface under a pressure of about 1,000 psi. The solution will be collected by four collection wells located around the induction well on 127 foot centers. Injecting the solutions under this pressure and creating a cone of depression around the collection wells by pumping them in surplus capacity will cause the solutions to flow from the injection well, through the mineralized fissures in the rock and into the collection wells. This will cause some of the copper oxide and carbonate minerals to leach into solution. The injection rate for the current system will be 25 gpm.

The wells, including several monitoring wells, were previously drilled during a program to demonstrate the conductivity of rock and the containment of the solutions. The previous well construction included a triple protection system. The injection and collection wells were drilled into bedrock at the bottom of the aquifer. A steel well casing was then placed and the annulus was grouted with an acid resistant cement. The well was then continued to the zone to be tested. A fiberglass injection pipe was placed to the zone to be leached and the annulus filled with an acid resistant cement. With this quadruple protection system in place the project was tested with a saline solution to determine the

rate at which solutions could be transmitted between the wells. This solution was returned to evaporation ponds.

If the pilot plant is successful and the partners can demonstrate the physical, financial and environmental feasibility of the project will be expanded to a commercial operation.

The ground water will be protected in several ways:

1. The in situ mining operation will be injected nearly 1,000 feet below the productive aquifer in the area.
2. The natural neutralizing capacity of the surrounding rock insures that any acid solutions that escape the designated test area will be neutralized.
3. Solutions will be controlled by over pumping from the recovery wells and there by insuring solution control.
4. Leakage into the fresh water aquifer or the vadose zone from the wells has been prevented by a redundant lining system around the wells.
5. Monitoring wells surrounding the project did not show any communication between the injected solutions and the ground water acquirer.
6. These monitoring wells will provide a continual check on the in situ mining test.

If the project is successful it will demonstrate success of in situ leaching which can have the following benefits over conventional mining:

Production costs are reduced by the elimination of crushing and grinding and handling ore and waste materials. This will also result in reduced energy and labor costs.

The process will use domestically produced materials and energy rather than expensive foreign produced petroleum.

In situ leaching will make some deposits feasible that cannot not currently be mined by other mining methods because they are too deep, too wet, or too low grade.

In situ leaching is safer than conventional mining methods because employees are not exposed to hazards of underground or open pit mining.

The environmental involvement of in situ mining is much smaller than conventional methods and the environmental safe guards are easier to install and monitor.

If this demonstration is successful it will have a tremendous impact on the way we make copper for electrical transmission and use.

The in situ leaching process is covered by the following environmental permits

Underground Injection Control

Agency: U.S. Environmental Protection Agency
Department: Underground Injection Control Program
Agency: Arizona Department of Environmental Quality
Department: Aquifer Protection Permit
Agency: Arizona Department of Water Resources
Department: Pinal Active Management Area
Department: Well Driller Certification Program

Air Quality

Agency: Pinal County
Department: Air Quality Control District

Land Use

Agency: Pinal County
Department: Pinal County zoning ordinances

Mine Safety

Agency: Arizona Mine Inspector
Department: Notification of start up

Storm Water Discharge

Agency: Environmental Protection Agency
Department: National Pollutant Discharge Elimination System

Solid Waste

Agency: Arizona Department of Environmental Quality
Department: Solid Waste Facility

Hazardous Substances

Agency: Emergency Planning
Community Right-To-Know Act
State Emergency Response Commission
Federal Hazardous Materials Transportation and Uniform
Safety Act

HANNA-GETTY JOINT PROJECT

PINAL COUNTY

WR MG 12-5-77 - The Hanna-Getty copper discovery near Casa Grande is now managed by a new company, the CASA GRANDE COPPER CO., (card), jointly owned by the two partners. 12-22-77 bh

See Paydirt April 1979 - U.S. Copper Production Could Be Increased By 53 Percent in 1980s, Survey Shows.

MG WR 10/4/79: John Stone, Project Manager, Casa Grande Copper Company, reports that company is just about finished with its surface diamond drilling and hopes to make a decision on bulk sampling method soon after the first of the year (1980).

RRB WR 4/14/80: Visited Casa Grande Copper Co. west of Casa Grande (Pinal County). Talked to Phil Nason who said they have completed their drilling program and are ready to proceed with sinking exploratory shaft and the development of enough ore to run pilot metallurgical tests. Program is now on hold.

Arizona Department of Mines and Mineral Resources

Verbal Information Summary

Mine: Santa Cruz (f) and Fannie Grande (f)
County: Pinal

Date: March 1, 1995
Engineer: Nyal Niemuth

Summary from "An update of the Santa Cruz in situ copper mining research project by Jon Alness, Mining Engineer, with the U.S. Bureau of Mines at the U.S. Bureau Mines Copper Industry Briefing held at ADMMR's Office, February 28, 1995.

Draft manual of generic in-situ design criteria was completed in 1988 and is available.

Field Test Goals: 1) Obtain cost data, 2) Determine leach solution grades, and 3) Demonstrate technology is environmentally safe.

USBM funds 75% of the project, while partners Asarco and Freeport McMoran fund 12.5% each.

Field test of the 5 spot well pattern is about to begin. Construction of the pump plant and SX-EW facility is underway and acid injection should begin by November. It will operate between 18 months and 4 years depending on results. Well pattern is 125' corner to corner with the center well being the injection well. Lixivant will be injected at 200-300 psi. The SX-EW plant will be pilot scale, able to produce 1,000 tons of copper per year of commercial size cathode copper product. After leaching is completed a diamond drill hole will be completed to allow examination of core to determine recovery, mineralogical changes, etc.

Site has 4 monitor wells to check near surface (400') ground water.

Reserve estimate is 1 billion tons of 0.55% oxide. (does this include Fannie Grande?)

The project's current status: 1) Geological characterization is complete, 2) Hydrologic characterization is complete, 3) Aquifer Protection permit obtained, and 4) Environmental assessment complete.

An aquifer protection permit was obtained in October, 1994, 29 months after application.

Significant findings from the tracer element study:: 1) Sufficient solution can be introduced and recovered for in-situ leaching to occur, 2) No communication between leach area and local ground water, 3) Geochemistry indicates deposit can be leached and that all units attenuate acid, and 4) Obtaining the permit indicates such projects can be permitted in Arizona under APP guidelines. A paper on the permitting is forthcoming shortly.

GW WR 1975 Wednesday, December 1 - Went to the Casa Grande Dispatch office for directions to the Getty-Hanna drilling area, but the woman at the desk did not know the specific area, saying "its west of town". Went to the Francisco Grande Hotel where definite directions were also not obtained; the manager was out. After an hour or so driving "west of town" and west of the hotel a couple of rig masts were spotted immediately west of the hotel air strip in Sec. 24, T6S, R4E. Here Steven Van Nort, geologist for Hanna was scanning core from one of 5 rigs in operation. Mr. Van Nort said they had cored some 30 to 40 holes. When questioned about mineral intercepts and water he gave an evasive reply. This area is agricultural land and doubtless contains an aquifer in the gravel above the bed rock which may offer some difficulty to a caving system of mining. Mr. Van Nort mentioned that Occidental Minerals was drilling to west of the Getty-Hanna acreage. After another 1½ hour search a Shelton Failing drill rig was spotted near a ranch house 2½ miles west of the Hanna ground in Sec. 15, T6S, R4E. Here although Mr. Shelton admitted he was drilling for Occidental that's about all the information he would release. However, it was overheard that this was the first hole and that another would be drilled about ½ mile further west. No representatives of Occidental were present.

HANNA-GETTY DEPOSIT

The following was prepared from notes on J. D. Lowell's talk at the Arizona State AIME conference December 6, 1982 entitled "The Casa Grande West Orebody".

The deposit, discovered in 1976, was developed and drilled by the Hanna Mining Company. It is located in Pinal County, T6S, R5E Sec. 18. The first indications of the ore body were found in the cuttings from a dozen water wells in the general area of the deposit.

The water wells were in a conglomerate that contained mineralized fragments. Geologic evidence used to locate the ore body included mapping the paleo stream directions to deduce where the mineralized pebbles came from, being within the Ray-Ajo mineralized trend, and the knowledge that the Sacaton ore body was both cut by a fault and underlain by a fault.

In drilling for the orebody no mineralization was encountered until the 11th hole. In total 119 holes were drilled at an average drilling cost of \$16.23/foot.

The ore body blocked out is approximately 2000' long by 800' wide with mineralization occurring at depths of 1600' to 3300'. Overburden consists of alluvium, volcanics, and conglomerates. The Taramide intrusive deposit contains 350 million tons of 1 % copper with a .5% grade cutoff, .01% molybdenum plus some gold and silver credits. Total sulfides compose 1-3% of the ore body, mainly in the form of chalcopyrite and pyrite. The high grade of the deposit is due in large part to a supergene enrichment blanket composed of atacamite along with chrysocolla in the oxide zone. This rather rare copper mineral possibly reflects oxidation in a salty environment, perhaps an evaporite basin. Interestingly this ore body is also underlain by a fault and bounded by a fault on the east side. Mr. Lowell was optimistic that the deposit would be mined. This was due to three factors.

1. The high grade, nearly twice that of other porphyry copper deposits in southwestern Arizona.
2. There will be no water problem as with the Florence deposit. Here the water is confined to upper gravels with the deposit itself dry.
3. Favorable rock behavior, as determined by tests of the core, will allow mining by block caving methods.