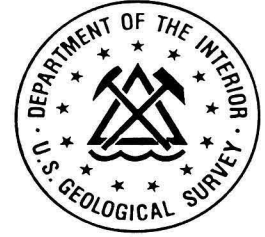


Trip 15:
Silver Bell, North Silver Bell
October, 1994



Bootprints Along the Cordillera
Porphyry Copper Deposits from Alaska to Chile

**THIS PAGE
INTENTIONALLY BLANK**



Dear Field Trip Participants:

On behalf of the **Arizona Geological Society, Society for Mining, Metallurgy and Exploration Inc., and the U. S. Geological Survey,** we bid you welcome to the Bootprints Along the Cordillera field trip program. We have assembled a collection of field trips that portray the geologic and mineralogic diversity that exists along the cordillera of North and South America.

We wish to thank all of the field trip leaders who volunteered their time, effort, and expertise to organize their individual trips. We also want to thank collectively, all of the mining companies and staff who graciously allowed us to visit their properties. Without their cooperation, this program would not have occurred. A special thanks goes to Kathie Harrigan of Asarco for her help in the compilation of the field trip guides. We also want to thank Tucson Blueprint who underwrote the complete reproduction cost of the guides.

Mark Miller and Jim Briscoe
Field Trip Co-Chairmen
October 2, 1994

WELCOME TO THE SILVER BELL - NORTH SILVER BELL FIELD TRIP!

Faculty at the University of Arizona have been taking groups of students and professionals on the tour that we are about to do for many years. The area is close to Tucson, manageable in size for a one-day trip, and most of all, it is one of the world's GREAT exposures of undisturbed outcrop over a porphyry copper system. You can take what you will see today with you to southern Peru, to Mexico, or to Irian Jaya and apply the principles almost 'verbatim'.

After we pass north along I-10 to the Rillito-Avra Valley exit at the north end of the Tucson Mountains, we head west (left) past the Cal-Mat cement plant (that stacking shed is the largest single room in Arizona, and the conveyor belt from mine to plant is 6 miles long!), we will cross the broad Avra Valley with the mine dumps on the skyline straight ahead. We pass the Waterman Mountains on the left as we approach the mine, and we will go into the ASARCO office there for a quick look at the geologic map and some specimens and for a geologic orientation. Then we will see a little of what 'artificial' outcrops look like in the Oxide and El Tiro pits (propylitized syenodiorite and quartz dacite, phyllically altered quartz monzonite porphyry and alaskite, and potassically altered Qmp) before we head for North Silver Bell, where we will walk outward through a half-symmetry of similar phenomena to see them in undisturbed condition.

This trip may be the last one, since NSB is scheduled for an open pit - heap leach - SX-EW operation very soon.

It is appropriate that we make this reconnoiter as part of the Bootprints Symposium in honor of Harold Courtright and Kenyon Richard. They were advocates of SB-NSB for years as a teaching laboratory for Asarco personnel, and they both took a lively interest in its local geology and conceptual evolution during their productive lives. Many of Asarco's Bright Young Men were assigned residency here, including Fred Graybeal, Barry Watson, Jim Briscoe, Jim Galey, and Steve Davis. Davis and JMG collaborated on the field notes and tour construction some years ago for a SEG Field Symposium. We owe thanks to each of these men, to Dave Norman, the present Chief Mine Engineer, to Sal Anzalone, Chief Mines Geologist for Asarco, and of course to Kenyon Richard and Harold Courtright. Recent studies by Peter Lipman and David Sawyer of the USGS will also be involved.

John Gilbert

GEOLOGIC ROAD LOG — TUCSON - SILVERBELL

Vehicles enter

Interstate 10 northbound, Tucson Mountains on left (W), Santa Catalina Mountains at 1:00 o'clock (NE). The Freeway continues N over an intermontane valley with as much as 3 Km of post-Paleocene gravels below.

Drive N successively past Grant, Orange Grove, and Ina Exits past Wasson Peak on your left. At Cortaro Road overpass (about 10 minutes), Safford Peak (3576') is at 10:00, the Old Yuma Mine south of Contzen Pass at about 8:00. Most of this northern end of the Tucson Mountains is composed of mid-Tertiary (26 my) andesites and dacites in a long narrow ridge (purple on the PCGM) which obstructs our westward journey. Safford Peak is Safford Dacite, a young unit. The Santa Catalinas at 4:00 are a gneiss dome composed of Precambrian age metasediments 'reset' at their upheaval date of 26 my. It will be best perceived in the afternoon light when we return. The San Manuel-Kalamazoo PCD at the town of San Manuel is at 3:00 behind the gneiss-Apache Group ridge. At 1:00-2:00 are the Tortolita Mountains, mainly Precambrian but shown by G.H. Davis and coworkers to be a complex metamorphic core complex. (As the N end of the Tucsons is approached, their foothills are spiked with saguaro cactus, palo verde is in the median strip, and mesquite is on the right shoulder.)

Exit I-10 at Rillito following Silverbell signs, duck under freeway, cross Santa Cruz River, and (1 mile) pass Arizona Portland Cement plant. Cement rock is quarried 5 miles away at Twin Peaks, carried by conveyor belt to the coal, gas, or diesel-powered kilns. Plant serves all of southern Arizona, is in fact a gold mine.

2.5 miles later (on higher ground), you can see the Tucsons (9:00), the cement quarry hills (Twin Peaks, fraternal, not identical—the quarry is in shaley Devonian Martin and Mississippian Escabrosa ls, the other Cambrian Bolsa quartzite) at 10:00, the Coyotes and Quinlans at 10:30 in the distance with Kitt Peak (the NASA-AURA observatory) and Baboquivari Peak (both LGr) prominent, the Roskruge Mountain Laramide and Tertiary volcanics low to the pass south of the El Paso Natural Gas pump plant, the Cretaceous and Paleozoic Watermans at 11:00, and the Silver Bells, dominated by Silver Bell Peak and Mt. Lord, at 12:00. Ragged Top, a Miocene ignimbrite plug to be part of the North Silver Bell skyline, is at 12:30, out of the Silver Bell cluster. Picacho Peak, another young volcanic neck, is at 2:00, and the Precambrian Picacho Mountains are to their east.

We traverse square miles of fields of vegetables and cotton (famous PIMA long staple cotton - your shirt may be made of it!). Portland Ridge and the Silver Bell tailings loom ahead.

At Anway Road (12 miles and 15 minutes from I-10), we begin to climb the long gradual pediment surface to Silver Bell. The thick gravels of the down-faulted basin (see Avra Valley basin, profile B-B¹ on the 1"= 50 mile foldout map, ABGMT) are behind; from here to Silver Bell, veneers of gravel conceal — porphyry copper deposits(?!). At 10:00 to 12:00, the Watermans, the Roskruges to left in middle distance. Volcanics are S of pump station, Paleozoic and Cretaceous sediments N of conspicuous saddle. The gray-brown cliffs are Escabrosa limestone. Tailings are on the right.

After the bend, waste dumps on the left, the mill and Portland Ridge at right center, and Silver Bell Peak beyond. Stop at ASARCO offices having passed townsite on left.

GEOLOGIC ROAD LOG — SILVER BELL-NORTH SILVER BELL

Follow the country road west of townsite. Beyond corrals, occasional outcrops of Amole sediments, Recreation Redbeds. Then outcrops of Silver Bell alaskite with occasional Qmp.

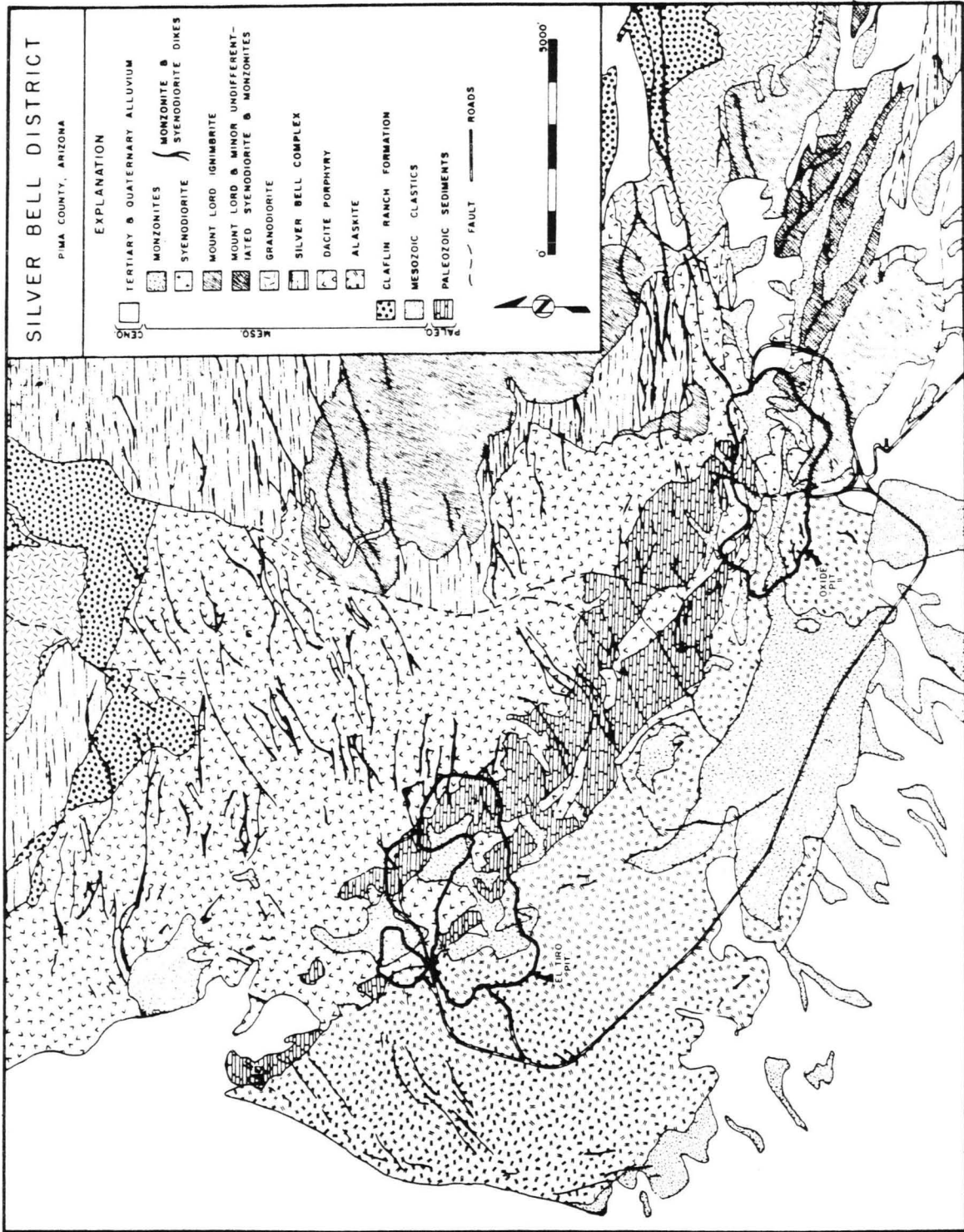
At 3.5 miles is a pre turn-of-the-century smelter site, with foundations and slag, a unit which served early (pre-SASCO smelter, 1906) Pb-Zn-Cu-Ag interests, was served by railroad from the North.

For the next few miles - the Santa Rosas (see county map) are due west, the South Comobabis to the south in the distance. In the middle distance are two Papago Indian preserves, Koht Kohl (to left, upper Paleozoic) and Ka Kohl (to right, mid-Tertiary volcanics). To the northwest are the Slates (Lakeshore) and the Vekols (Vekol).

The road curves back, heads NE past the Atlas Mine, a BS & K property of veins of sphalerite-pyrite, minor chalcopyrite-galena in hydrothermally skarnified Paleozoic limestones.

At 6.5 miles and 20 minutes out of Silver Bell, the road is on the old RR grade through thick caliche.

At 7.0 miles, go through gate on RR grade. The West Silver Bell Mountains are to the left in a spectacular saguaro forest, the North Silver Bell property is immediately ahead.



J.L. GALEY, 1979

FIGURE 1

NORTH SILVER BELL -- Tour Guide by John M. Guilbert (University of Arizona) and Steven R. Davis (then ASARCO), originally for the 1979 SEG Field Conference, revised by JMG for Arizona Geological Society-University of Arizona-Society of Economic Geologists Boot Prints Along The Cordillera Symposium, 1994.

The North Silver Bell (NSB) area is controlled, in 1994, by ASARCO. It has long been recognized as a northwesterly extension of the Silver Bell system, itself recognized as a 'porphyry copper' in 1909. It provides an extraordinary display of first-order PCD exploration characteristics at intermediate to shallow levels in undisturbed outcrop, not more than 1-1.5-km deep in a PCD system. Here you will see epizonal activity manifested by pebble dikes and breccias that are the upward forerunners of Qmp dikes below, and Qmp dikes that themselves flare 70-100 meters down to merge into a Qmp stock. You will see potassic alteration, with 1000ppm Cu, yield laterally to later phyllic and then to early propylitic alteration, all in natural outcrop to be compared with mine exposures in the Oxide and/or El Tiro pits. You will see capping and limonite minerals over secondary ores, and characteristics of weathering of different alteration and lithologic types. And you will see spectacular stockworks and shatter zones that are fundamental to PCD occurrences the world around.

And you will be among the last to see them, except via an SEG Video Field Trip tape that is in preparation. Recent drilling by ASARCO, coupled with 1970s drilling by ASARCO and Minex, has proven 80,000,000 tons of 0.4% Cu SXEW reserves. A pit will extend from the Bolsa Quartzite hills to the south, near the dumps from El Tiro, including the hill east of Point C and northward to take the hill west of 'The Saddle' and east to beyond the classic Points E and F. Many of the outcrops to be visited today will be gone with the completion of permitting, probably in the next months.

The Boot Prints field tour on October 8, 1994, has to be tightly scheduled, but you can lead yourself over it later at your leisure, as long as access is permitted and the outcrops exist. After a couple of stops in the Oxide and El Tiro pits to see the rocks in mine exposures, we will park near Point C and proceed to Points B-F and then up the ridge to Points K and L before heading back to the vehicles.

The rock types at NSB include major dacite porphyry intruded by major quartz monzonite porphyry, both cut by late minor andesite dikes. The dacite porphyry is predominant, outcropping over 75% of the map area. It is probably better termed rhyodacite porphyry (granodiorite equivalent). It is a thick sill or a thick extrusive unit. To the NE it has a lower lithic fragment content and more abundant biotite, and it may be part of a stock. At NSB it has many lithic fragments, fractured readily, and its ratio of veinlet to disseminated pyrite is high. It is generally low in quartz-eye content, containing about 20% rounded quartz 'eyes', 30-40% plagioclase>K-feldspar phenocrysts, and 40-50% aplitic groundmass, all around variable amounts of distinctive lithic fragments. It is an excellent reactant, and records alteration effects well over a 3-kilometer half-symmetry of the Silver Bell system.

Proceed about 200 feet east into the railroad grade cut.

POINT B is the RR cut and the nearby creek bed to the north. The RR cut is in Laramide quartz monzonite porphyry (Qmp), part of a major stock and dike system (to the east) which intrudes the dacite porphyry (Dp). The cut is distinctly potassically altered; excellent q-K-feld veins, predictably with minimal biotite (low Fe-Mg). Low total sulfide and fracture permeability means no or minor supergene enrichment, but rather low-pyrite oxidation and the production of 'copper oxide phases' - chrysocolla, principally. The point is that goethite not jarosite, is the principal limonite, with chrysocolla and 'spotty dendrites' of melaconite. The copper stays in the outcrop - these average 1000 ppmCu, 50 ppmMo, not unlike those at El Arco, and not unlike the grassroots exposures referred to at Sierrita.

Go from the cut down into the wash of North Silver Bell Creek - the potassic alteration is far more obvious here in Dp - with prominent q veining and K-feld flooding, with disseminated py-cp. The stockwork effect is well developed, and again the outcrops are not completely leached, although they are oxidized. Supergene enrichment underlying these outcrops is low grade.

Proceed eastward to adit area.

POINT C. The 'new' portal is in sericitized Dp. A vesicular andesite dike slashes through - note that it is faulted, downdropped to the eastern, mountain-ward side, unusual in this Basin and Range terrane. Note 'spotty' high-Cu dendrites and quartz-veinlet silicification.

(We can't go underground in the adit. It goes - 10° for 315' N87°E, levels and forks, one drive 300' NE, one 200' SE. It samples the enriched blanket terrane under the hill before you, shows excellent structure control of sec cc on py, moderate tonnages of ~0.5% Cu, and Mo).

The old adit 60-70' N of the new adit shows quartz veining and sericitization, excellent fracturing, highly visible quartz eyes characteristic of Dp - get used to them. You are already east of the K-alt center, into superimposed phyllic alteration.

(From here, you can either proceed up Tin House Wash (THW) to Points D-L, or reverse the itinerary by proceeding DUE EAST beyond the New Adit toward Point L on the drill pad up on the hill and reading the trip log 'back to front'. All points are identified and color-coded -- you can approach them in random order if you prefer).

Follow the road northeasterly about 150'.

POINT D. Here we move out of 'stocklike' (to west) Qmp into Dacite porphyry cut by Qmp dikes. Get used to distinguishing the two, and compare with El Tiro occurrences. Several small dikes of Qmp cut Dp before Point D, and the stock 'cupola' is exposed to NW of road behind you. Here a 3' red flag between two stones defines a dike. Uphill, red flagging marks a contact, Dp to W (downhill), Qmp to E (uphill). Qmp shows plag laths, few q eyes, well-developed biotite books, generally subdued rounded weathering. Dp has fine GM, prominent abundant q eyes, rare bi, 'cherty' lithic fragments, and prominent fractures.

Walk uphill along road, in Dp. Churndrill hole cuttings (CDHc), though, are Qmp, more abundant at depth. K-alt, K-feld flooded, py, minor cp and mb. The pink flag in the palo verde tree (step upstream into wash a few feet) is on silicified (silic) Qmp in potassic alteration. The major Dp-Qmp contact is between here and Tin House Saddle -- sericitized Dp is general in and beyond the saddle. Hill immediately north of Saddle is K-alt.

Continue east along Tin House Wash road. Pause 30-40' beyond (east of) saddle. Note hills to north in middle distance. The anomalous red is hematite after and over a chalcocite blanket. Elsewhere, yellows and oranges are jarosites and goethites. Residual hematite box works in phyllic alteration of Dp make the brick red color. Proceed along road. CDHc here are Dp with dissem fg py, minor mb, some sec cc. Hole would probably go into Qmp at depth. One hundred feet beyond pass, the mine dump shows sericitized (ser) Dp, q-mb veinlets (vlts). The greenish stain is nontronite and (probably) ferrimolybdate. Proceed uphill along road to blue flagging past float of phyl and prop Dp, perched gravels of mixed rocks, including andesite, syenodiorite.

POINT E. The blue flaggings delimit a spectacular outcrop (OC) of randomly oriented fractures, a classic stockwork (stkwk). The distant flag is a real photopoint. Generally, primary q fills centerlines, with ex-sulfides, of veinlets in prevasively ser Dp. Cse hypogene ser flanks vlts. OC oxidized, hem flooding, alu nite in vlts, probably some supergene arg (kaol.). Excellent envelope development. Streak the jarosite - the light streak means kaol or alun admixture. Portentious OC. High structure density. Remember Sierrita. Note texture of Breccia Ridge to south. 10-20' beyond second flagging in road is N60W fault gouge in Dp - alunite, jarosite, clays.

(If you stay on the road to its intersection with the wash, you cross a gravel bank with fabulous Sonoran flora -- saguaro, prickly pear, ironwood, palo verde, staghorn and teddybear cholla, hedgehog, and many wildflowers of a sun-drenched hillside. But you miss out -----).

Double back northwesterly down tributary wash here (at fault). Excellent natural OC of Dp, ox and ser. Jar-goeth q-ser vlts weathered in clear relief. Another photostop 30' from Tin House wash, but there are more. Upon reaching THW, there are classic Dp OC's for 50' downstream. Have a look, but head upstream 100' past slabs of caliche.

POINT F. The streambed here is probably structure-controlled -- it runs N65E. Magnificent textbook stkwk Dp. Stream polished at creekbed, another photostop. High color contrast, transported goeth-jar flooding, clear ser envelopes, q and heavy suls to 1" in frac. Probably once sec cc here. Bank under tall saguaro strongly frac and jtd. About halfway along stop, Dp adit with Cu stains. Inspect it and its frac density, and compare with OC above. Out of stream, natural non-stream-polished OC. Above that, drill pad CDHc of ser Dp, few tenths % cc on py, some ox. Qmp deep, if present at all. Prowl this area -- pervasive phyllic alt Dp, texture, including fragments, obscure.

Proceed upstream. N80W streambed. About 150' beyond F is N70W-85°S prominent fault zone in ser Dp. Flt bx, mylonite under red flag in ironwood. Follow THW upstream. Its box walls are N75-85E, 80-85S vlts and jts common in NSB and SB, cut by N35E-65NW. Heavy silic-ser at bend, weaker q-ser but

strong flt-jts at waterfall. Still N85E. (Above waterfall, excellent flora -- yellow-flowered brittlebrush, purple lupine, California poppies, clumps of miniature fishhook cactus, flowering hedgehog, whitish-barked ironwood, green palo verde; 100' above falls, staghorn cholla (pronounced 'choya') on S bank, teddy bear cholla on N.) Dwarf-shrub flowering acacia in wash is a 'copper flower'. Flt bx 40' above falls.

Over next 200', to road intersection with wash, frags showing up in Dp -- less pervasive alt, phyl level diminishing. Strong copper staining in OC at intersection means py diminishing relative to, for example, Point F.

Up the wash, 50' past road - THW intersection, is andesite dike. Same as in SB pit, 19.5-22 my dike event. Cu ox stains and paint late. Near Dp stkwk, lim is jar, goeth.

Another 50' upstream is a boulder of fresh Qmp -- with minor dissem py! Dp here less alt.

Green flagging 200' upstream marks Point G.

POINT G. Qmp dike in Dp. We are now far enough east that Qmp is only dike-form and, as will be seen, it channels alt-min easterly into less-alt Dp. Here the blue and green flagging on the 'tuning fork' saguaro is over alt Dp near its contact, with Qmp under yellow and green flagging in creosote bush. Proceed to east-two sets of green flagging, one in the rill, mark a narrow (3-6') Qmp, low-relief, mod-ser dike.

On up T.H. Wash, less-ser Dp, ep-chlor coming in. (Ignore pink flagging between Points G and H until return). Go 300-400' upstream to white flagging.

POINT H. Series of low OC of Dp, still silic (q vlts, μ vlts). Ser down dramatically, orig textures evident. Careful exam reveals chlor vlts and impregs. Plag white to greenish, kaol-ser to chlor. No ep. Dp weakly prop., silic., erratic here.

Continue 300-400' upstream. Green flagging on S side demarcates Qmp dike, spheroidal weath, heavy ox, ser, ~80' wide. Dp ser at margins, propyl 10' beyond. Alt-min carried well east of last descrip (propyl Dp).

100' farther along THW, green-blue flagging on Dp (jar \pm alunite-kaol), green-yellow on Qmp dike (heavy lim, goeth-hem). Both ser, an eastward 'prong' travelling along Qmp. Nearly fresh (NF) - prop Dp on either side. Sharp color-change a few feet upstream is return to Dp.

Upstream 100' is grotto-waterfall to left (N) behind mesquite. Plunge-pool and low plunge is in Dp, clear contact above first cataract, heavy-lim (jar) Qmp above.

Upstream 150' from TH Cataract (!), 350' from bend, is orange flagging of Point I.

POINT I. Weakly propyl. Dp, rock grayish, greenish cast. Still well frac, mod. q vns, but fewer. Ep vlts, some chlor, bleached. Variable chloritization-epidotization continues for 1000 feet beyond here, generally with chlor-ep, ep-chlor-cal, ep-cal zones. At the base of Point I sign are pieces of ep-veined, bleached Dp, and much darker, NF Dp. Note that the OC here resembles the epveined bleached material--the OCs are importantly altered. There are no more formal stops beyond here, but feel free to press on upstream toward the B mont l-gn-bar-fl occurrence, (probably mid-Tertiary). Between

here and there, prop yields to NF. For example, 200-250' beyond Point I (in wash under green flag in dying mesquite) are strong epidote clots and veinlets with K-feld.

Feel free to turn S anywhere along THW, from here or to the east; cover country, go uphill, generally working west (back down-stream) toward Breccia Ridge. Or—head down THW, veer left down wash at Point H sign, and follow pink flagging uphill to South.

Upslope from THW, first grade crosses Qmp dike—look at alt-min-ox. First knoll is Dp, sparse frac, weak ser, well east of phyllic alt. Continue to knoll.

Ridge Crest Knoll (pink and yellow flagging) in goeth-jar-al, hem-jar, mod.-structured Dp. Probably some cc; fracs pred N70W. Heavy alunite on S side of knoll—1/2" vlt. Facing due N here (the mid-distance peak beyond color anomaly), color contrasts to W, N, and E are clear--less hem, more goeth across canyon, no cc=propyl. Qmp dike low on NW near hill; trace Qmp dike from Point G in THW up hill to E. Two Qmp dikes are joined by a Qlp one.

Is this a copper province? Due W on skyline, the distant round knob with the nipple is Vekol Peak, site of Vekol deposit. Nearer and next to N are Slate Mts at Lakeshore mine. Through notch just W of N is Casa Grande Mt--ASARCO's Sacaton mine may be visible. Casa Grande West is west of Sacaton. Yes!

Follow pink flags up to skyline saddle, (where Silver Bells(?) are in bloom, with lupine, California poppies, brittlebrush). 50 feet SE of saddle is a knoll with a thin pebble--breccia dike with Dp and atzite pebbles which projects to Point J. SB obvious; mines and prospects down to SE near road to microwave tower are along another Qmp dike.

Follow Breccia Ridge to west. Note that N70W jt direction yields progressively to stockwork. Structure more pron. westerly--well devel near Survey Beacon, leached vlt, stkws. 20' from Beacon on crest is pebble dike marked with orange flagging.

POINT J, white flagging. Nearby orange flagging traces clear-cut pebble dike 1-2 feet wide, 50 feet long, well-rnded pebbles, traceable precisely along ridge crest. Almost certainly 'leading edge' of Qmp dike 200-300' below. Excellent fracture net-stkwk here, alun vlt. Mod. leaching.

Proceed W along ridge. Old prospect pit--ironwood tree prob. 100 years old means Silver era prospect. Cu stain in shear. Some prospects contain 30-foot saguaro, indicate a +150 year age of the prospect. Some of these early pits must have been dug by Indians or early Spaniards.

100' east from lowest saddle or ridge (orange and pink flag) is excellent breccia dike zone, round and angular frags. We are approaching breccia pipes--structure, alt, and min will augment westerly. Look west to next hill and its hem stain, part of the augmentation. Move over to it, note pron. incr. in q veining-silic. Look west from here (yellow-green flagging), another picture stop, of shatter and true breccia pipes. The topographic arc low on the S side of the prominent pipe-hillock is a Qmp dike. Breccia bottoms in Qmp and is cut by Qmp dikes.

POINT K (red flagging) is right on a 3' Qmp dike which clearly cuts shatter bx. Nearest prominent knoll (20-30') is shatter bx. Look at it -- 'frags' not rotated. Walk across next 2 knobs past shatter breccia knoll 30-40 feet from Point K to pipes of true intrusive breccia -- rock flour; rotated frags of Dp, basement. Blue flagging=division between shatter and true bx at last knoll -- red circle outlines 18" Dp bx clast with 1/2" q veins ending at clast margin, clearly a rotated intramin frag. Study bx continuing along N side. Cu stains. Bx=vent-fissure pipe complex, Qmp against bx on S side. Proceed down to saddle with Microwave Tower road. Several Qmp dikes cut through here--pink flagging on miniature fishhook cactus is precisely above Qmp (right)-Dp (left) contact. Dp increasingly ser, but ox Cu present--not strongly pyritized-leached. Nontronite, spotty dendrites indicate 500 ppmCu.

From Microwave Road Saddle, proceed west along old road with pink flagging. Note increasing silic, flooding, geometrically like K-alt; we are nearing a return to Adit Hill and Point C. Note K-alt-K-feldspar-q-flooding coming in to end of road, with increasingly interesting limonites, both qual and quant. At end of road, turn back to NE and go to top of hill.

On NW side of hilltop is a small prospect pit in Dp with strong silic, ser, and 'Golden gertie' limonite, that 80% jarosite-20% goethite mix that bodes so well. Relief limonite on ex py-cc vlt. Stockwork, 'spotty' high-Cu-Mn-ox dendrites, Qmp dike nearby. This area one of pervasive ser, minimal vlt control. 10' N of Survey Station (1'E of Anchor) is nice turgite. 25' NE of Survey Station are heavy Cu-stained vlt. The whole hill is silicified with ser variable from 30 to 100%, mod. vlt. density. From here look west--the RR cut of Point B is clearly visible. It's orangey goethite, as it should be, from oxidation of biotite, magnetite, and sparse sul. But the nearer Adit Hill (above Point C, the adit) is anomalously goethitic--it should be redder, more hematitic--except that its sec cc blanket isn't (after all) very rich.

Proceed downhill, through bleached ser, hem-goeth-jar-stained Dp to Bowtie Saddle. In saddle, Qmp (we're near the Qmp stock area) and Dp are Cu-stained, sericitized, and show spotty high-Cu dendrites. Look at these excellent road cuts.

From Saddle, continue along road with gentle downgrade to west and pink flags, approaching west face of Adit Hill. Strong jarosite (higher pyrite) relict textures, patchy hem after cc, abundant Cu stains, higher q-silicification, mixed potassic-phyllic alt. Jarosite and Cu definitely increase to west; CDHc are Dp with q-mb. Road hooks to N at its end, adit in sight below.

Note here that the dumps from the adit are jarosite-stained in near pile, earliest-dumped and first-excavated; then hematite-stained material. More distant dump area is 'ore piles' of slightly greenish "post-mine" oxidized, cc-enriched "ore", q.v.

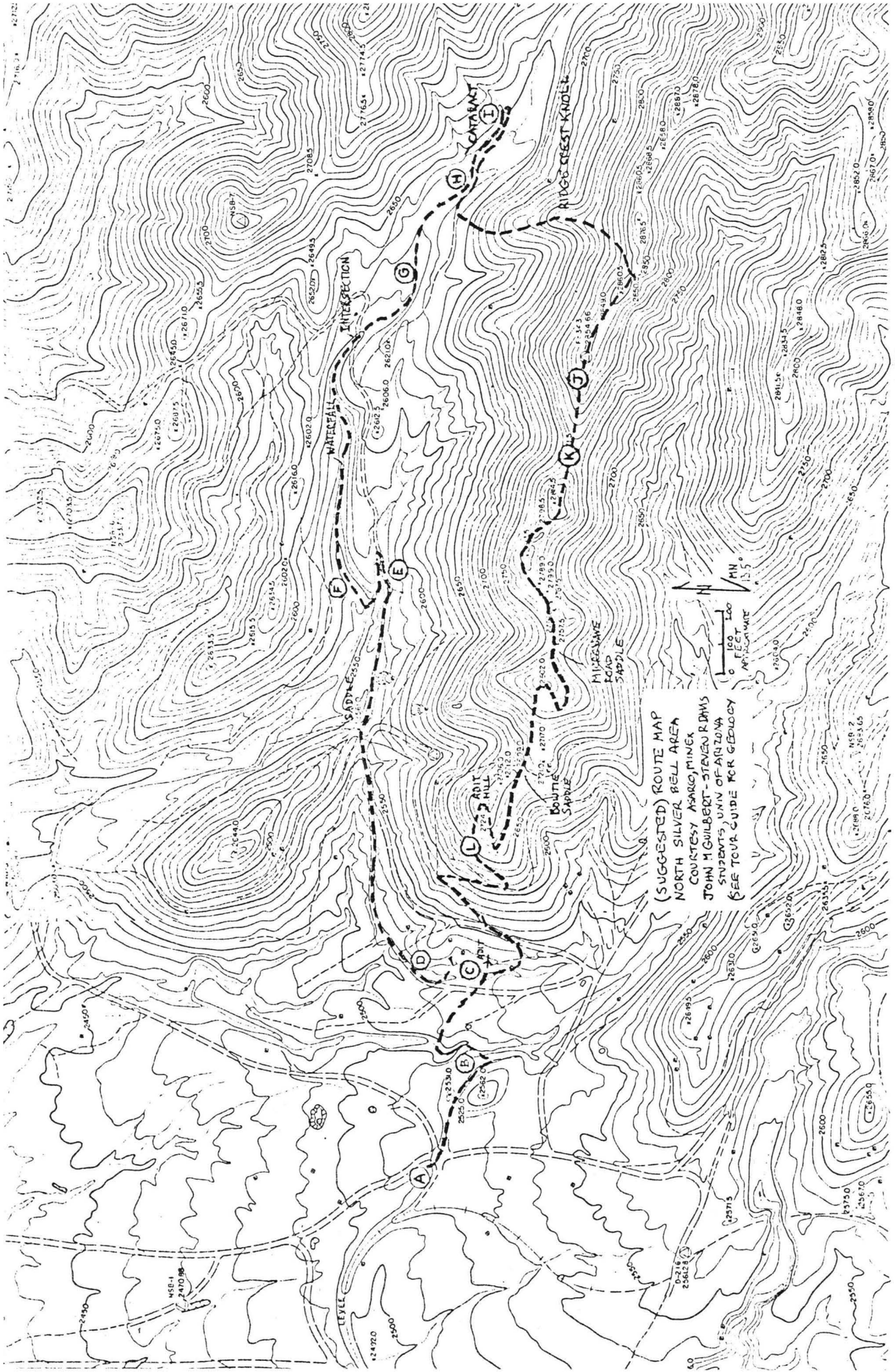
Proceed from 'hook' in road uphill to hilltop and green-white flagging. Enroute, K-alt and ser obvious, ser younger. Mod-low structure density, mod. jarosite. Qmp summit, moderate structure density, jarosite-goethite stain not too impressive.

Walk downhill to NW to Drill Station, Point L.

POINT L. This OC is in Dp-the wall of the bulldozer cut is an excellent exposure of a K-alt silicified stockwork, with veinlets with q-sulfide center-lines, now with jarositic limonites, 'spotty' dendrites of more than 500 ppmCu, but with minimal Cu ox stains. CDHc here are mixed-Dp > Qmp, but clearly Qmp is at depth (latest CDHc). Ser-silic frags, py common, with some moly and minor cc.

From here, walk due west down hill to Adit portal (Point C). Capping propitious, but not 'classic'. Hematite, jarosite, goethite on q-ser vlt's obvious, but quantitatively subordinate. Walk over this hillside carefully-it is at boundary between potassic and phyllic and is underlain by only marginally subeconomic 'ore'.

The loop has been closed. The tour has travelled from potassic into superposed phyllic of first low, then total extensiveness, diminishing eastwardly (except along sub-outcrop Qmp stocks-and outcropping Qmp dikes) to chlor, chlor-ep, chlor-ep-cal propylitic, then back into the nucleus via an increase from fractures to shatter box to true intrusive breccia, with a shift from prop to phyllic to potassic and with corresponding change in qualitative and quantitative limonites.



(SUGGESTED) ROUTE MAP
 NORTH SILVER BELL AREA
 COURTESY ASARGO, MINGX
 JOHN H GUILBERT-STEVEN R. DAHS
 STUDENTS, UNIV OF ARIZONA
 SEE TOUR GUIDE FOR GEOLOGY

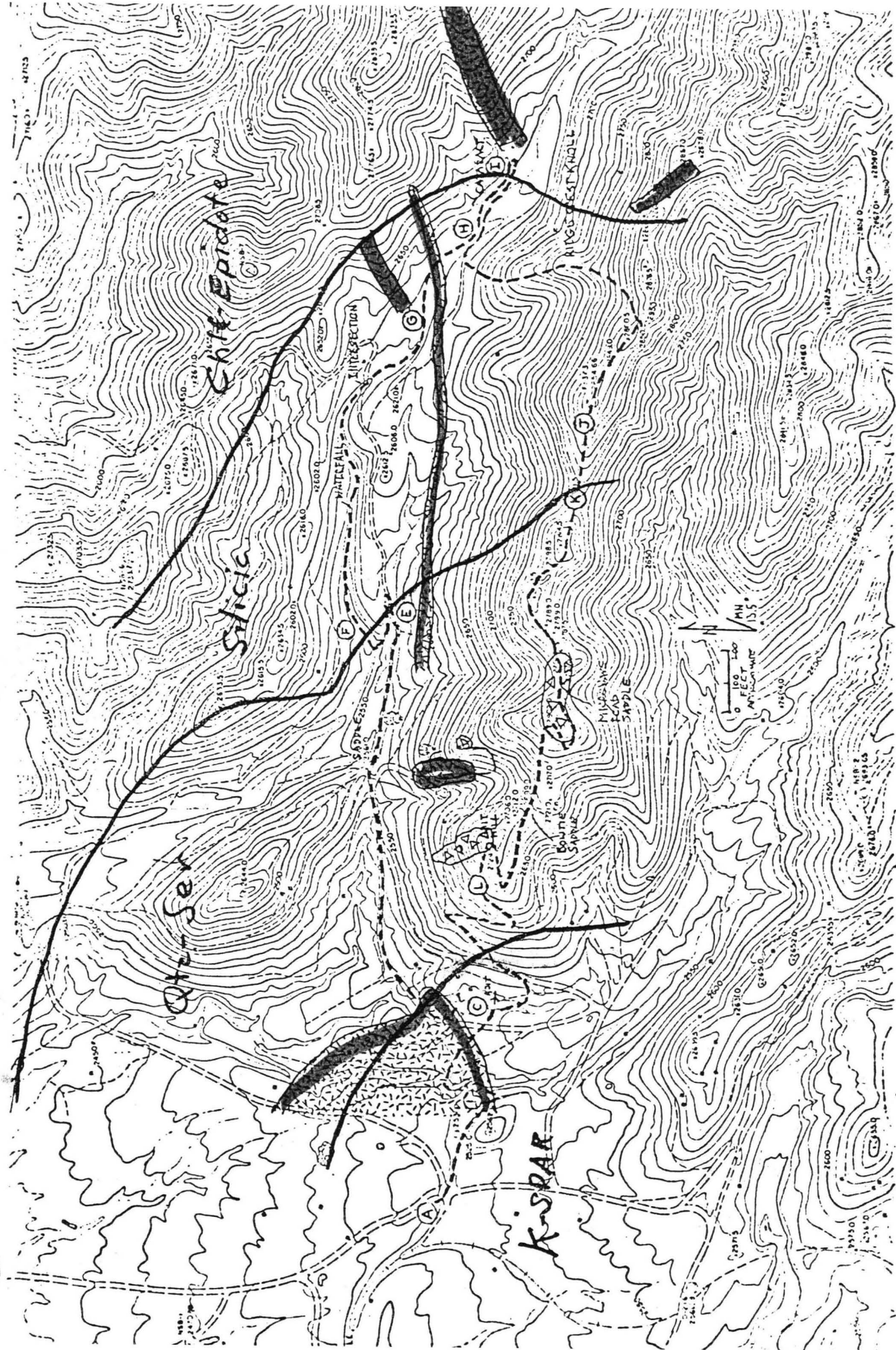


Qmp



Breccia

Dacite Porphyry



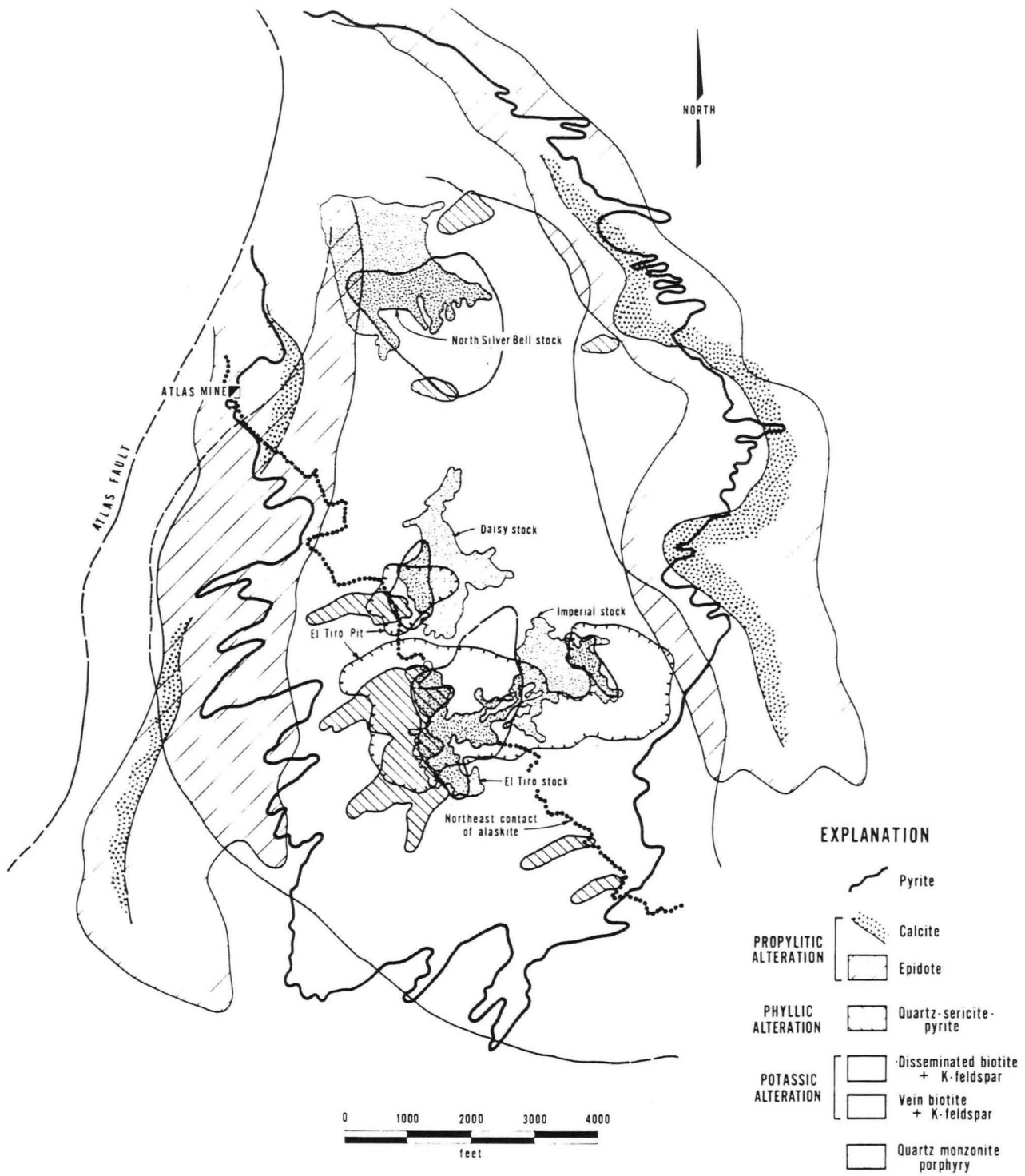
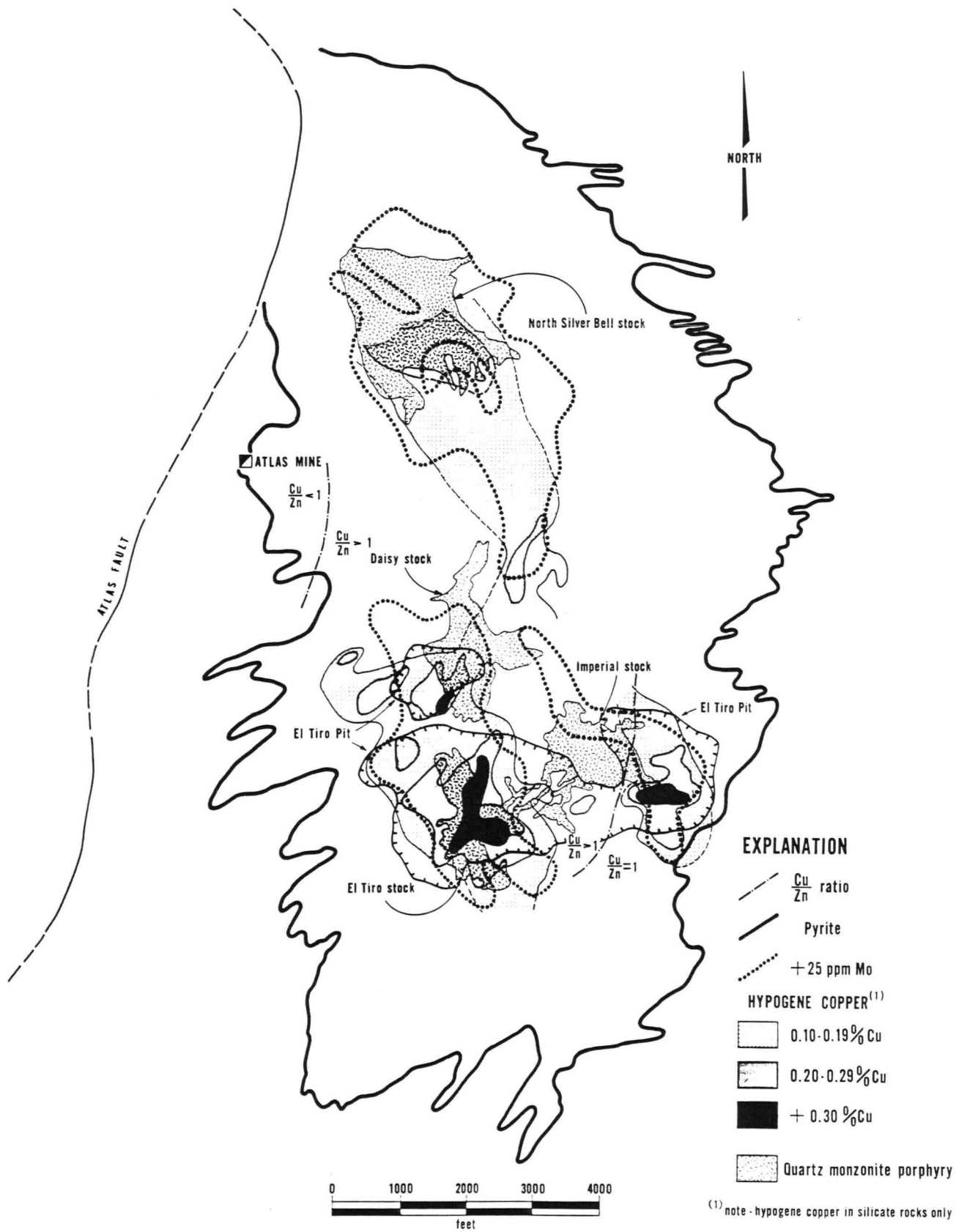


Figure 24.5. Alteration zones in the El Tiro area. Southwest of the alaskite contact potassic and propylitic assemblages are poorly developed and discontinuous, and zone boundaries are drawn on relatively few data points.



(1) note - hypogene copper in silicate rocks only

Figure 24.6. Mineralization zones in the El Tiro area