CONTACT INFORMATION
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Arizona Geological Survey
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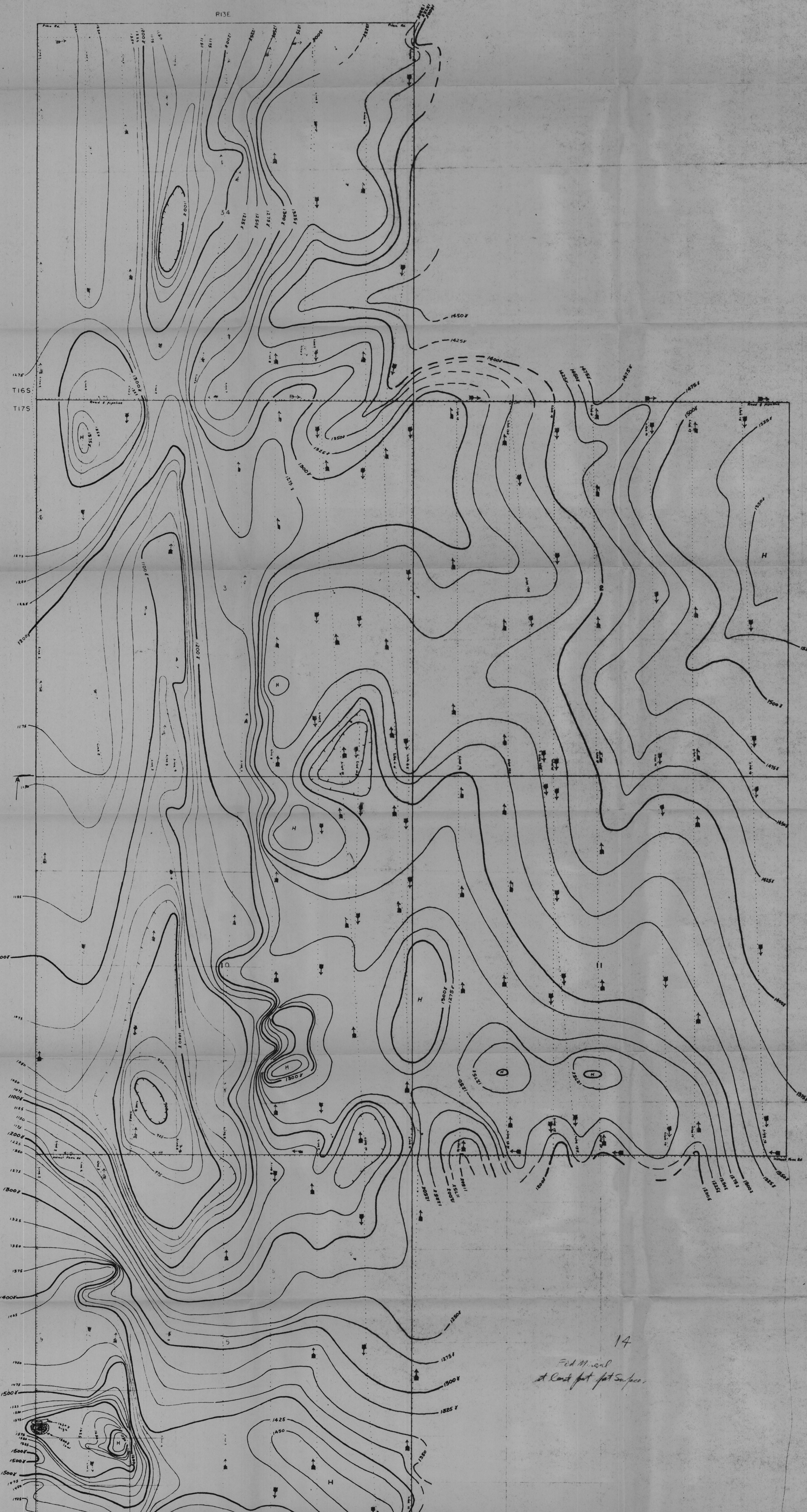
Phoenix, AZ, 85012
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov



CONTOURS ARE GAMMA VALUES USING 1000 FOR ARBITRARY BASE DATUM

DOTTED LINES ARE MOBILE MAGNETOMETER TRAVERSES

CONTOUR INTERVAL: 25 GAMMAS

N

SCALE: 1" = 400'

From: W. Y. Fish & W. H. Conlee, Jr.
Arizona Nucleonics, Inc.
2255 Aviation Highway
Ph. 622-7423.

MAGNETIC SURVEY
(TOTAL INTENSITY)

PIMA COUNTY, ARIZONA

FOR

SINALOA & WESTERN EXPLOR. SYNDICATE

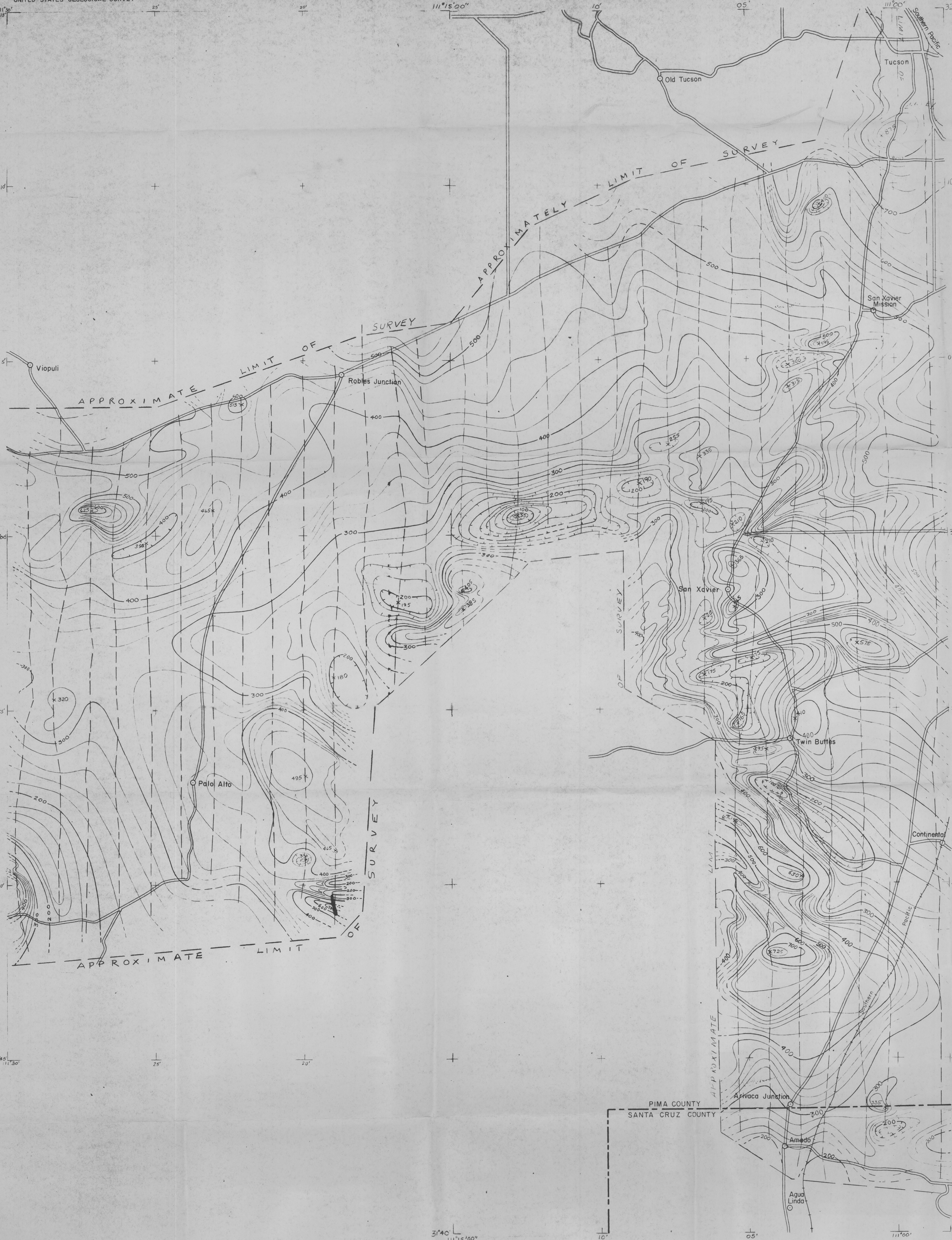
BY

HEINRICHS GEOEXPLORATION CO.
P.O. BOX 5671 TUCSON, ARIZONA
OCTOBER, 1960
REVISED

22

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

GEOPHYSICAL INVESTIGATIONS
PRELIMINARY MAP



EXPLANATION

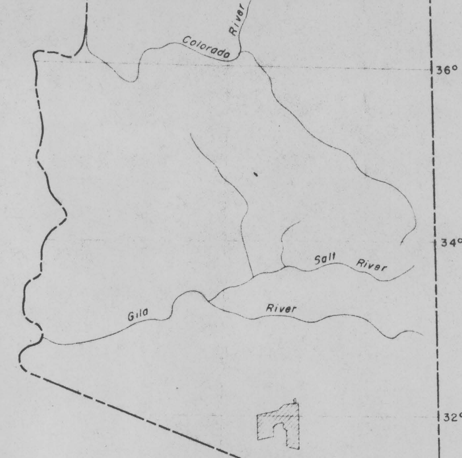
Magnetic contours
Showing total intensity of the earth's magnetic field in gammas, relative to arbitrary datum; hachured to indicate closed areas of lower magnetic intensity; dashed where data are incomplete

Measured maximum or minimum intensity within closed high or closed low

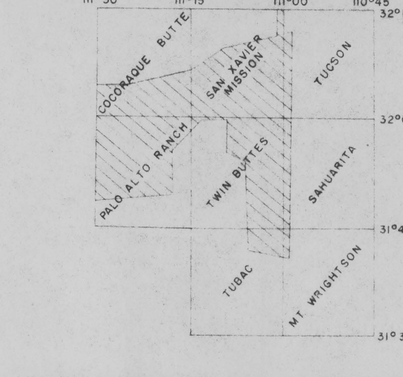
Flight path
Showing location and spacing of data

NOTE

Aeromagnetic data are obtained and compiled along a continuous line, whereas ground magnetic surveys are made at separate points. Errors within the normal limits of any magnetic measurement may cause slight discrepancies between flight lines in an aeromagnetic map, which would be more obvious than similar discrepancies between points in a ground magnetic map. For this reason as much care should be exercised in evaluating magnetic features that appear as elongations along a single aeromagnetic traverse as in interpreting an anomaly indicated by a single ground station.



INDEX MAP OF ARIZONA SHOWING LOCATION OF AEROMAGNETIC SURVEY MADE AT 4000 FEET BAROMETRIC ELEVATION, 1959



INDEX MAP SHOWING U.S. GEOLOGICAL SURVEY TOPOGRAPHIC QUADRANGLE MAPS USED AS COMPILATION BASE

AEROMAGNETIC MAP OF THE TWIN BUTTES AREA, PIMA AND SANTA CRUZ COUNTIES, ARIZONA - FLOWN AT 4,000 FEET BAROMETRIC ELEVATION

By
Gordon E. Andreasen and James A. Pitkin
Scale 1:62 500
1 0 1 2 3 MILES
Contour intervals 20 and 100 gammas
1962

APPROXIMATE MEAN DECLINATION

MINERALS EXPLORATION COMPANY
1708 WEST GRANT ROAD, GRANT ROAD INDUSTRIAL CENTER
TUCSON, ARIZONA 85705

HEAD OFFICE:
P. O. BOX 54945
LOS ANGELES, CALIFORNIA 90054
AREA CODE (602) 624-1572

August 6, 1971

Mr. James L. Kelly
Anaconda Company
Box 127
Sahuarita, AZ 85629

Dear Mr. Kelly:

Please accept my thanks for the interesting tour of the Twin Buttes pit given to us by Wilson McCurry. I was particularly interested, of course, in the exposures of breccia pipes, and what bearing they may have on the occurrence and distribution of ore minerals.

The large, central breccia pipe presents some intriguing problems. I had expected to find substantial mixing and rotation of fragments in such a large pipe (300 ft. x 700 ft). I was surprised but not disappointed to find that it was a quartz-filled dilation breccia with little apparent rotation or displacement. Also, there seemed to be little evidence of corrosion along the edges of the fragments.

The question then becomes, what happened to the 30-50% volume of rock now occupied by the relatively barren quartz filling. The pipe has a common, if not typical, shape in plain view so I conclude that the pre-quartz fracturing is a near-surface expression of a deeper, possibly mineralized breccia pipe. The fact that the fragments are pyritized, but not affected by the subsequent ore-mineral forming fluids indicates that the pipe (quartz filling) was formed later than the earliest sulfide mineralization and earlier(?) than the copper mineralization adjacent to the pipe. Therefore, a deeper part of the pipe could reasonably be expected to show collapse features and mineralization associated with the first (and second?) stage of copper sulfide formation. If the direction of plunge of the pipe is known, a deep drill hole intersection of the pipe would answer a number of geological questions that could prove useful to future development at Twin Buttes or similar mineral deposits.

The extent of the xenolithic porphyry is also of interest to me as another possible evidence of breccia pipe formation. The presence of scattered mineralized (ore) fragments in a "B" porphyry matrix suggests a possible post-mineral intrusion of "B" porphyry up a breccia pipe "vent", flushing the breccia up and out of the vent. If this is true, the shape of the xenolithic porphyry should be compatible with a preceding breccia pipe (carrot shaped).

The implications of the "x" breccia north of the pit fault on the northeast side of the pit are also interesting. The "x" breccia has the physical appearance of a pebble dike of intrusive breccia with a coarse phlogopitic matrix. The emplacement process indicates a fluidized system not observed elsewhere in the pit. The inference is that one (or more) of the breccia pipes in the area was fluidized at some time during its development and was the source for "x" breccia-type pebble dikes.

I hope you will not consider these speculations too presumptuous, based as they are on a very brief visit to the pit. Obviously I am not hampered by the necessity of rationalizing any of the facts developed by careful field work over a number of years.

Again let me extend our thanks for the opportunity of observing another fascinating occurrence of breccia pipes.

Sincerely yours,

H. T. Eyrich
Regional Exploration Manager

HTE:sg

cc: Wilson G. McCurry

MINE		MINING DISTRICT
Twin Buttes (Cu, -Pb?, Mo??)		Twin Buttes

COUNTY	STATE	COUNTRY
Pima	Arizona	U.S.A.

AMS 1° x 2° Topographic Map	U.S.G.S. Topographic Map 30'
Nogales	None
U.S.G.S. Topographic Map 15'	**U.S.G.S. Topographic Map 7-1/2'**
Twin Buttes	None

AERIAL PHOTOGRAPHY AVAILABLE: (Including photo mosaics)
AMS: Photomosaic 55AM81, sheet 3, (1:250,000). Photography - 1956, 1:50,000, Project 55AM81, Roll 4, Nos. 301-302.

GEOLOGIC MAPS AVAILABLE:
Pima and Santa Cruz Counties, 1960, 1:375,000: Arizona Bureau of Mines.
Cooper, J. R., 1960, (see reference below) 1:31,680.

OTHER MAPS AVAILABLE:
Aeromagnetic map (see reference below).
Gravity map (see reference below).

REFERENCES

Cooper, J. R., 1960, Some geologic features of the Pima mining district, Pima County, Arizona: U.S. Geol. Survey Bull. 1112-C, p. 63-103.

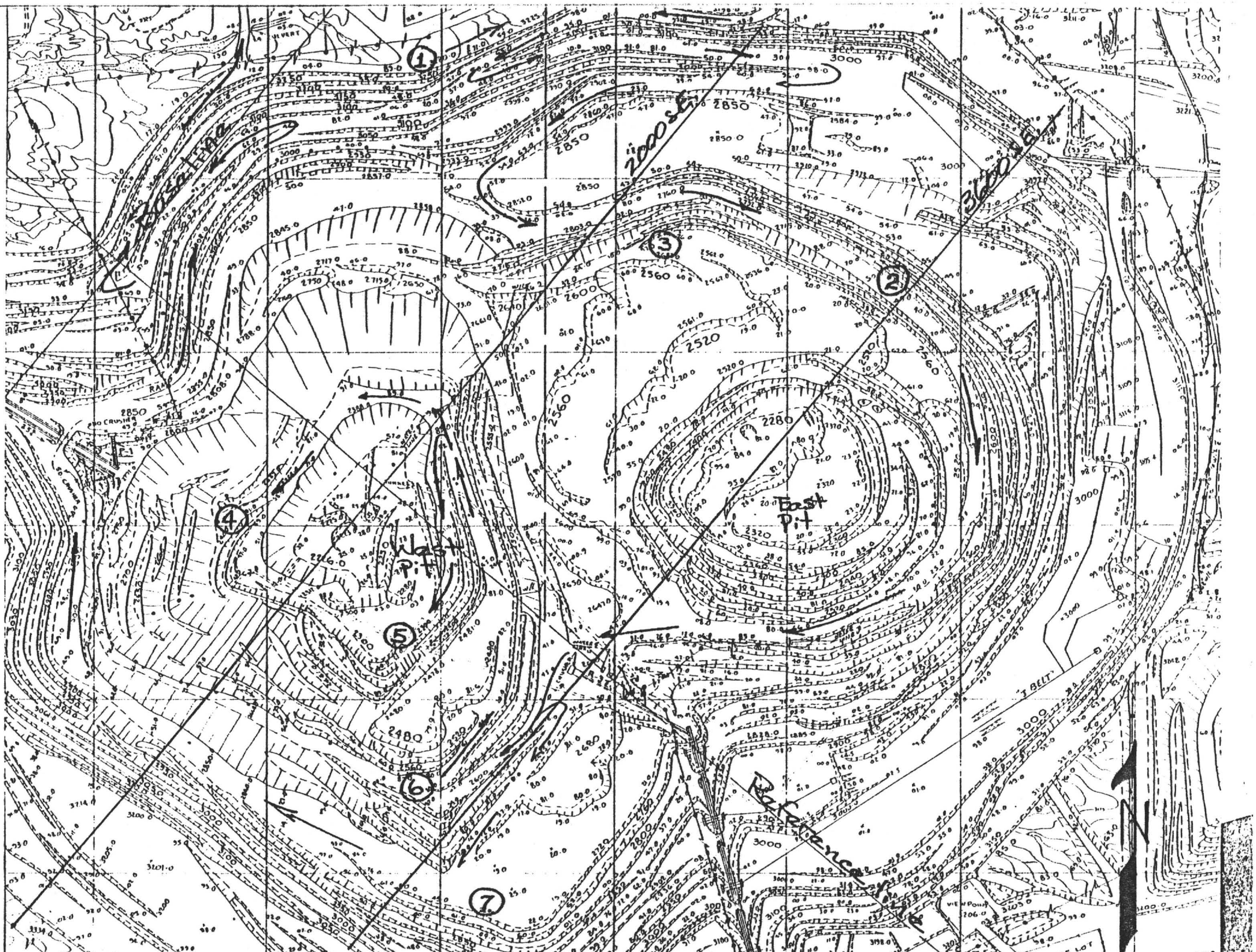
Lacy, W. C., 1959, Structure and ore deposits of the east side of the Sierrita Mountains: Ariz. Geol. Soc. Digest, V. 2, p. 185-192.

Schmitt, H. A., 1959, The copper province of the Southwest: Mining Engineering, V. 11, p. 597-600.

Andreasen, G. E., and Pitkin, J. A., 1963, Aeromagnetic map of the Twin Buttes Area: USGS Map GP-426 (1:62,500) 50¢.

Plouff, D., 1961, Gravity Survey near Tucson, Arizona: U. S. Geol. Survey Professional Paper 424-D, Art. 384, p. D258-D259.

Frischknecht, F. C., Ekren, E. B., 1961, Electromagnetic Studies in the Twin Buttes Quadrangle, Arizona: U.S. Geol. Survey Professional Paper 424-D, Art 385, p. D259-D261.



Twin Buttes Mine   ANAMAX Mining Co.   Approx. Scale 1" = 670'   1 Jan. 1978

1-745

TABLE I
Rocks of the Southern Pima Mining District
Pima County, Arizona

Age	Formation, Members		Description	Thickness - Feet	(Meters)	Age Dates (M.Y.)
Holocene thru Pliocene	"Alluvium"		Sands, gravels, caliche conglomerate at base.	0-1000**	(0-305)	
Miocene	Formation of Tinaja Peak		Volcanics, gravel and sands.	?		
			Andesite dike.			23.6 (K-Ar, B)
Oligocene	Helmet Fanglomerate		Fanglomerate, andesite flow, tuffs and monolithic breccias.	10,500	(3200)	27.9 (K-Ar, B) tuff 20.7 (K-Ar) andesite
Paleocene	Quartz monzonite porphyry		Variable texture, Twin Buttes Mine intrusives.			56.9 (K-Ar, B) 58.6 (K-Ar, B)
	Biotite Rhyolite		Quartz latite tuff with lithic fragments.	?		57 and 58 (K-Ar, B)
	Ruby Star Granodiorite		Granodiorite, quartz monzonite and aplite.			57.1, 58.7, 59 61.4 (K-Ar, B)
Late Cretaceous	Red Boy Rhyolite		Rhyolite flows and tuffs.	700-1000	(214-305)	
	Demetrie Volcanics		Basal conglomerate, andesite flows and breccia, local rhyolitic tuff.	8000	(2440)	
Early Cretaceous	Angelica Arkose	Ma_3*	Arkose and siltstone with beds conglomerate.	to 1300**	(to 397)	
		Mac*	Conglomerate, volcanic clasts.	50-300**	(15-92)	
Jurassic (?)	Whitcomb Quartzite	Ma_2*	Quartzite and arkose.	10-270**	(3-82)	
		Mav*	Quartzite and acidic volcanics.	0-190**	(0-58)	
		Mv*	Rhyodacite tuff, partly welded.	0-280**	(0-85)	
		Ma_1*	Quartzite and acidic volcanics.	0-220**	(0-67)	
Jurassic	Sierrita Granite		Granite, aplite and gneiss.			140 (RB-Sr, WR) 150 (Pb-a, Z)
Triassic	Harris Ranch Monzonite		Monzonite, granite and quartz monzonite.			190 and 210 (Pb-a, Z)
	Rodolfo Formation	Msv*	Siltstone and volcanics.	0-1000**	(0-305)	
		M_L*	Conglomerate, carbonate-rich.	0-250**	(0-76)	
	Ox Frame Volcanics		Rhyolitic to dacitic volcanics and quartzite.	4000+	(1200+)	
Permian	Rain Valley Formation		Limestone, minor sandstone beds.	+400**	(122)	
	Concha Limestone		Cherty limestone.	+480**	(146)	
	Scherrer Formation	Ps_4*	Quartzite, local carbonate beds.	50-120**	(15-37)	
		Ps_3*	Dolomite, local beds sandstone.	80-140**	(15-37)	
		Ps_1*	Quartzite, partly bimodal, minor carbonate beds.	150-320**	(46-98)	
	Epitaph Formation	Pe_4*	Interbedded siltstone and limestone, local anhydrite and quartzite.	90-150**	(27-46)	
		Pe_3*	Limestone, minor siltstone and anhydrite.	100-270**	(31-82)	
		Pe_2*	Interbedded siltstone, dolomite, limestone and anhydrite.	100-350**	(31-107)	
		Pe_1*	Siltstone, minor anhydrite.	150-380**	(46-116)	
	Colina Limestone		Limestone, thin beds siltstone, anhydrite and local quartzite.	230-370**	(70-113)	
	Earp Formation		Siltstone and standstone, partly limy and dolomitic; beds limestone and shale.	300(?)-500**	(92(?)-153)	
Pennsylvanian	Horquilla Limestone		Limestone, beds siltstone, quartzite near base.	550(?)-980	(168(?)-299)	
	Black Prince Limestone		Chert and limestone pebble to cobble conglomerate, local ferruginous shale.	0-32	(0-10)	
Mississippian	Escabrosa Limestone		Limestone, partly cherty.	200-450	(61-137)	
Devonian	Martin Formation		Dolomite, limestone and local siltstone.	±240**	(±73)	
Cambrian	Abrigo Formation	Cal*	Interbedded limestone and siltstone.	290-350**	(+85)	
		Caq*	Interbedded quartzite, shale and siltstone.	+280**	(+85)	
	Bolsa Quartzite		Quartzite, local basal conglomerate.	170-290**	(52-88)	
Precambrian	Granite		Granite, locally gneissic, local Pinal Schist inclusions.			850 (Pb-a, Z)

* Member nomenclature, as on Twin Buttes maps.

** Thickness in Twin Buttes mine.

ACM Twin Buttes