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**L. CLARK ARNOLD**  
CONSULTING GEOLOGIST Ariz. Reg. #8883

June 18, 1989

Mr. J. David Lowell  
Route #3 Box 197  
Nogales, AZ 85621

Dear Dave,

The compilation which follows represents the best efforts of John Kinnison and myself to extract from the 15 boxes of CAP files any possible exploration leads regarding leachable copper reserves in southwestern U.S.. In the course of reviewing and sifting the material, several ideas occurred to us which are indirectly or geographically related to CAP work. These ideas are included, and appear at the end of the tabulation. Files appear to be missing for at least three projects which I clearly recall but for which I am unable to locate any data. A list of these projects appears following the numbered references. Also included is a current list of copper reserves published by the Arizona Department of Mines and Mineral Resources and a small scale map of Arizona and New Mexico showing the location of most of the CAP project areas.

A report entitled *Literature Research of Copper Oxide Deposits Arizona, New Mexico, Nevada, Utah, Colorado and Southern California* by John E. Kinnison and Charles L. Fair was also consulted. The projects are listed in the order reviewed.

Yours very truly,



L. Clark Arnold



John E. Kinnison

## 7-21 BOX O WASH

Two files geophysical and general. Outcrops show evidence of exotic as well as sulfide copper mineralization which has been the object of at least one unsuccessful attempt at heap leaching. Occurrence may represent a fault sliver of porphyry mineralization situated along the Ray-Copper Butte-Pioneer- Red Hills-Posten Butte trend. QMC drilled one hole which bottomed in gravel at 2302 feet. Previous Kaiser drilling in the area to the south intersected pyritic mineralization.

## 2-27 STEINS PASS

Five files describing two projects in same general area. Drilling by previous companies was summarized in a report by Magma. Six CAP drill holes eliminated a large part of the shallow area south and northwest of the Steins mineral cluster. No other targets identified.

## 3-15 KLONDYKE

One file of geochemical assays. Not drilled. No targets identified.

## 4-15 ARAVAIPA

One file of land status. Not drilled. Skarn alteration of the Aravaipa area extends onto the San Carlos Apache Reservation. A well developed and extensive skarn, which proved to be barren, was mapped in detail by LCA and SVN in the course of the San Carlos program. These skarns may be related to the magmatic event which produced the Horse Mountain volcanic series west of Aravaipa which has been shown to be of Midtertiary age. LCA suggests possible lead-zinc exploration target in the concealed lower part of the Paleozoic section in the Aravaipa District.

## 15-48 SAN LUIS

Seven files including a report by Justin Wilkinson and a description of four drill holes. The project was based on an attempt to locate the source of mineralized detritus in the subsurface which came to light as a result of the earlier Las Guijas program by QMC. Tested sources included a buried ridge in the Altar Valley as well as the upper part of the Cerro Colorado drainage.

## 16-43 JOHN THE BAPTIST

One file of geochemical samples. Area located a few miles

southeast of Ajo. The Locomotive Fanglomerate is known to contain exotic mineralization and John notes the "copper ribbon" which is a band of oxide occurrences extending south from the P.D. pit.

#### 17-7 GLOVE MINE

Two files including a geophysical file and CAP final report. Project was designed to test a covered area at the north end of the Santa Rita Mountains adjacent to a weak Mo anomaly associated with a mineral cluster. A single drill hole failed to intersect premineral rocks. No oxide target apparent.

#### 18-50 SAWTOOTH Mountains

One file which includes geochemical sampling and gravity survey. No drilling. JEK recalls a few copper oxide shows adjacent to cover. Gravity suggests shallow cover on the southeast flank of the Silver Reef Mountains. A water well intersected unmineralized schist at shallow depth. No specific oxide target apparent.

#### 19-51 CONGRESS

One file which includes a final report, logs and assays for seven drill holes and results of a geophysical survey. A weak Mo geochemical anomaly associated with the Congress cluster was tested but revealed only weak pyritic mineralization. No oxide target apparent.

#### 22-54 QUARTZSITE

One file of Cu and Mo geochemical results. Anomaly is present. Not drilled. Only apparent target is the Stray Elephant area west of Quartzsite which is presently under review.

#### 23-55 GLOBE

One file including final report and general file. Three drill holes tested a structural interpretation of the east end of the Globe District which was developed by Art Still. Test was negative in two holes and failed to intersect premineral rocks in a third.

Numerous occurrences in the area make the district generally favorable. Art Blucher described very large reserves of 0.3% oxide copper in an area called the Madera or Morgan. The Department of Mines and Mineral Resources lists a property called Gibson south of Miami to which it ascribes 11 million tons of 0.7% Cu

mineralization. John also recalls a prospect on the south side of the Schultz Granite with some oxide reserves. There is some confusion apparent regarding the location(s) and names of these various properties. At least a small amount of additional work is probably warranted to correctly identify and list the various occurrences.

#### 8-47 GUNSIGHT

Two files including a final CAP report and results of a geophysical survey. Four drill holes laid out to test the projection of weak alteration and mineralization. Test did reveal extensive unmineralized hematitic breccia. Bill Jones worked on this project. No oxide targets apparent.

#### 10-25 DOS CABEZAS

Four files rather extensive. Area includes Spike-E Hills. Seven holes drilled by CAP tested a pyritic porphyry zone but failed to reveal a copper center. Art Still and John Kinnison both recommended drilling in Section 8 but property problems with a local real estate developer prevented acquisition and testing of this area. Viable target remains if property were available. No apparent oxide target.

#### 9-30 BLACK DIAMOND 6-29 SIX MILE HILL

A broad area of shallow cover at the edge of the Sulfur Springs Valley near Pearce, Arizona was tested by 15 drill holes. An extensive area of pyritic mineralization in black shale was defined but lacked copper or gold values. The area has since been tested by Santa Fe Minerals with apparently negative results. An area near Mexican Hat, south of Pearce, is the site of a recent "discovery" by a joint venture including Santa Fe and Oneida Resources. Six drill rigs were recently reported drilling an area tested several years ago by Union Oil. Jim Loghry worked on the program and reports that copper mineralization with a gold credit associated with skarn alteration in the lower part of the Paleozoic section is the cause for the excitement.

ASARCO drilled an area of shallow chalcocite mineralization many years ago. Could be a target for leachable reserves but property is doubtless unavailable at present as a result of high level of activity in the area.

## 11-36 ANIMAS VALLEY

One property file. No drilling.

## 12-31 BROWN'S PEAK

One general file with geochemical results. No drilling or geological report.

## 14-26 FORT BOWIE

One file with published geologic map. No drilling.

## 11-41 VICTORIO Mountains

One file with some USGS maps. No drilling. Work by Gulf Resources was successful in developing a tungsten reserve on property controlled by Leonard Resources.

## 147-180 HELVETIA-EMPIRE-PAULENE

File material has been incorporated in LCA file on some work in the Cuprite area. CAP project was designed to offset and test weakly cupiferous pyritic mineralization beneath an interpreted thrust sheet. Several holes intersected weak disseminated pyrite but revealed no improvement in copper grade. No apparent target for oxide reserves.

## 147-181 FLORENCE RIDGE

One file which is incomplete. This material may have been moved to the Florence Ridge 148-181 file. Project was drilled with negative results.

## 150-183 WEST GRAHAM

Files with final report, geophysical report, geologic notes and assays. Project was based on exotic copper mineralization in the upper plate of a low angle fault. Five drill holes penetrated the fault and tested the lower plate with negative results. Claims were later optioned by Billiton and investigated as a gold prospect. Extent and results of their exploration are unknown.

## 32-64 COMOBABI

One file with geologic map and gravity survey. Well developed mineral cluster and some fringe type alteration. Area was always highly regarded by SVN but difficulty in dealing with Papago tribe prevented more than cursory work.

## 33-66 CAVE CREEK

One file with geologic reconnaissance and geochemical assays. Will Chester worked on this area. No target generated and no apparent oxide target.

## 34-68 DRIPPING SPRINGS/EL CAPITAN

Two files and CAP final report. Project originally conceived by Art Blucher in 1967. Drilled twice by QMC without reaching bedrock. Finally tested by CAP in connection with a joint venture with QMC with three holes to bedrock which gave negative results.

This brings to mind the Chilito area which was investigated by Art Blucher. Gerry Irwin had a reserve figure of 65 million tons @ 0.4% Cu when he compiled data for the Department of Mineral Resources. The Chilito area is controlled by ASARCO if I'm not mistaken.

## 37-70 BROCKMAN HILLS NM

Two files, one general and one assay report along with CAP final report. Project came to CAP via Mr. Chet Sutton who was a tool pusher for L.C. Jones. He had a sample of cuttings which contained sulfide minerals which supposedly same from a petroleum test south of Deming. The CAP drilled five holes which intersected some weak sulfides in volcanic rocks but with background copper values. Will Chester looked after the drilling. No apparent oxide target.

## 38-71 POLAND JUNCTION

One general file with JDL memorandum. File may be incomplete. Project was deep drilling target recommended by Art Still. Not drilled - no apparent oxide target.

## 39-72 WINCHESTER Mountains

One general file with geologic report and geochemical results. Anomalous Cu and Mo in parts of outcrop. Jim Guthrie of NEL and Will Chester worked on this area. Area was not drilled. No apparent oxide target.

## 40-73 OLD BEXTRUM

One file with geologic map and geochemical assays. Some anomalous Cu values. Project located several miles southeast of Ruby. A few samples appear to have anomalous Cu values. Field work by Will Chester. No

target was defined. No apparent oxide target.

#### 41-74 WILHOIT (HASSAYAMPA)

One file with geochemical notes and assays. Some anomalous Cu values noted. This project may be related to the Hassayampa project about which I inquired and on which Dick Hewellett did an ore reserve estimate.

#### 42-75 THE NIPPERS

Two files with geochemical data, gravity and miscellaneous information. No drilling. Cluster seems to show some anomalous Cu values.

#### 24-56 WATERMAN CRETACEOUS

File contains some notes and geochemical sampling results and reports on the Silver Hill and Silver Bell mines. As I recall no target was ever developed in this area.

#### 25-57 ARAVAIPA MAGNETIC ANOMALY

Area was visited and reviewed by John Sumner who recognized a very strong but also very local magnetic anomaly west of Aravaipa. John concluded that anomaly originated in the volcanic rocks themselves rather than a mineralized zone.

#### 26-58 NOGALES

File contains CAP final report and gravity survey. Mineral cluster in the area of the Nogales airport was tested by six drill holes with negative results. No oxide target apparent.

#### 27-59 SLEWFOOT

File contains a number of old reports, an assay file and a CAP final report. Project was located in the Verde Valley east of Camp Verde and attempted to locate the source of exotic mineralization in the Hickey volcanics. John notes that source could be either a porphyry copper or massive sulfide deposit. Project may warrant review in an attempt to develop a better geologic concept or target.

#### 30-62 PARKER-WICKIUP

One file with topographic map. Area was drilled by BCMC and investigated by the CAP but no target was ever developed. No obvious oxide target.

## 31-63 QUIJOTOA

Two files geochemical and area of interest as well as file of geologic maps, cross sections and gravity surveys. Tom Heidrick did a good deal of mapping in the area but all of the targets recognized were on the Papago Reservation and unavailable to exploration.

## 142-175 CHOLLA MTN.

Three files, geochemical, drilling and general as well as CAP final report and gravity survey. ASARCO drilled a copper deposit approximately one-half mile southwest of the Conoco Poston Butte deposit. The ASARCO deposit was rumored to be partly oxide and smaller than the Conoco deposit. The CAP target was southwest of the ASARCO area and attempted to intersect chalcocite which had been displaced from the ASARCO deposit by a low angle fault. The drilling results were negative.

Cross sections show the position of the ASARCO oxide mineralization which could constitute a target if ASARCO has released fee land.

## 143-176 AJO NORTH

One file and CAP final report. Object of program was to locate a faulted segment of the Ajo deposit. Two drill holes failed to penetrate post mineral section at depths of approximately 2000 feet. No targets remain within drilling depth.

## 144-177 LONE MTN.

Major CAP drilling program delineated a large tonnage of marginal grade copper mineralization with strong zinc credit at considerable depth southeast of Silver City, New Mexico. I recall that one of the last holes drilled at Lone Mountain intersected a long section of near surface oxide copper mineralization. The geometry was such that considerable tonnage could have been present.

Project has since been optioned to Chevron and within the last few months to Doug Irving of Albuquerque who represents BHP or its U.S. equivalent. There could be an oxide target at Lone Mtn. if BHP limits itself to the deeper mineralization having a high zinc credit.

## 44-77 HACHITA

Three files including CAP final report 1974 as well as

a reference to a later project by Bethlehem looking for tactite mineralization beneath a low angle fault. Bethlehem drilling data not in CAP files. Area appears to have been tested with negative results - no other targets apparent.

45-78 NAME ??

One file showing land status in area of Santa Rita Mountains

61-94 KELVIN

Four files including CAP final report as well as drill logs and geologic reports from previous exploration programs by Cities Service and others. Drilling by CAP and other groups renders area discouraging as far as additional targets of any type. No new ideas at this time.

64-97 WHITLOCK Mountains

General file with information on Sol and Ash Peak areas as well as some published material. One file with hydrologic data, CAP final report and geophysical data. Project attempted to locate source of Mo groundwater anomaly between Peloncillo Mtns and Ash Peak. Drilling encountered Tertiary volcanic rocks, hot water and minor sulfides. No explanation for Mo anomaly. No new targets at this time.

? PAINTED ROCK

One file includes reconnaissance work by JEK on Painted Rock mineral cluster, Harry Winters drill area north of the Eagle Tail Mountains, and granite window in the Kofa Game Range in the northern Kofa Mountains. No targets recognized.

79-112 SLATE Mountains

One file with geochemical map but no assays. See also 18-50 Sawtooth. JEK reconnaissance in the Slate/Sawtooth area didn't produce any targets.

89-122 LAS GUIJAS

One large file including geology, gravity and drill logs. Project was done for Quintana and was followed by the San Luis project in connection with the CAP. No oxide targets apparent.

## 90-123 RUBY

Well defined Ruby mineral cluster drilled in connection with the Quintana Porphyry Recon program. Used reverse circulation drilling to explore thick Tertiary volcanic section east of Ruby. One of three holes may have intersected premineral rocks which proved to be unmineralized. There is presently considerable interest in this part of Santa Cruz County in examining Midtertiary disseminated gold mineralization. No oxide copper targets are apparent.

## 91-124 HARSHAW

File contains CAP final report, gravity survey and miscellaneous maps. Area of shallow cover is relatively small. Two holes drilled but only one penetrated postmineral section and gave negative results. No oxide targets apparent.

## 94-127 HUACHUCA MOUNTAINS

File shows only land status map. No target generated in connection with CAP.

## 98-131 JOHNSON CAMP

This was the first mineral cluster tested in connection with the Quintana program. Very little property was available in view of extensive work by competitive groups. Several holes were completed with negative results on both sides of the Gunnison Hills. A separate project by the CAP later explored an area south of Dragoon part of which had been tested previously by Phelps Dodge Corp.

JEK notes possible untested mineral center east of the Burro Pit on ground controlled by Cyprus. See also recent review of the Cyprus Johnson holdings for Bethlehem Resources.

## 100-133 GREATERVILLE

One file with topographic maps. This area was explored by QMC for whom we drilled a single hole southeast of the Rosemont area. Leon Whatley was the driller and hole failed to penetrate the postmineral section. Area seems generally favorable in view of the known mineralization at Rosemont and Peach-Elgin, but shallow cover is a sparse commodity and no ideas immediately occur at this time.

## 105-138 MAMMOTH NORTH

File contains JDL letter and some geochemical information. Area was located in San Pedro Valley between San Manuel and Copper Creek. Tested in connection with another CAP project which resulted from work by John Kinnison. Area generally favorable, but cover is very thick and no specific targets are immediately apparent.

## 107-140 WICKIUP

One file with maps, JDL letter and miscellaneous data. Area was abandoned on basis of weak outcrop showings.

## 106-139 CONSITE

File contains CAP final report. Project attempted to locate "root" zone of the Continental deposit. Two holes were drilled with negative results. A possible target still exists on state land beneath Duval (Cyprus) tailings area. Land acquisition almost certainly not possible.

## 110-143 EDWARDS PROJECT

File contains 1974 report by JEK which was later updated. Recent material is absent from file. Target is a new porphyry center north of Twin Buttes. Project was thwarted by Mr. Edwards' refusal to deal reasonably. Target still exists - property definitely a problem.

## 128-161 BURRO CREEK

One file with topographic map showing mineral cluster and old drill hole locations. Also included are geochemical assays for drill holes, mesquite and groundwater. Mineral cluster fronts on alluvium. Rock geochemistry not anomalous -- no drilling.

## 129-162 SILVER BELL WEST

One file with gravity survey and land status. JEK did some reconnaissance in this area but could not generate a drilling target. There are some small deposits of exotic copper in alluvium and in the Recreation Red Beds. No new concepts or apparent targets at this time.

## 130-163 ALDER CANYON

Two files, one with gravity data and other with property status. Project was an attempt to generate a CAP target

by locating the source of the Alder Canyon gold placers. No target was generated.

132-165 TEVISTON (SAN SIMON)

One file with mesquite and rock geochemical sampling results. No target generated.

133-166 WHITE TANKS

One file contains miscellaneous data including results of geochemical sampling showing anomalous copper geochemical values. Area was an exposed zone of alteration and mineralization which extended beneath post mineral cover. It was previously drilled by Cominco, Kaiser and Bear Creek. Zone is sizeable but apparently contains only pyritic mineralization. No untested copper exploration target is apparent.

135-168 WINKLEMAN PEDIMENT

One file contains gravity report, geochemical assays and field notes. Narrow pediment is present beneath the bajada at the north end of the Tortilla Mountains. No drilling targets were generated.

134-167 LORDSBURG

One file with topographic map and notes. Mineral cluster abuts alluvium south of the town of Lordsburg. LCA and JDL visited the area and concluded that area immediately adjacent to alluvium was occupied by "fresh" outcrops. Some gravity work was also done but I am unable to recall results and geophysical data does not seem to be included in file. This was the famous trip on which the airplane caught fire.

136-169 SAN PEDRO

Two files including one geophysical file with results of gravity and magnetic surveys and another with drill logs and property information. Project was designed to test an aeromagnetic "low" similar to the one associated with the San Manuel deposit but situated beneath the San Pedro River on a line between San Manuel and Copper Creek. Drilling encountered quartzite at about 900 feet. Results were negative. No new targets apparent.

137-170 COPPER DICK see also HACHITA 44-77

One Expando file contains geochemical assays, field notes and geochemical work sheets as well as a report by J.R.

Bellemy for Bethlehem Copper (1977) and a CAP final report. Project tested an extension of tactite mineralization beneath a low angle fault of post mineral age. Detailed geologic mapping preceded a single drill hole by Bethlehem. It was concluded that the Old Dick tactite was a small roof pendant and no additional work was recommended. No oxide targets are apparent.

#### 139-172 BALD MOUNTAIN

Two files, one contains geochemical data and summary of existing drill holes, the other results of a gravity survey and miscellaneous data. CAP final report appears to be missing. Project was based on an interpretation of the geologic history of the Tyrone area which includes the development of a ferruginous conglomerate in the area east of the Tyrone pit. The CAP group had access to previous drilling by Amax which had intersected some chalcocite mineralization. The project was a joint venture with Amax. We deduced that the Tyrone system had been significantly rotated and faulted and that the chalcocite blanket may not have been situated directly above the highest grade primary mineralization. A conclusive test of the hypothesis required drilling on property controlled by Phelps Dodge Corp. This was not possible and several holes were drilled as close as possible to the ideal locations. Drilling tended to support the structural interpretation but was not conclusive in this regard.

Gravity surveys in the area between Tyrone and Lone Mountain suggested a wide shallow pediment on the Lone Mountain side of the valley adjacent to a well developed mineral cluster as I recall. There may be a grass roots exploration target in this area.

#### 140-173 GRASSHOPPER

One file with CAP final report, geochemical assays and miscellaneous data. Project was located in Montana and supervised in part by Jeff Meyer. Three drill holes tested the possibility of chalcocite mineralization associated with a porphyry copper-molybdenum system. Grades encountered were submarginal. Possibility for increased grade at greater depth was deemed insufficient to justify additional expense. No oxide targets apparent.

#### 155-188 SULPHUR SPRINGS VALLEY

One Expando file contains field notes, geochemical assays, gravity survey data and CAP final report. Nine

holes were drilled on a shallow buried ridge in the Sulphur Springs Valley adjacent to the Pearce area where previous work had located pyritic black shale deposits. Drilling encountered thick volcanic sections in some areas and non-mineral rocks in others. No porphyry system was recognized. No oxide targets are apparent.

#### 156-189 KELVIN EAST

File contains gravity data, miscellaneous field maps, geochemical assays and a CAP final report. Two holes were drilled to test possible extension of mineralization beneath post mineral cover. Results were negative and no oxide targets are apparent.

#### 157-190 WEST COURTLAND

One file contains geologic field sheets, geochemical assays, alteration outline on work sheets. No target generated, no drilling. No oxide targets apparent.

#### 158-191 ARMAGOSA

One file contains aerial photographs, gravity survey results, a report by Justin Wilkinson on the fanglomerate and a CAP final report. Project attempted to locate the source of mineralized fragments in the Tinaja Fanglomerate south of Sierrita/Esperanza. Three drill holes failed to intersect mineralization. Source of pebbles remains uncertain. No oxide targets apparent.

#### 159-192 CONTRERAS WASH

One file contains topographic maps with some field notes, geochemical assays and results of a gravity survey. Gravity data suggests existence of a pediment one to two miles wide between the deep portion of the Altar Valley and outcrops on the west side of the valley. No specific target developed -- no drilling. No oxide target apparent.

#### 152-185 VALMY NEVADA

Two files contain general data, geological data and CAP final report. The CAP drilled seven holes totaling 4100 feet through shallow alluvial cover at the north end of the Battle Mountain District. Alteration and mineralization associated with the Battle Mountain cluster apparently does not extend beneath cover. Area is very close the recent Marigold discovery by Cordex. No oxide targets apparent.

148-181 FLORENCE RIDGE  
151-184 FLORENCE RIDGE SOUTH

Two holes were drilled to test the projection of weak alteration and mineralization noted in outcrop beneath postmineral cover. The area tested is situated on a narrow buried ridge along the Ray-Kelvin trend. Both holes intersected premineral rocks but with discouraging results. No oxide targets apparent.

20-52 CASA GRANDE WEST

Project resulted in the discovery of announced reserves amounting to 300 million tons @ 1% Cu. Hanna-Getty interest in the property was recently sold to ASARCO/Freeport. The deposit is presently the focus of a joint venture between the U.S. Bureau of Mines and the owners to design, build, permit and operate an *in situ* leaching operation.

Additional exploration targets exist in the area. The best one may be the Desert Carmel area north and east of the main orebody which has so far been inaccessible because of property ownership.

145-178 COURTLAND

File is very extensive and includes in addition to CAP material, reports by Bruce Kilpatrick, Dick Nielsen and various published reports. Work by the CAP was successful in penetrating the Courtland thrust in a previously untested area, but with negative results. The tabulation by the Arizona Department of Mines and Mineral Resources shows reserves amounting to 10 million tons @ 0.5% Cu for the "Turquoise" deposit. Santa Fe Minerals is presently active in the area and may have discovered a copper-gold skarn zone south of Mexican Hat Mountain.

Area is interesting but intensely prospected and presently the scene of intense activity. Oxide targets are probably unavailable.

146-179 KORN KOB

One large file includes extensive information assembled by the CAP as well as a 1971 report by Heinrichs Geoex which was prepared for Essex International. CAP drilling was designed to test an area of Gila Conglomerate located north of the area of known mineralization. No attempt was made to evaluate existing reserves. Three holes produced negative results.

The Georex report suggests 20 million tons @ 0.4% Cu with additional exploration possibilities. A letter by JDL and LCA dated May 13, 1983 indicates a figure of 8 million tons @ 0.4% Cu. Mineralization occurs in a limy host and is very difficult to characterize. The industry has tended to discount the deposit because of its limy nature, but similar mineralization at Johnson Camp proved to be leachable. There could be a target at Korn Kob.

#### PROJECTS FOR WHICH DATA ARE MISSING

##### SACATON WEST

This project was conceived by John Kinnison and involved testing an area of shallow cover in the Casa Grande district. Three holes were completed to bedrock with negative results. No oxide target is apparent as a result of this work.

##### NORTH STAR

This area located west of the Florence Highway was extensively reviewed using NEL file data. We were unable to generate any targets not already tested by previous work.

##### DRAGOON SOUTH

The projects tested an area south of the Southern Pacific Railroad south of Dragoon, Arizona. Part of this area had been previously drilled by Phelps Dodge Corp. Shallow cover was very limited as I recall and drilling was negative. No previously unrecognized targets are evident.

## EXPLORATION POSSIBILITIES NOT DIRECTLY RELATED TO CAP WORK

## COPPER CREEK

The Old Reliable breccia pipe in the Copper Creek District was shattered and leached *in situ* in a project by Ranchers Development Co.. The system employed produced cement copper which resulted in a buildup of iron in the leached zone. The project was abandoned at that time and has since been cited by the EPA who sought to control seepage of copper bearing water into Copper Creek. Magma responded by investing more than \$250,000 on a containment system which has eliminated the seepage problem and satisfied the EPA. Magma has filed suit against its former partners to recover the cost of the system and its maintenance. The property is almost certainly available and should probably be studied in light of SX-EW technology currently available.

## ZONIA

John's information indicates reserves of 35 million tons @ 0.31% acid soluble Cu, may also have a lower tonnage of somewhat better grade. Property was held by Antioch Resources and Queenstake. The Antioch interest was sold to Union Texas Petroleum Co. 1330 Post Oak Houston, TX 77252 Telephone (713)623-6544.

## HASSAYAMPA PROJECT

John Kinnison recalls an ore reserve by Dick Hewlett and a report by Tom Nye suggesting possible oxide reserves. We are unable to locate any file data on this occurrence.

## SAN JUAN

Deposit was examined by John and Harold Courtright who noted that old drill core which was available indicated oxidation to depths of about 600 feet. The Arizona Department of Mines and Mineral Resources has information that the deposit contains 16 million tons @ 0.52% acid soluble copper. Oxidation which extends to a depth of 600 feet, is well below the present small open pit. Mr. Alf Claridge holds the controlling interest in the property and drilling and reserve data is reported to be available through Grover Heinrichs.

## DUNDEE ARIZONA

Exotic copper in conglomerate and breccia downstream from Jerome. May constitute a lead for a larger exotic

deposit according to page 21 of John's literature review of oxide copper resources.

#### MINERAL BUTTE

John's file data reviewed in connection with this compilation suggests that information received 20 years ago from Dean Lynch may indicate a better grade than more recent conversations. Property is on Indian lands but not necessarily out of reach in view of our success with the Apache tribe using the assistance of Kendall Cumming.

#### MINERAL HILL MINE

Located 21 miles northeast of Parker, Arizona. In 1969 Powder Metals Corp. operated a 1000 tpd leach operation for several months. Host is limestone and reported to resemble the Swansea deposit. May or may not be excessively acid consuming. Possible oxide target.

#### MAC ARTHUR LYON COUNTY NEVADA BLUE JAY AREA - YERINGTON NEVADA

Mac Arthur property which was explored by the Anaconda Co. and found to contain some 32 million tons @ 0.3% Cu is presently controlled by a group called Timberline Resources. They are represented in Tucson by Douglas Martin whose office is located at 2344 East Speedway Blvd. Tucson, AZ 85733.

The Blue Jay area is due east of Yerington on the opposite side of the valley from the town. Our information dates from about 1973 when it was controlled by Grant Huntley. JDL notes in file suggest five to ten million tons @ 0.5% Cu with a stripping ration of 1:1. File also includes drawings by Irv Gray.

#### WICKENBURG PEAK

John Kinnison commented that the reserve figure quoted by Kelsey Boltz seemed very low in view of the large amount of drilling done on reasonably closely spaced drilling. He called Ray Ludden who was unable to recall any drilling done by P.D. Corp. in the Wickenburg area. It thus appears that all of the drilling was done by Phillips and Nuclear Dynamics.

#### TRIGG PROPERTY

Property is located north of the Tyrone deposit near Silver City, New Mexico and includes two mineralized zones called Copper Mountain and Copper Leach. This

mineralization which consists primarily of chrysocolla is apparently exotic. Deposit may contain 16 million tons @ 0.5% Cu. Deposit is rumored to have metallurgical problems.

#### SHARON STEEL DEPOSIT NEAR BAYARD NEW MEXICO

Deposit is high magnetite skarn which was mined partly from an open pit and partly from underground. LCA visited the area during the CAP project and was shown small areas of leached capping after chalcocite developed in intrusive rocks adjacent to the skarn zones. As I recall these areas were either untested at the time of my visit or had been tested only in cursory fashion.

Sharon Steel has recently filed bankruptcy and the property could be available. There may be a target consisting of leachable chalcocite.

#### CACTUS AND CARLOTTA PROSPECTS

These two occurrences surfaced during our review of the Globe-Miami District. I have no file data but the Arizona Department of Mines and Mineral Resources lists reserves for both deposits. These may be worth further investigation.

#### PALO VERDE

This area was located west of the Casa Grande area and attempted to locate the source of a very large Mo groundwater anomaly which extended over twenty miles or more. We found no file data - it may have been incorporated into some other file. Several holes were drilled with negative results. No oxide targets are apparent.

#### RICH HILL

John has found a reference to a water well drilled in 1936 which encountered strong copper mineralization from 185 to 223 feet. This hole was followed by a second hole which also found similar grade material. The Rich Hill claims were located in 1938 and a shaft was started.

Although the exact location of the wells and the shaft has not been determined they were apparently located at the edge of alluvial cover west of Mineral Butte. It may be possible to recover the exact location using the information available.

The high grade material intersected may represent some

form of chalcocite, cuprite or native copper related to a porphyry system. Such mineralization could constitute an important exploration lead.

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TABLE XXIII

## COPPER RESERVE BASE IN ARIZONA (1)

DEPOSIT & LEGAL DESCRIPTION	COMPANY	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
ANTLER T17N R16W Sec 4	Standard Metals Corp.	Sulfide	5	1.95	With 4.13% Zn, 0.94% Pb, and 1.05 Ag oz/ton. Annual Rpt & Form 10-K, 1987. An additional 2.5 million tons reported in 1979 Annual Report.
ATLAS T11S R8E Sec 32	American Pacific Mining Co. Inc. <i>See Title C.C. &amp; Nevada old in BS&amp;K column.</i>	Sulfide Acid Soluble Sulfide Acid Soluble	5 5 19 12	0.64 0.37 0.66 0.38	Report on BS&K Project, Pima Co., AZ" by Frank H Buchella. Cutoff at 0.40% Cu. Cutoff at 0.20% Cu. Asarco property adjacent to Atlas. Asarco property adjacent to Atlas.
BAGDAD T14N R9W Sec 4	Cyprus Minerals Co.	Sulfide	43	0.45	With 0.018% Mo. (includes acid soluble) Form 10-K, 1987.
BUCKEYE EAST T3S R12E Sec 26	Asarco Inc.	Acid Soluble	22	0.65	AZ Mining Assoc. "AZ Wilderness 1988" Report A-23 to Congress.
CACTUS T1N R13E Sec 36	Magma Copper Co.	Mixed	10	0.70	Cactus Prospect Rpt. Cutoff at 0.2% Cu.
CARLOTA T1N R13E Sec 36	Owens, S.B.	Acid Soluble	4	0.85	Reported 1979.
CASA GRANDE T6S R5E Sec 18	Casa Grande Copper Co.	Mixed	352	1.00	Getty Oil Co. Annual Report, 1980. With 0.01% Mo. Cutoff at 0.5% Cu.
CHILITO T4S R15E Sec 22	Asarco Inc. <i>Cu in Basin Prod. &amp; Origin Prod type spec.</i>	Mixed	75	0.51	Chilito Mines Report. With 0.01% Mo, 0.04 oz Ag.
CHRISTMAS (OP) CHRISTMAS (UG) T4S R16E Sec 30	Inspiration Consolidated Copper Co.	Sulfide Sulfide	7 20	0.63 1.82	Inspiration Resources Form 10-K, 1983. (same as above)

(continued)

TABLE XXIII (CONT)

## COPPER RESERVE BASE IN ARIZONA (1)

DEPOSIT & LEGAL DESCRIPTION	COMPANY	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
COCHISE T23S R24E Secs 9 & 10	Phelps Dodge Corp.	Acid Soluble	170	0.50	Annual Report, 1987.
COPPER BASIN T13N R3W Sec 20	Phelps Dodge Corp.	Sulfide	175	0.55	With 0.021% Mo.
COPPER BUTTE T3S R13E Sec 30	Asarco Inc.	Acid Soluble	22	1.09	AZ Mining Assoc. "AZ Wilderness 1988" Report A-23 to Congress.
COPPER CREEK T8S R18E Sec 11	Magma Copper Co.	Sulfide	80	0.55	Old copper reserves data.
COPPER QUEEN T23S R24E Sec 9	Phelps Dodge Corp.	Mixed	1	5.50	Underground. Phelps Dodge Prospectus May 8, 1975.
DOS POBRES T5S R26E Sec 27	Phelps Dodge Corp.	Sulfide	232	0.89	Form 10-K, 1987.
DRAGOON T16S R22E Sec 25	CF & I Steel Corp.	Acid Soluble	25	0.50	0.5 to 0.6 acid soluble copper.
DYNAMITE T17S R13E Sec 30	Smith, V.A. - Estate	Mixed	100	0.53	Unpublished estimate.
EMERALD ISLE T23N R18W Sec 22	TSC Enterprises, Inc.	Acid Soluble	1	0.40	3 million tons at 0.1% Cu USBM RI 8236, Pub. 1977.
ESPERANZA T18S R12E Sec 16	Cyprus Minerals Co.	Sulfide	48	0.27	With 0.034% Mo. Pennzoil Form 10-K, 1981.
FOUR METALS T23S R16E Sec 20	Dore Mining & Milling	Sulfide	3	0.82	Iso Mines Ltd. Annual Report, 1965.

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TABLE XXIII (CONT)  
COPPER RESERVE BASE IN ARIZONA (1)

DEPOSIT & LEGAL DESCRIPTION	COMPANY	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
GIBSON T1S R14E Sec 21	Lodestar Minerals Inc.	Acid Soluble	11	0.7	43 million tons at 0.04% Cu. Fletcher, J.B. et al report Aug. 1984.
HELVETIA T18S R15E Sec 36	Asarco Inc.	Sulfide Acid Soluble	337 22	0.54 0.55	With Sulfide - 0.088 oz/ton Ag, 0.0005 oz/ton Au.
I-10 T15S R23E Sec 31	Cyprus Minerals Co.	Mixed	100	0.52	Unpublished estimate; with 0.02% Mo.
INSPIRATION AREA MINES T1N R14E Sec 25	Cyprus Minerals Co.	Acid Soluble Sulfide	167 110	0.60 0.52	Inspiration Resources Corp. Annual Report, 1987. Acquired by Cyprus from Inspiration July 1, 1988.
IRON DOOR T13S R25E Sec 17	Unknown	Sulfide	63	0.38	Spike-E Hills Rpt. Cutoff at 0.20% Cu.
KALAMAZOO T9S R16E Sec 9	Magma Copper Co.	Sulfide Sulfide shaft pillar	211 101	0.77 0.68	Form 10-K, 1987.
KAY COPPER MINE T8N R2E Sec 4	Rayrock Mines	Sulfide	3	UNK	Unpublished estimate.
KORN KOB T11S R17E Sec 14	Keystone Minerals Inc.	Acid Soluble	2 8	0.53 0.44	North Ore Body. South Ore Body. Holmes & Narrou report on Korn Kob, March 1974 section 5.
LAKESHORE T10S R4E Sec 25	Cyprus Minerals Co.	Sulfide (Porphyry) Sulfide (Tactite) Acid Soluble	41 9 16	0.71 1.35 0.80	Noranda Annual Report, 1984. Noranda Annual Report, 1984. Cyprus Minerals Form 10-K, 1987.

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TABLE XXIII (CONT)  
COPPER RESERVE BASE IN ARIZONA (1)

DEPOSIT & LEGAL DESCRIPTION	COMPANY	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
LONE STAR T6S R27E Sec 5	Phelps Dodge Corp.	Mixed	1065 1000	0.58 0.41	World Mining, May 1981. Phelps Dodge Form 10-K, 1987.
MAGMA MINE T1S R12E Sec 35	Magma Copper Co.	Sulfide	4	5.70	Magma Form 10-K, 1987.
MAME T19S R25E Sec 20	Hope Mining & Milling Co.	Acid Soluble	1	1.10	Unpublished estimate.
MIAMI EAST T1N R15E Sec 19	Magma Copper Co.	Sulfide Sulfide	6 50	3.14 1.95	Newmont Mining Annual Report, 1985. Minerals Yearbook 1973, VII Area Reports USBM.
MIAMI TAILINGS T1N R15E Sec 30	Magma Copper Co.	Acid Soluble	35	0.33	Magma Form 10-K, 1987. Expect 54% recovery.
MINERAL BUTTE T4S R7E Sec 1	Unknown	Mixed	15	0.42	Cutoff at 0.32% Cu. Bear Creek report.
MINERAL PARK T23N R17W Sec 19	Cyprus Minerals Co.	Sulfide	35	0.17	With 0.054% Mo. Pennzoil Form 10-K, 1981.
MISSION COMPLEX T16S R12E Sec 31	Asarco Inc.	Sulfide	367	0.64	With 0.12 oz/ton Ag. Asarco Annual Report, 1987.
MORENCI/METCALF T4S R29E Sec 16	Phelps Dodge 85% & Sumitomo 15%	Sulfide Sulfide	739 241	0.76 0.69	Additional reserve is Sulfide - 241 million tons at 0.69% Cu. Phelps Dodge Form 10-K, 1987.
NEW CORNELIA T12S R6W Sec 27	Phelps Dodge Corp.	Sulfide	209	0.50	Phelps Dodge Form 10-K, 1987.

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TABLE XXIII (CONT)  
COPPER RESERVE BASE IN ARIZONA (1)

DEPOSIT & LEGAL DESCRIPTION	COMPANY	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
ORACLE RIDGE T11S R16E Sec 16	Continental Union Minerals	Mixed	11	2.25	AZ Conference AIME Dec. 1977. With 0.64 oz/ton Ag, Copper Studies Inc, NYC March 30, 1979.
PEACH ELGIN T18S R15E Sec 15	Asarco Inc.	Sulfide Acid Soluble	14 10	0.78 0.75	West, Barbara J. report, January 1980.
PINTO VALLEY T1N R14E Sec 2	Magma Copper Co.	Sulfide	421	0.39	Magma Form 10-K, 1987.
POSTON BUTTE T4S R9E Sec 33	Conoco Inc.	Mixed	800	0.40	Copper Studies Inc, NYC, March 30, 1979. 500 million tons at 0.50% TCu from Conoco Annual Report, 1972.
RAY T3S R13E Sec 10	Asarco Inc.	Sulfide	677	0.70	Asarco Annual Report, 1987.
RED MOUNTAIN T22S R16E Sec 20	Kerr McGee Corp.	Sulfide	100	0.71	Tucson Daily Citizen, Sept. 23, 1970.
SACATON EAST (UG) T5S R5E Sec 26	Asarco Inc.	Sulfide	15	1.25	Asarco Inc. Form 10-K, 1979.
SAN JUAN T5S R26E Sec 35	Cochise Mining Corp.	Acid Soluble	16	0.52	Cutoff at 0.35% Cu or 20 million tons at lower grade with lower cutoff. Producers Minerals Corp rpt June 1975.
SAN MANUEL T8S R16E Sec 34	Magma Copper Co.	Sulfide Sulfide shaft pillar	59 103	0.62 0.64	Magma Form 10-K, 1987. Cutoff at 0.50% Cu.
SAN MANUEL OPEN PIT T8S R16E Sec 35	Magma Copper Co.	Acid Soluble Acid Soluble Acid Soluble	44 11 272	0.43 0.14 0.36	Open Pit. Magma Form 10-K, 1987. Open Pit Marginal. Magma Form 10-K, 1987. In Situ. Magma Form 10-K, 1987.

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TABLE XXIII (CONT)  
COPPER RESERVE BASE IN ARIZONA (1)

DEPOSIT & LEGAL DESCRIPTION	COMPANY	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
SANCHEZ T6S R27E Sec 25	Harpoon, Inc.	Sulfide Acid Soluble Sulfide Acid Soluble	120 80 123 12	0.50 0.30 0.40 0.77	With 0.008 oz/ton Ag, 0.1 oz/ton Ag, unpublished estimate. Cutoff at 0.2% Cu, rpt on Carpenter Mine. Cutoff at 0.5% Cu, rpt on Carpenter Mine.
SANTA CRUZ T6S R4E Sec 13	Freeport McMoran <i>Asarco</i>	Acid Soluble	800	0.43	50% joint venture with ASARCO. USBM data 1985.
SHEEP MOUNTAIN PROPERTY T8N R2W Sec 13	Smith, Ken P. et al	Sulfide	<del>300</del> 75	<del>0.30</del> .45	To 400 tons, copper content approx. Unpublished estimate.
SIERRITA T18S R12E Sec 7	Cyprus Minerals Co.	Sulfide	326	0.30	With .037% Mo. Cyprus Minerals Co. Form 10-K, 1987.
SILVER BELL T12S R8E Sec 11	Asarco Inc.	Sulfide	21	0.68	With .07 oz/ton Ag. Asarco Annual Report, 1987.
SQUAW PEAK T13N R5E Secs 29 & 30	Squaw Peak Copper	Sulfide	20	0.36	Roe, Robert R., 1976 report.
STRONG & HARRIS T15S R22E Sec 13	Durham, A. et al	Mixed	60	0.60	Unpublished estimate with 0.70% Zn.
TURQUOISE T19S R25E Sec 17	Santa Fe Mining	Acid Soluble	10	0.50	Pub. 1975 by Union Oil.
TWIN BUTTES T18S R13E Sec 5	Cyprus Sierrita	Sulfide Acid Soluble	37 11	0.92 0.73	Cyprus Minerals Co. Form 10-K, 1987. (same as above)
VAN DYKE T1N R15E Sec 30	Kocide Chemical	Acid Soluble	100	0.50	Mining Engineering, Dec. 1977.

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TABLE XXIII (CONT)  
COPPER RESERVE BASE IN ARIZONA (1)

DEPOSIT & LEGAL DESCRIPTION	COMPANY	MAJOR MINERAL TYPE	MILLIONS OF TONS	AVERAGE Cu CONTENT	REMARKS/SOURCE
VEKOL HILLS T10S R3E Sec 4	Papago Tribe, Tohono O'odham	Sulfide	105	0.56	With 0.014% Mo, 16 million tons acid soluble Cu. Final EIS, Vekol Hills Project, US Dept of Interior, Bureau of Indian Affairs, May 1988.
VENTURA T23S R15E Sec 1	Cyprus Minerals Co.	Sulfide	6	0.26	Iso Mines Ltd Annual Report, 1965. With 0.28% MoS (6 million additional tons possible)
WHITE MESA T38N R9E Sec 29	Navajo Tribe	Acid Soluble	2	0.75	Mayo, E.B., 1955 report.
ZONIA T11N R4W Sec 12	Antioch Resources & Queenstake Resources	Acid Soluble	35	0.31	Lundin, R. J. et al, Feb. 1985 report.

72

TOTAL COPPER RESERVE BASE IN ARIZONA

Sulfide	5.6	Billion tons at 0.65% Cu
Acid Soluble	1.9	" " " 0.44% Cu
Mixed	3.6	" " " 0.54% Cu
TOTAL	11.1	" " " 0.58% or 64 million tons of copper

(1) Reserve Base - That part of an identified resource that meets specified minimum physical and chemical criteria related to current mining and production practices, including those for grade, quality, thickness, and depth. The reserve base is the in-place demonstrated (measured plus indicated) resource from which reserves are estimated. It may encompass those parts of the resources that have a reasonable potential for becoming economically available within planning horizons beyond those that assume proven technology and current economics. The reserve base includes those resources that are currently economic (reserves), marginally economic (marginal reserves), and some of those that are currently subeconomic (subeconomic resources).  
"Mineral Facts and Problems" 1985 Edition, Bureau of Mines Bulletin 675, page 3.



