DEPARTMENT OF THE INTERIOR
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Follow-up Evaluation of Fifteen Geochemically Anomalous Areas and Evaluation of Four Prospects in the Farah Garan-Kutam Mineral Belt, Kingdom of Saudi Arabia

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ABSTRACT

A follow-up exploration program was conducted in fifteen areas anomalous in precious and base metals within the Farah Garan - Kutam mineral belt, which forms part of a strongly deformed greenstone terrane in the southern part of the Proterozoic Arabian Shield. Using detailed chip-sample traverses, the program also evaluated four mineralized prospects, two of which (Raiah and Al Misadij prospects) had been recognized before the exploration program began; the additional two prospects (Kuhaym and Khathl prospects) were discovered during the course of the exploration program.

Mineralized rock discovered during the exploration program consists of three types: (1) precious- and base-metal occurrences associated with large, lenticular, quartz-veined dolomitic bodies interpreted to be submarine exhalative deposits; the highest metal-concentration values are associated with silicified shear zones within the dolomite, which commonly were the sites of ancient mines; (2) precious- and base-metal mineralization associated with several small, isolated quartz veins scattered throughout the mineral belt; and (3) zones (several kilometers long and several hundred meters wide, with long axes oriented parallel to foliation) of variably silicified and pyritized greenstone and quartz-sericite phyllite; extensively dolomitized rock generally occurs in a zone surrounding the silicified and pyritized rock. Grades and (or) tonnages of all occurrences discovered during the exploration program are low--the silicified and pyritized zones are entirely barren of base or precious metals--and no further work on them is recommended.

The only significant mineralization discovered within the study area is located at the Raiah prospect, where a silicified shear zone (about 1 m wide) in lenticular exhalative dolomite body, contains as much as 5 ppm Au, 85 ppm Ag, 1.1 percent Cu, 2.6 percent Pb, and 10.7 percent Zn. Concentrations of the same elements within the surrounding dolomite are anomalously high, although they are significantly lower than values obtained in the shear zone. The inferred small tonnage of the deposit does not warrant further study.

INTRODUCTION

This report summarizes the results of a program of exploration for and sampling of mineralized rocks in the region of the Farah Garan ancient mines, which are located in the southern Arabian Shield of the Kingdom of Saudi Arabia at about lat 17° 40' N., long 43° 39' E. This study, undertaken during November and December, 1988, is part of a program of mapping and resource evaluation in the Farah Garan - Kutam mineral belt conducted by the U.S. Geological Survey Saudi Arabian Mission in accordance with the Ninth Extension of the Work Agreement between the Saudi Arabian Directorate General of Mineral Resources and the U.S. Geological Survey under Subproject 3.03.10. The report was technically reviewed by P.R. Johnson.

The study involved two phases. During phase I, detailed investigations were undertaken of previously determined wadi sediment anomalies (Saleh, 1985; and Samater, 1989) in an attempt to determine the source of the anomalies. During phase II, chip sampling across four zones of sulfide mineralization was carried out; two of these zones were previously identified during regional mapping (A.A. Bookstrom and W.R. Vennum, unpub. data) and the other two were located during investigation of wadi-sediment anomalies.

The Farah Garan region is dissected by numerous wadis that flow generally east and the topography is rugged, with about 800 m of relief. Numerous ancient mines located in the area, from which copper and (or) gold were recovered, attest to the mineralized nature of the region. Most of the ancient mines have been sampled and many of them have been studied in detail (Smith and others, 1977; Smith, 1979; and Parker, 1982). These studies concluded that the potential for recovery of base metals was low, although Smith (1979) and Sanderson (1984) recommended further work in the area of the Farah Garan ancient mines. Based largely on the amount of work previously done on ancient mine sites, the present study focused on discovering new zones of mineralization in unmined areas.

GEOLOGIC SETTING

All rocks studied during this investigation were grouped within the late Proterozoic Jiddah group by Anderson (1978), although Parker (1982) mapped only lithofacies within the region without using formal unit designations. The layered rocks comprise a steeply west-dipping metavolcanic and metasedimentary sequence that was metamorphosed as high as the greenschist facies; rocks in the western part of the mineral belt reached lower amphibolite facies (Parker, 1982), probably due to the effects of contact metamorphism near intrusions. Shearing is locally pervasive and many contacts between units are tectonic.

Geologic mapping in conjunction with current exploration of the Farah Garan - Kutam mineral belt (Bookstrom, Vennum, and others, 1989) revealed that metavolcanic rocks are more abundant than metasedimentary rocks and constitute a bimodal suite of basalt and dacite. This sequence of layered rocks was forcibly intruded by two batholiths of intermediate composition: the Wadi Tarib batholith (west of the present study area) and the Hadadah pluton (at the eastern margin of the study area). The homoclinal-appearing metamorphic sequence generally strikes north-northeast and dips steeply northwest. It is, however, tightly folded internally and has undergone extensive ductile shearing approximately parallel to the axial planes of the folds. For further details of the geology of the region, refer to Bookstrom, El Komi, and others (1989) and Doebrich (1989).

EVALUATION OF WADI-SEDIMENT ANOMALIES

DEFINITION OF TARGET AREAS AND THEIR SUBSEQUENT EXPLORATION

In a separate study (Samater, 1989), panned concentrates obtained from 450 wadi-sediment samples collected throughout the Farah Garan district were analyzed for gold, silver, copper, lead, and zinc; anomalous values for these elements defined 21 exploration targets (Samater's targets are preceeded by an "A" on plate 1 and in the subsequent discussion). During the present study, traverses across 14 of these target areas were made mostly along wadi systems (plate 1) and all observed and suspected mineralized zones were chip sampled. In addition, one anomaly reported by Saleh (1985; his Y-7 anomaly, shown on plate 1) was investigated, as were several sites outside the geochemically defined target areas. This study's sampling program concentrated on areas containing gold anomalies, and selected wadis upstream from sites that yielded gold values greater than 0.2 ppm in pan concentrates were traversed. Ancient mines were present in five of the target areas (A-4, A-14, A-15, A-16, and A-18), although these mines have already been studied in detail (Smith, 1979; Parker, 1982; Bookstrom, 1989; and Doebrich, 1989); consequently, relatively few composite samples were collected at several of the mines.

Wadis and ridges were walked within each target area and any zones of suspected mineralization were chip sampled. Within most mineralized zones, one sample was collected and each sample was a composite of chips from the area of mineralization (generally greater than about 4 m^2). Most mineralization encountered during the traverses consisted of 1) quartz veins, commonly containing limonitic clots and, rarely, copper mineralization; some small ferruginous and (or) dolomitic zones adjacent to the quartz veins were also sampled, 2) pyritic and locally silicified quartz-sericite phyllite, typically containing conspicuous blue-gray quartz "eyes", and 3) sideritic, brown, quartz-veined dolomite.

Two new prospects, in addition to two prospects previously identified during regional mapping (and described in the next section), were found during the evaluation of wadi-sediment anomalies. One prospect (Kuhaym prospect of this report) was found near the largest gold anomaly found in the district by Samater (24 ppm Au in pan concentrates at one site only in target A-20); the prospect consists of a large zone of silicified pyritic greenstone interlayered with metamorphosed hornblende diorite. The second prospect (the Khathl prospect of this report) is located at the eastern, downstream end of another geochemical anomaly (A-17). The mineralized area was initially identified from the air by its characteristic reddish alteration and is the largest area of pyritic mineralization known in the Farah Garan mineral belt.

The sampled target areas are described individually below. All cited gold and silver values from pan concentrates are from Samater (1989). Study of frequency-verses concentration histograms yielded threshold values of 0.2 ppm for gold and silver. Any gold and silver values greater than 0.2 ppm are considered anomalous.

Target A-1 (samples 243235 and 243237-243240)

This area is anomalous in silver, with as much as 36 ppm Ag detected in pan-concentrate samples, and is underlain by rocks that include metabasalts (locally showing good pillow structure), quartz-sericite±chlorite phyllite, and quartz diorite. Dolomitization is locally strong. Observed mineralization is minor, consisting of small, slightly ferruginous oxidized zones (all samples).

Target A-2 (samples 243304-243307)

Gold is weakly anomalous in this area (less than 2 ppm in pan concentrates). Thin ferruginous and dolomitic margins on quartz veins cutting locally dolomitized chlorite phyllite and one slightly oxidized aplitic intrusive (243307) were sampled. One quartz vein (243305) contained thin stringers of chalcopyrite and malachite encrustations.

Target A-3 (samples 243203-243205, 243207-243211, 243213, and 243215-243219)

This target area is located immediatly south of the Farah Garan mine area and partly in the runoff area that leads from it. Pan concentrates of wadi-sediment samples indicate that this area contains weak gold, silver, copper, lead, and zinc anomalies. Most samples are from quartz veins with limonitic and dolomitic margins cutting variably dolomitized quartz-sericite phyllite. Two pods of brown sideritic dolomite (243209 and 243210) were sampled, as was a zone of silicified pyritic quartz-sericite phyllite approximately 300 m long and as much as 20 m wide (243215-243219).

Target A-4 (samples 243327-243330)

This area includes the Farah Garan ancient mines, as well as the Raiah prospect, which is described separately in the next section of this report. The bedrock was examined along one wadi, in which a gold anomaly (3.7 ppm) was determined from pan concentrates, and quartz veins cutting "quartz-eye"

phyllite is common in the area. Sample 243318 was collected from a 10 by 30 m pod of brown-weathering, grayish-brown, coarse-grained dolomitic marble containing numerous small, randomly oriented veins and wisps of black-weathering (desert varnished) white quartz. Some thin, silicified ferruginous veins cut the marble. The pod is part of a narrow zone (at least 6 km long) of exhalative-dolomite bodies within extensively dolomitized, mostly tuffaceous metamorphic rocks.

Target A-17 (samples 243256, 243257, 243259-243262, 243264, 243268)

Gold is strongly anomalous (as high as 5.7 ppm in pan concentrates) in this area. Samples 243256 and 243257 were collected in ferruginous quartz veins as wide a 1 m cutting chlorite phyllite. Except for sample 243262, collected from a 1-m-wide ferruginous zone in quartz-eyed quartz-sericite phyllite, all other samples were collected from variably silicified and pyritized zones trending parallel to foliation. Samples 243259, 243260, and 243261 were chip composites, collected about 30 m apart along the 60-m-long strike of a silicified zone that is as much as 10 m wide and contains about 10 percent finely disseminated pyrite. Sample 243268 was collected from a 50-m-wide, strongly silicified, weakly pyritiferous, partially oxidized metatuff. The Khathl prospect, described in the next section, lies across the eastern, downstream side of target A-17.

Target A-18 (samples 243222-243227)

Two wadis contributing material to gold anomalies (as high as 2.2 ppm in pan concentrates) were traversed. Country rock is metabasalt or meta-andesite, progressively dolomitized toward the east. The Milha mine (Parker, 1982) is located immediately north of the target area and may be at least partly responsible for the largest gold anomaly. Zones of silicified and pyritized rock were sampled; samples 243222 and 243223 were collected from an approximate 10-m-wide zone of silicified disseminated pyrite in pillow basalts. Sample 243227 is bright-orange gossaniferous(?) soil; nearby outcrop is calcareous, but otherwise it is apparently unmineralized.

Target A-19 (samples 243233 and 243234)

Weak gold anomalies (as high as 0.7 ppm from pan concentrates) define this target and both samples were collected from iron-stained, dolomitic sericite± chlorite phyllite. Graphitic phyllite is immediately adjacent to 243234.

Target A-20 (samples 243241-243243, 243245, 243246, 243248, and 243250)

The largest gold anomaly measured from panned concentrates (24.0 ppm) in the Farah Garan district was found in this area. The Kuhaym prospect is adjacent to the northern boundary of the target area and does not contribute material to the site from which the 24-ppm gold anomaly was collected; gold concentrations at two wadi-sediment sampling sites draining the Kuhaym prospect were negligible. All rock-chip samples were collected in the small wadi that feeds the site of the 24.0-ppm gold anomaly. The upper part of the wadi is entirely underlain by quartz-sericite phyllite and the lower part contains well-layered metagraywacke and siliceous metatuff. Samples 243241-243243 were collected from micaceous, locally dolomitic

quartz-sericite phyllite and strongly quartz-veined brown dolomitic rock (243330) were sampled. The country rock is strongly dolomitized. The quartz veins contain abundant ferruginous, calcareous clots as large as 1 cm.

Targets A-5 and A-6 (samples 243285-243288)

Gold values from pan concentrates obtained from two localities along the main wadi that drains this area contain strong gold anomalies (3.7 and 6.4 ppm), although few alteration zones were found. Sample sites 243286 and 243288 are located outside of either target area were collected, but are from outcrops that contribute material to target A-6. All samples were collected from quartz veins cutting quartz-sericite±chlorite phyllite or quartz diorite. The veins have ferruginous and (or) calcareous margins. At sample site 243285, quartz-sericite phyllite country rock is slightly oxidized and displays sparse iron staining.

Target A-10 (samples 243297-243303)

This target is located north of the main area covered by plate 1 (see inset) and yielded only one anomalous gold value (2 ppm) from pan concentrates. All samples were collected from ferruginous and calcareous quartz veins cutting mostly quartz-sericite phyllite. One sample (243302) is a mixture of brown limonitic dolomite and quartz-vein material. Malachite staining was observed at sample site 243303, a 25-cm quartz vein cutting dolomitized quartz-sericite phyllite.

Target A-14 (samples 243319-243323)

The Hemair ancient mine (Smith, 1979) is located in this area, but except for the mine area itself, little evidence of mineralization was found. Small zones of oxidized and slightly iron-stained metagraywacke (243319) and quartz-sericite phyllite (243320 and 243321) were sampled. One quartz vein (243322), 2-3 m wide and containing ferruginous partings, cuts dolomitized metagraywacke. Chip sample 234323 was collected across a 50-cm-wide silicified, limonitic, and malachite-stained vein located at the south end of the Hemair mine.

Target A-15 (samples 243265-243267)

This target area contains the Al Asherfat ancient mines, although anomalies for all metals analyzed in pan concentrates are weak; the maximum gold anomaly found in the pan concentrates is 0.25 ppm. Two wadi systems were traversed: sample 234265 was collected from a 1 by 20 m gossan zone located in highly calcareous quartz-sericite phyllite; sample 234266 was collected from apparently unmineralized sheared quartz diorite in an ancient-mine pit; and sample 243267 was collected from a 5-m-wide zone of oxidation and iron staining in calcareous quartz-sericite phyllite.

Target A-16 (samples 243315-243318)

The wadi located above the site of the strongest gold anomaly (2.4 ppm in pan concentrates) in this target area was traversed. Most rock within this area is extensively dolomitized quartz-sericite±chlorite phyllite containing lenses of brown limonitic dolomite (samples 243315, 243316, and 243317). Typical "quartz-eye"

margins of quartz veins cutting quartz-sericite phyllite. Samples 243245 and 243246 were collected from slightly iron-stained quartz-sericite phyllite locally containing small pods of wad-encrusted quartz. Samples 243248 and 243250 were collected from highly siliceous metagraywacke and metatuff containing as much as 12 percent anhedral pyrite in blebs as large as one centimeter. The mineralized zone is about 10 m wide and extends at least 50 m approximately parallel to the strike of foliation; pyrite content is highly variable.

Target Y-7 (Saleh, 1985) (samples 243331-243334)

The wadi that was traversed feeds a site at which a 2-ppm gold anomaly (from a -180μm size fraction, not a pan concentrate) was measured during a regional geochemical sampling undertaken by Riofinex Ltd. The details of the Riofinex survey are unpublished, although Saleh (1985), in a report on a follow-up sampling program, presents some of the data obtained from the Riofinex work. The 2-ppm gold anomaly was the largest anomaly measured in the original Riofinex sampling program.

During the traverse of target Y-7, no significant mineralization was noted. Samples 243331 and 243332 were collected from outcrops located outside the target area, but are directly upstream. Sample 243331 was collected from a slightly oxidized zone (as much as 3 m wide and greater than 20 m long) in metagraywacke. Sample 243332 was collected in an area containing numerous small boudined quartz veins containing sooty vugs in metagraywacke. Sample 243333 was collected from a shear zone in quartz diorite, and sample 243334 was collected from zones of 1- to 2-cm-wide white, ribbon-like silicic bands cutting medium-grained pyritic greenstone; the rocks contain as much as 5 percent small pyrite cubes.

Samples collected from outside target areas

Two areas outside the target areas were sampled (not including samples 243286 and 243288, which are included with targets 5 and 6). These areas are located along an oxidized pyritic zone at Wadi Maslulah (samples 243228-243232), and in mostly exhalative dolomite near the ancient Hemair south mine (samples 243324-243326) (plate 1).

RESULTS OF TARGET EXPLORATION

Assay values for chip composite samples collected during target exploration are given in table 1 (plate 1). Significant precious and base-metal anomalies were found at only a few isolated outcrops, generally in rocks of very limited extent. All of the anomalous values were from either quartz veins or from ferruginous, brown dolomitic lenses (or siliceous veins cutting the dolomites) in calcareous phyllites. The relatively weak anomalies or limited extent of mineralized rock do not seem to justify follow-up studies.

Details of notable outcrops, listed by their target areas, are described as follows:

1. Target A-2. Sample 243305 (0.15 ppm Au and 3,750 ppm Cu) was collected from a 0.5-m-wide quartz vein, containing visible malachite and chalcopyrite, cutting chlorite phyllite.

2. Target A-3. Sample 243204 (almost 1 ppm Au) was collected from a small quartz vein containing 1-2-cm-wide limonitic zones and some visible pyrite cubes. The vein cuts quartz-sericite phyllite. Samples 243209 (2.9 ppm Au) and 243211 (1.5 ppm Au) are from 3- and 1.5-m-wide (respectively) lenticular zones of brown, sideritic, quartz-veined, locally brecciated exhalative(?) dolomite in quartz-sericite phyllite.

3. Target A-14. Sample 243323 (3 ppm Au, 110 ppm Ag, 1.7 percent Cu, and almost 1 percent each of Pb and Zn) was collected from an approximately 0.5-m-wide, brown to black, sheared, cherty, malachite-stained siliceous vein at the south end of the Hemair mine, a locality already sampled in detail by Smith (1979).

5. Target A-17. Sample 243256 (3.1 ppm Au) was collected from a limonitic, locally brecciated, lenticular quartz vein (as wide as 1 m) that contains a few visible pyrite cubes. The vein cuts dark-green, highly-foliated chlorite phyllite (metagraywacke?).

6. Hemair south area (outside target areas). Sample 243325 (almost 0.5 ppm Au) was collected from a 20-cm-wide limonitic dolomite lens in calcareous, locally graphitic quartz-sericite phyllite; many such lenses are present in the area.

PROSPECT EVALUATIONS

The first three of the following four prospect evaluations were carried out by Kellogg; the final prospect evaluation (Khathl prospect) was undertaken by Jannadi and El Komi. All geochemical analyses were performed by Skyline Laboratories, (Denver, Colorado, USA). In the following discussion of base- and precious-metal values, "anomalous" values are subjectively considered to be above 0.009 ppm Au, 1.0 ppm Ag, 200 ppm Cu, 50 ppm Pb, 100 ppm Zn, 50 ppm As, 50 ppm Sb, and 2 ppm Te.

RAIAH PROSPECT

Geology of the Prospect

The Raiah (Shepardess) prospect (fig. 1), first discovered by A.A. Bookstrom, is located near the bottom of a deep canyon about 2.5 km east-northeast of the Farah Garan ancient mine; coordinates of the prospect are lat 17° 41'10" N., long

43° 40'20" E. Strongly foliated and lineated quartz-sericite phyllite, locally containing "quartz eyes," is the predominant rock type. Variably dolomitized greenstone layers and lenses, probably representing basaltic flows or tabular intrusives, bound both the east and west margin of the prospect. Chlorite-sericite phyllite and sericite-talc phyllite are also common; the latter rock type, located at the north end of the prospect, is adjacent to the west side of a quartz-veined exhalative dolomite body. In extreme cases of dolomitization, greenstone has been altered to a massive greenish-gray sericitic dolomite and quartz-sericite phyllite has been altered to a strongly foliated, light-brown quartz-sericite-dolomite phyllite containing abundant lenses of brown dolomite. The large lens of grayish-brown, brown-weathering, quartz-veined exhalative dolomite contains several small ancient mines along a single vein of highly ferruginous and silicified dolomite. Malachite, cuprite, and galena were identified in the vein (as wide as 1.1 m).

Facing directions were not found in the prospect area. Foliation is parallel to compositional layering in most places, although greenstone layers within quartz-sericite phyllite cut across foliation in the phyllite in the southwest part of the prospect area (fig. 1); these occurrences may represent dikes.

Metallization

Two types of metallization were recognized in the Raiah prospect: 1) prominent pyritization within the quartz-sericite phyllite sequence and 2) quartz veins in the exhalative dolomite containing copper, lead, and zinc sulfides. Visible sulfide mineralization within the exhalative dolomite itself was not noted.

The pyritization is found mostly within weakly to strongly silicified quartz-sericite phyllite. A nonmineralized zone of carbonatization extends as much as several tens of meters outward from silicified, pyritized rock, so the deposit is crudely zoned. Silicified rock is gray, well indurated, locally cherty, fine grained, and contains about 10 percent euhedral to anhedral pyrite cubes and blebs as large as 3 mm across. The mineralized rock occurs in numerous lenses oriented parallel to foliation and embedded in reddish-orange and yellow, strongly ferruginous and (or) pyritic, locally white and punky (argillic alteration?), foliated quartz-sericite phyllite. The presence of abundant pyrite indicates that the deposit is largely unoxidized, probably the result of rapid erosion and downcutting during late Tertiary and Quaternary time.

The silicified pyritic zone terminates along strike, both to the north and south, into strongly carbonated quartz-sericite and chlorite-sericite phyllite. The termination of mineralized rock in the north is less than about 10 m across (measured parallel to foliation). At the south end, the termination is hidden beneath wadi alluvium. The two zones of termination of mineralized rock may represent faulted contacts that have subsequently been sheared into petrographically gradational zones.

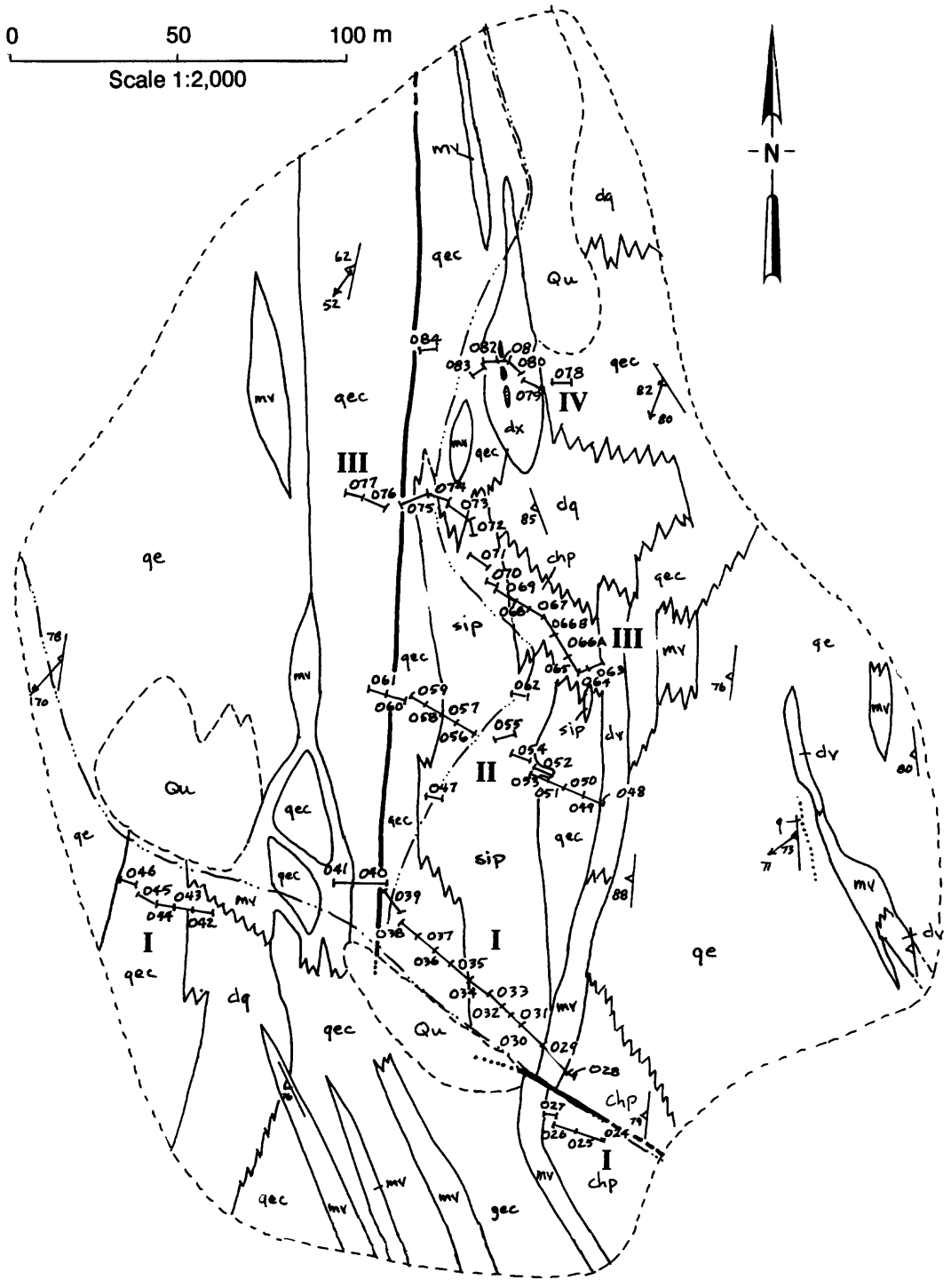

Figure 1.--Geologic map of the Raiah prospect, showing locations of chip-sample traverses, marked I-IV. All assay values in tables for traverses I-IV are in ppm; 0 ppm indicates that the amount is below detection limits, which are: 0.002 ppm (Au), 0.05 ppm (Ag), 5 ppm (Cu), 5 ppm (Pb), 5 ppm (Zn), 5 ppm (As), 1 ppm (Sb), and 0.005 (Te; value is shown to nearest 0.1 ppm).

EXPLANATION

Qu — QUATERNARY DEPOSITS UNDIVIDED--Mostly talus

q — QUARTZ VEIN

sip — PYRITIZED, SILICIFIED ROCK--Mostly gray, very well indurated, very-fine to medium grained, strongly silicified rock containing as much as about 10 percent finely disseminated pyrite; protolith mostly quartz-sericite phyllite; occurs as oblate reddish-weathering pods aligned parallel to foliation in generally reddish-brown, foliated, ferruginous sericitic matrix; weathers reddish brown

chp — CHLORITIC PHYLLITE--Brownish-gray to greenish-brown, well-foliated greenstone

dq — DOLOMITE DERIVED BY CARBONIZATION OF QUARTZ-SERICITE PHYLLITE--White to greenish-gray, generally sericitic and foliated; light-brown weathering; contains numerous lenses of massive brown dolomite

dv — DOLOMITE DERIVED FROM CARBONIZATION OF GREENSTONE--Massive, greenish gray, medium grained, well indurated; weathers dark brown

dx — DOLOMITE INTERPRETED TO BE VOLCANIC EXHALATIVE--Greenish-gray to grayish brown, massive, medium-grained dolomitic marble containing numerous white, black-weathering, irregularly oriented quartz stringers; weathers brown

qe — QUARTZ-SERICITE PHYLLITE--Light-grayish-green, well-foliated rock locally containing conspicuous quartz "eyes," probably representing tectonically eroded phenocrysts; weathers light to dark brown; probably metamorphosed dacitic or rhyolitic submarine tuff

qec — OXIDIZED AND LOCALLY FERRUGINOUS AND DOLOMITIZED QUARTZ-SERICITE PHYLLITE

mv — GREENSTONE--Mostly metabasalt or meta-andesite, but may include metagraywacke; grayish green, strongly chloritic, well indurated; at least in part hypabyssal

60 — CONTACT--Showing dip; dashed where approximately located

FAULT--Dashed where inferred; dotted where concealed

70 — FOLIATION--Inclined

70 / 40 — FOLIATION--Showing direction and plunge of crenulation lineation

ANCIENT MINE

024 — CHIP-SAMPLE TRAVERSE--Shows last 3 digits of RASS number, to be preceded by 243 (e.g., 243024)

WADI

Traverse I

Sample Number	Au	Ag	Cu	Pb	Zn	As	Sb	Te
243024	0.005	0	75	0	135	0	0	0.1
243025	0.005	0	70	15	195	5	0	2.0
243026	0	0.4	130	0	180	5	0	2.4
243027	0.009	0	55	25	95	0	0	0.4
243028	0.005	0.2	145	0	280	0	2	1.8
243029	0	0	15	0	325	0	2	0
243030	0	0.4	95	15	145	0	0	0.4
243031	0.004	0.6	95	15	145	0	2	0.4
243032	0.004	0.6	75	0	100	0	0	0.3
243033	0.003	0.6	135	5	210	0	0	1.2
243034	0	0.4	85	5	125	0	0	0.5
243035	0	0	80	0	225	5	1	0.5
243036	0.003	0	145	0	265	10	0	1.6
243037	0	0.2	140	0	180	15	0	1.4
243038	0.003	0	140	15	95	15	0	1.8
243039	0	0	20	0	30	0	1	0.3
243040	0	0	30	0	0	0	0	0.4
243041	0	0.4	35	0	160	0	2	0.1
243042	0	0.2	45	0	45	5	0	0.5
243043	0.004	0.4	55	0	80	0	0	0.4
243044	0	0.4	15	0	20	0	0	0.3
243045	0	0	50	0	35	0	0	0.3
243046	0.003	0	50	0	95	0	0	0.4
243047	0	0	75	0	150	20	0	0.6

Traverse II

Sample Number	Au	Ag	Cu	Pb	Zn	As	Sb	Te
243048	0.018	2.2	820	175	5,550	0	7	0.2
243049	0.014	1.2	500	40	2,050	10	2	3.6
243050	0.012	1.6	315	25	980	10	2	1.8
243051	0.005	0.4	110	35	390	5	0	1.4
243052	0	0.4	60	25	190	5	0	0.5
243053	0	0	110	0	285	10	1	1.2
243054	0	0	55	10	150	10	0	0.4
243055	0.004	0	65	15	100	10	0	0.3
243056	0	0	90	10	75	20	0	0.3
243057	0.006	0	75	0	75	10	0	0.3
243058	0	0.4	75	0	55	10	0	0.3
243059	0	0.2	60	0	50	10	0	0.6
243060	0.002	0	45	0	65	10	0	0.7
243061	0	0	10	0	15	0	0	0.6
243062	0	0	55	10	100	5	0	1.8

Traverse III

Sample Number	Au	Ag	Cu	Pb	Zn	As	Sb	Te
243063	0.025	0	75	0	60	25	0	0
243064	0.009	0.8	355	75	560	15	5	2.6
243065	0	0.8	145	60	305	10	4	3.2
243066A	0	0.6	90	0	165	5	3	1.6
243066B	0	0.4	100	0	190	0	-	1.0
243067	0	1.4	150	25	490	0	2	1.6
243068	0	0.8	85	0	125	0	0	0.6
243069	0	0.2	80	0	80	0	1	0.6
243070	0.003	0.4	55	0	60	5	0	1.4
243071	0.004	0.6	75	0	280	5	0	0.8
243072	0	1.2	105	0	170	5	0	0.8
243073	0	0.4	110	0	140	10	1	0.5
243074	0.005	0	80	0	90	5	0	0.6
243075	0.005	0	20	0	70	0	1	0.6
243076	0	0.2	10	0	50	0	1	0.2
243077	0	0	20	0	95	0	0	0.4

Traverse IV

Sample Number	Au	Ag	Cu	Pb	Zn	As	Sb	Te
243078	0.006	0	100	0	125	10	1	0.6
243079	0.120	4.1	780	255	5,650	45	125	11.0
243080	0.080	4.8	250	950	6,450	30	85	8.0
243081	0.560	32.0	2,500	6,700	9,900	20	30	60.0
243082	0.380	24.0	2,750	940	25,000	40	125	5.4
243083	0.450	11.0	1,500	2,300	9,250	10	12	12.0
243084	0.003	1.6	60	235	495	5	0	2.4
243085*	5.000	85.0	11,000	25,500	107,000	30	555	260.0

*chip-sampled across 1.1-m-wide sheared, ferruginous quartz vein in ancient mine 4 m south of 243081; contains visible malachite, galena, and cuprite.

EXPLANATION

Qu — QUATERNARY DEPOSITS UNDIVIDED--Mostly talus and wadi alluvium

go — GOSSAN--Zone of reddish-brown, strongly hematitic and calcareous, poorly consolidated rock; occurs mostly along a 0- to 2-m-wide linear trend (fault zone?) in southern part of prospect

bm — BLACK MARBLE--Black, fine-grained, carbonaceous, calcitic marble in wisps and bodies interlayered with partially dolomitized and oxidized quartz-sericite phyllite

dm — DOLOMITE FROM CARBONIZATION OF METABASALT--Greenish-gray to gray, medium-grained, well-indurated, massive, dolomitic marble

dmp — PYRITIC DOLOMITE DERIVED FROM CARBONIZATION OF METABASALT--Greenish-gray, medium-grained, massive, well-indurated sericite-pyrite dolomite; pyrite is fine grained, anhedral, and comprises as much as 10 percent of rock

dx — DOLOMITE INTERPRETED TO BE VOLCANIC EXHALATIVE--Greenish-gray to grayish brown, massive, medium-grained dolomitic marble containing numerous white, black-weathering, irregularly oriented quartz stringers; weathers brown

dsf — SERICITIC, FERRUGINOUS DOLOMITE--Greenish-gray to white, iron-stained, moderately well foliated sericitic dolomite; weathers brown

qc — QUARTZ-SERICITE PHYLLITE--Light grayish-green, well-foliated rock locally containing conspicuous quartz "eyes," probably representing tectonically eroded phenocrysts; weathers light to dark brown; probably metamorphosed dacitic or rhyolitic submarine tuff

qcc — PARTIALLY DOLOMITIZED AND OXIDIZED QUARTZ-SERICITE PHYLLITE--Locally hematitic from oxidation of pyrite; contains numerous lenses of brown-weathering dolomitic marble

mg — METAGRAYWACKE AND METAPELITE--Light greenish-brown, medium-grained dolomitic metagraywacke and interlayered, poorly indurated, grayish-green, biotite-sericite phyllite

mv — METABASALT OF META-ANDESITE--Grayish-green, well-indurated, massive, chloritic metabasalt or meta-andesite that may be intrusive

——— CONTACT--Dashed where approximately located, dotted where concealed

FAULT--Dashed where inferred; dotted where concealed

70 FOLIATION--Inclined

50 80 FOLIATION--Showing direction and plunge of crenulation lineation

ZONE OF FELSITE COBBLES--Matrix supported and well rounded

109 118 CHIP-SAMPLE TRAVERSE--Shows last 3 digits of RASS number, to be preceded by 243 (e.g. 243118)

243126 GRAB-SAMPLE LOCALITY--Includes RASS number

GOSSAN ZONE

WADI

Traverse I

Sample Number	Au	Ag	Cu	Pb	Zn	As	Sb	Te
243119	0	0	35	0	85	0	0	0
243120	0	0.2	40	0	95	0	0	0
243121	0	0.2	30	0	80	0	0	0
243122	0	0	40	0	100	5	0	0
243127	0	0	40	0	85	0	0	0
243128	0	0	40	0	95	0	0	0
243129	0	0	30	0	90	0	0	0
243130	0	0	30	0	90	0	0	0
243131	0	0	40	0	80	0	0	0.1
243132	0	0	35	0	100	0	0	0
243133	0.004	0	35	0	85	0	0	0
243134	0	0	45	0	80	20	0	0
243135	0	0	45	0	85	10	0	0

Other chip-sample traverse sites

Sample Number	Au	Ag	Cu	Pb	Zn	As	Sb	Te
243123	0	1.0	40	0	70	10	0	0.1
243124	0	0.2	75	0	85	31	1	0.1
243125	0	0	40	0	145	0	0	0
243126	0.016	0	55	0	45	115	9	0
243136	0	0	40	0	85	0	0	0
243137	0.003	0.2	40	0	95	40	0	0

A speculative model for mineralization, based on the above relationships, is a submarine graben, probably up to the west, that was infilled with rhyolitic tuff. A basalt flow (along a ridge on the west side of the inferred garben) provided an impermeable cap under which convecting fluids produced the mineralization. The exhalative dolomite immediately north of the inferred graben may have resulted from hydrothermal vents associated with initial graben formation.

Sampling and Results

Four chip-sample traverses were made across the prospect. The orientation and location of each traverse were governed largely by the rugged topography and availability of outcrop; most traverses were oriented northwest, following wadi walls. The traverses were laid out by compass and tape, and consisted of individual sample segments, each with a separate RASS number, that averaged 5.8 m in length. The ends of segments were chiefly located at changes in lithology. Typically, about 3 kg of chipped rock were collected along each segment. Several isolated segments were also laid out across outcrops of interest. In all, 62 segments over a total distance of 362.4 m were sampled (fig. 1).

Within the pyritized and silicified quartz-sericite phyllite zone, values for all analysed elements (Au, Ag, Cu, Pb, Zn, As, Sb, and Te; tables on fig. 1) are very low. Precious-metal concentrations were, in most cases, near or below the detection limits (0.003 ppm Au and 0.2 ppm Ag). Base-metal concentrations were also low.

Anomalous silver, copper, and zinc concentrations were found along the three easternmost segments of traverse II (table 1), in a 13-m-wide zone of dolomitized quartz-sericite phyllite and greenstone. Sample 243048, which contains 2.2 ppm Ag, 820 ppm Cu, and over 0.5 percent Zn, was collected from a massive green dolomitized greenstone (metabasalt?) without visible mineralization; samples 243049 and 243050, with lower but still anomalous values for the same metals, were collected from punky, well-foliated, strongly dolomitized quartz-sericite phyllite.

Metal values within most of the exhalative body (traverse IV) are considerably higher than those within either the pyritized zone or the dolomitized zone surrounding the pyritized zone. Five chip-composite samples (traverse IV; samples 243079 to 243083) collected over traverse distances ranging from 3.3 to 5.4 m, had an average gold content of 0.318 ppm and an average silver content of 15.2 ppm. One sample, 243085 (not shown on fig. 1) collected 4.0 m south of sample 243081 across a 1.1-m-wide gray, iron-stained quartz vein within an ancient mine in the exhalative dolomite, contained visible malachite, galena, and cuprite; average metal values for the sample are 5.0 ppm Au, 85.0 ppm Ag, 1.1 percent Cu, 2.6 percent Pb, 10.7 percent Zn, and correspondingly high values for arsenic, antimony, and tellurium.

The minuscule tonnage of possible ore-grade rock within the exhalative dolomite and the almost complete lack of significant metallization within surrounding mineralized rock indicate that further work on this prospect is not

surrounding mineralized rock indicate that further work on this prospect is not warranted.

Al Misadij Prospect

Geology of the Prospect

The Al Misadij prospect (fig. 2), first identified by W.R. Vennum and named for a small village 3 km to the north, is located along the banks of a wadi at lat 17° 40'00" N., long 43° 42'10" E. No significant geochemical anomalies were identified near the prospect, which is bounded on the east by a ridge of massive, well-indurated greenstone (probably metabasalt) that is progressively dolomitized westward. Farther to the west, the dolomitized greenstone grades into strongly calcareous quartz-sericite phyllite with well-developed quartz eyes. Numerous lenses of brown-weathering, light-greenish-brown, irregularly quartz-veined (exhalative?) dolomite are interlayered with the calcareous quartz-sericite phyllite. Greenish-gray, noncalcareous quartz-sericite phyllite crops out in the southwest part of the map area (fig. 2). Black (graphitic?), foliated fine-grained marble, an unusual rock type in the Farah Garan district, is locally interlayered with dolomitic quartz-sericite phyllite at several places in the prospect. One pebbly zone within quartz-sericite phyllite attests to the sedimentary origin of at least part of the phyllite.

Metallization

Prior to sampling, two structural settings were hypothesized by the authors to contain significant metallization: 1) at the north end of the prospect, disseminated pyrite is present in massive, well-indurated dolomitized greenstone that has locally been sheared and oxidized to a foliated, ferruginous, sericitic dolomite; anhedral pyrite grains as large as 3 mm comprise as much as 10 percent of the rock; and 2) at the south end of the prospect, irregular pods of punky, iron-stained rock and gossan crop out along a shear zone as much as 5 m wide in strongly dolomitized sericite phyllite.

Sampling and Results

One 67.4-m chip-sample traverse, consisting of 12 sample segments, was laid out in the pyritized dolomitized greenstone (fig. 2). Two additional traverses (combined distance of 26.6 m) to the south were made across the ferruginous shear zone.

Despite the local development of pyritized zones within this prospect, most values for analysed elements are below background values (tables in fig. 2). Consequently, no further work at this prospect is recommended.

KUHAYM PROSPECT

Geology of the Prospect

The Kuhaym prospect (fig. 3) is located in rugged terrain at the southern end of the Farah Garan district at lat 17° 34'30" N., long 43° 42'00" E. The area is underlain mostly by metagraywacke and metabasalt (most of which contains pillow structures) locally sheared to chlorite phyllite, and hornblende metadiorite sills and irregularly shaped intrusive bodies. Amygdaloidal metabasalt crops out along the west side of the prospect and well-foliated quartz-chlorite-sericite phyllite is present near the north end.

Where relatively unaltered, the hornblende metadiorite is well indurated, massive, gray, medium grained, equigranular, and contains about 40 percent hornblende. However, in many places, this unit is chloritized and easily weathers to grus. Chloritization was probably a late tectonic phenomenon, as altered rock is foliated in places and zones of alteration are generally lenticular, with long axes oriented parallel to tectonic strike (approximately north).

Metallization

The mineralized zone consists of fine-grained silicified and pyritized metabasalt, which contains locally well-developed pillow structures. Where silicification is extreme, the rock is gray and cherty. Silicified and pyritized rock weathers into characteristic reddish-brown lenticular shapes (relict pillows?) contained within a matrix of foliated reddish-brown sericitic rock. Pyritization is highly variable; as much as 10 percent of rock volume is anhedral pyrite. No well-developed gossanous zones or veins were found in the prospect.

Sampling and Results

Three chip-sample traverses, oriented approximately east-west, were made across the pyritized zone; traverses I and III (fig. 3) extend into unmineralized rock at both ends. Each sampling segment was 10 m long, except for those segments at the ends of each traverse, which were considerably shorter than 10 m.

Concentrations of all metals analysed both within and outside the pyritized zone are very low, commonly below the detection limits (tables in fig. 3). Consequently, no further work is warranted at this prospect.

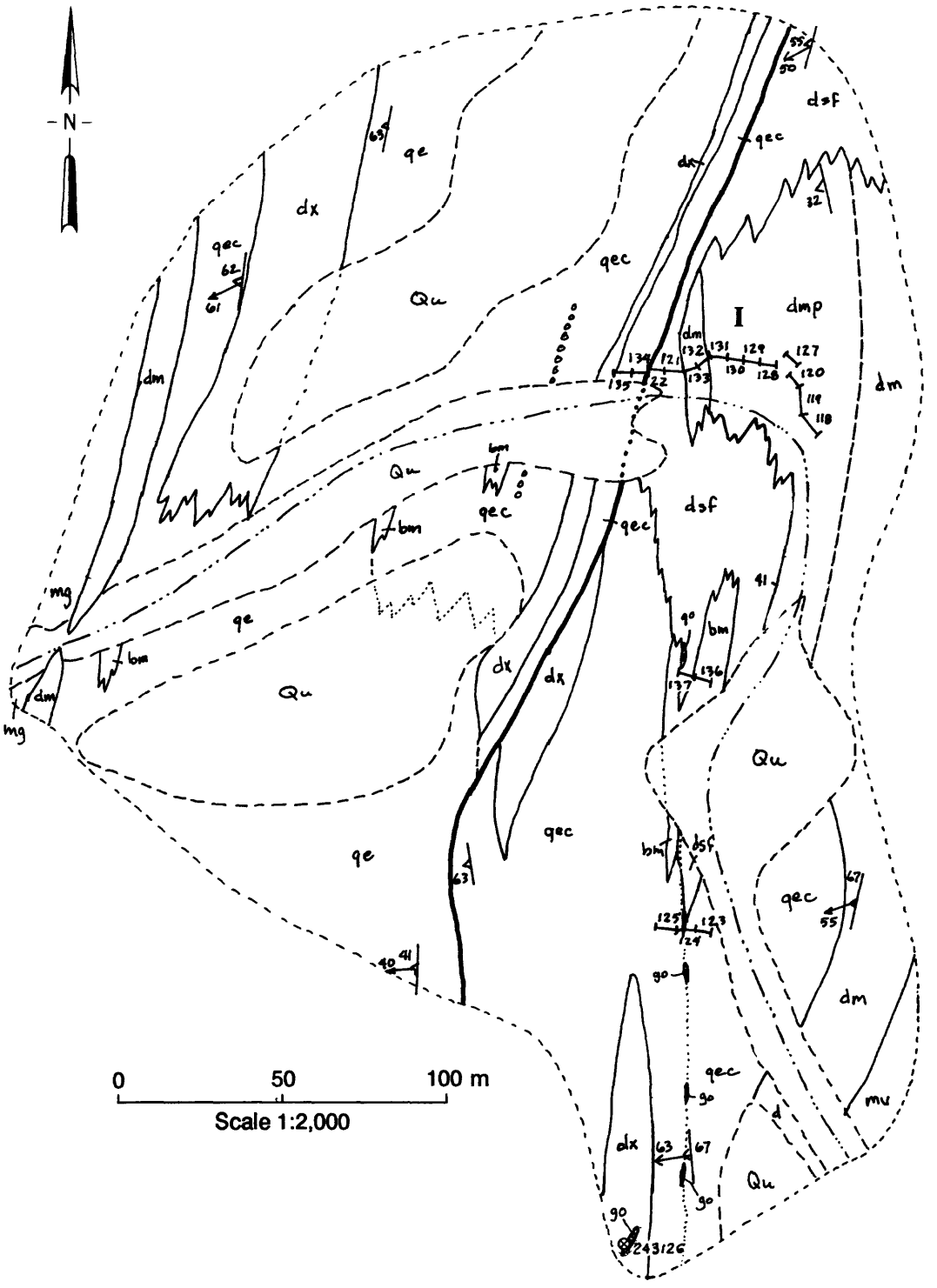

Figure 2.--Geologic map of the Al Misadij prospect, showing location of chip-sample traverse I and other traverses. All assay values in tables are in ppm; 0 ppm indicates that the amount is below detection limits, which are: 0.002 ppm (Au), 0.05 ppm (Ag), 5 ppm (Cu), 5 ppm (Pb), 5 ppm (Zn), 5 ppm (As), 1 ppm (Sb), and 0.005 (Te; value is shown to nearest 0.1 ppm).

Traverse I

Sample Number	Au	Ag	Cu	Pb	Zn	As	Te
243269	0	0	40	0	70	40	0
243270	0	0	40	0	40	10	0
243271	0	0	35	0	45	20	0
243272	0.005	0	30	0	40	0	0
243273	0.003	0	50	0	55	5	0

Traverse II

Sample Number	Au	Ag	Cu	Pb	Zn	As	Te
243274	0	0	30	0	55	5	0
243275	0.003	0	35	0	40	0	0
243276	0.006	0	40	0	55	0	0
243277	0	0	35	0	35	0	0

Traverse III

Sample Number	Au	Ag	Cu	Pb	Zn	As	Te
243278	0.006	0.1	60	15	65	10	0
243279	0	0	60	0	50	0	0
243280	0.003	0	30	0	45	5	0
243281	0	0	40	5	40	0	0
243282	0	0	40	0	50	0	0

EXPLANATION

Qu — QUATERNARY DEPOSITS UNDIVIDED--Mostly talus and alluvial deposits

sip — PYRITIZED, SILICIFIED ROCK--Gray, very well indurated, very fine to medium-grained, strongly silicified rock containing as much as about 10 percent finely disseminated pyrite; protolith mostly metabasalt; occurs as oblate pods aligned parallel to foliation in generally reddish-brown foliated, sericitic matrix; weathers reddish brown

chp — CHLORITIC PHYLLITE--Mostly sheared, well-foliated chlorite and chlorite-sericite greenstone

mv — METABASALT--Mottled grayish green, strongly chloritic, well indurated, locally amygdaloidal; abundant pillow structures; may include meta-andesite

mvf — FERRUGINOUS METABASALT--Weakly pyritic metabasalt; mostly oxidized and locally silicic; weathers reddish brown

mg — METAGRAYWACKE--Mottled grayish green, chloritic, locally showing well-preserved bedding features

di — METADIORITE--Gray to greenish-gray, medium-grained, equigranular, massive hornblende diorite; color index about 35; locally altered to greenish, crumbly rock in which hornblende has altered to biotite and (or) chlorite

——— CONTACT--Dashed were approximately located; dotted where concealed

FAULT--Dashed where inferred; dotted where concealed

80 FOLIATION--Inclined

75 77 FOLIATION--Showing direction and plunge of crenulation lineation

ZONE OF MATRIX-SUPPORTED ANGULAR CLASTS

269 CHANNEL SAMPLE--Shows last 3 digits of RASS number, to be preceded by 243 (e.g. 243269)

WADI

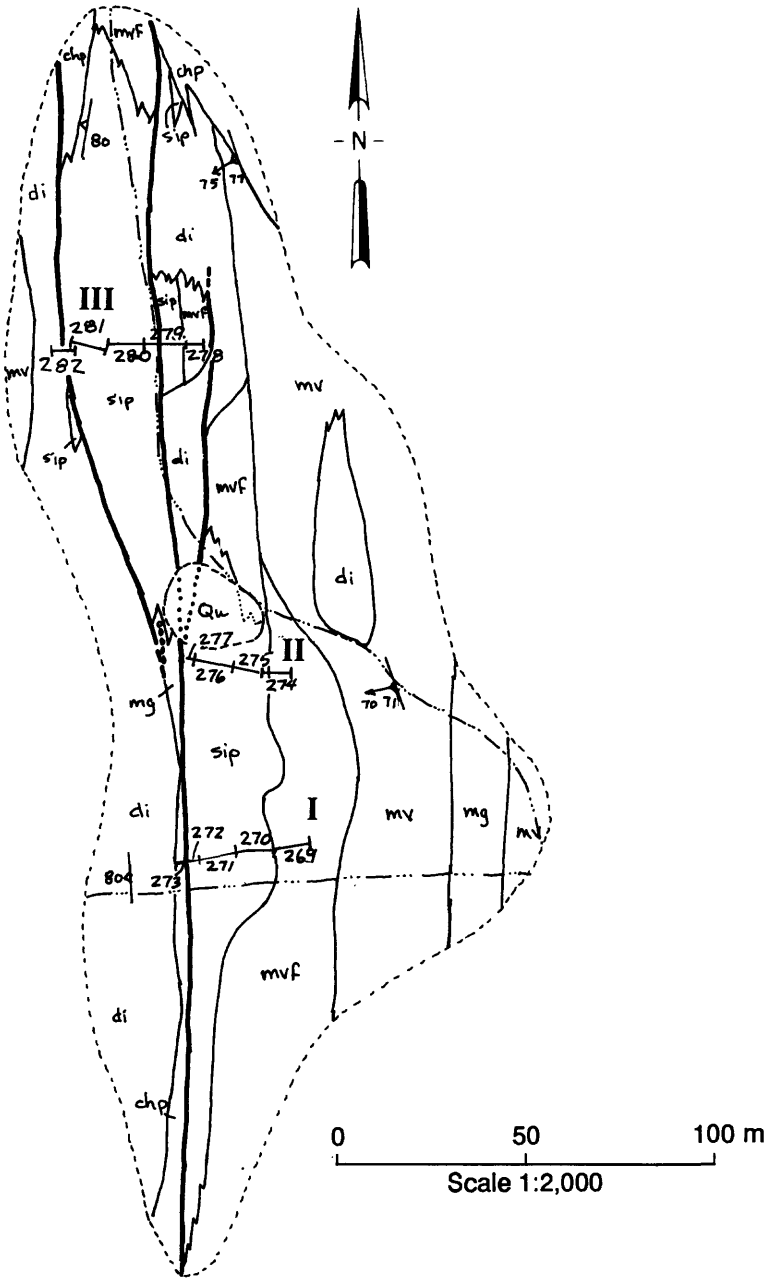

Figure 3.--Geologic map of the Kuhaym prospect, showing location of chip-sample traverses, marked I-III. All assay values in tables are in ppm; 0 ppm indicates that the amount is below detection limits, which are: 0.002 ppm (Au), 0.05 ppm (Ag), 5 ppm (Cu), 5 ppm (Pb), 5 ppm (Zn), 5 ppm (As), and 0.005 (Te; value is shown to nearest 1 ppm) .

KHATHL PROSPECT

Geology of the Prospect

The Khathl prospect constitutes a large, lenticular zone of pyritized and silicified rock, oriented with long axis parallel to the nearly conformable western margin of the Hadadah pluton (plate 1 and fig. 4). Coordinates of the approximate center of the prospect are lat 17° 37'00" N., long 43° 42'30" E. Three major rock units were mapped at the prospect: north trending units of quartz-sericite phyllite, pyritized and silicified quartz-sericite phyllite, and younger granitoid rocks of the Hadadah pluton. A few late barren quartz veins are found within all rock types.

Quartz-sericite phyllite that crops out on the west side of the prospect is gray to greenish gray, fine grained, locally chloritic, and has a well-developed, steep, north-trending foliation. Quartz-eye structures are locally well developed. The protolith probably was rhyolitic, dacitic subaqueous tuff, or tuffaceous sediments.

The pyritized and silicified quartz-sericite phyllite is gray to greenish gray and cherty, and is massive and very indurated where silicification is intense; elsewhere, foliation is moderately well to poorly developed. Oxidation of pyrite causes the rock to weather to a reddish-brown to brick-red color.

The Hadadah pluton intrudes the silicified quartz-sericite phyllite along the east margin of the prospect and is composed of gneissic and unfoliated, massive-weathering, dark- to light-gray quartz diorite, granodiorite, and quartz monzonite (Anderson, 1978).

Metallization

A zone of variably pyritized and silicified rock (as much as 300 m wide) extends about 5 km along strike on the west side of the Hadadah pluton. The entire extent of the pyritized zone is unknown, although it is certainly the largest one yet found in the Farah Garan mineral district. Pyrite occurs as finely disseminated blebs (as much as 3 mm in diameter) and comprises as much as 10 percent of the most-silicified rock, which occurs in an approximately 50-m-wide zone adjacent to the main north-trending wadi that runs through the area. The rocks in this zone are gray, cherty, almost massive, and extremely well indurated. No sulfides other than pyrite were observed in hand specimen.

The Hadadah pluton almost certainly played a major role in localizing mineralizing fluids, as suggested by the concentric nature of the pyritized zone and the Hadadah pluton, the close proximity of the pluton to the pyritized zone, and the relatively large size of the zone. These relationships imply that other, smaller but similar pyritized zones in the mineral belt may have been localized by the Hadadah pluton.

Sampling and Results

Chip sampling was carried out along 4 east-west-oriented traverses across the most pyritized and silicified rock (fig. 4). The chip-sampling interval was 10 m and sampling numbers increase to the west. Three isolated grab samples were also collected at this prospect.

As was found with other samples of pyritized rock, the concentrations of metals analysed were extremely low (tables in fig. 4), so no further work on this prospect is warranted.

CONCLUSIONS

The follow-up evaluation of geochemically anomalous areas and the evaluation of 4 prospects in the Farah Garan - Kutam mineral belt did not define any zones of mineralization worthy of further study. Subeconomic precious- and base-metal mineralization that was found was associated with large, lenticular, quartz-veined dolomitic bodies interpreted to be submarine exhalative deposits; the highest metal concentrations were associated with ancient mines. Anomalously high precious- and base-metal values were also found to be associated with several small, isolated quartz veins.

Although no deposits of economic interest were found, the study did reveal two aspects of mineralization in the area that should be considered in future exploration. Firstly, zones of disseminated pyrite are virtually barren of any precious- or base-metal mineralization. This conclusion is based on detailed sampling of 4 major pyritic zones and numerous smaller ones, including one zone located about 1 km from the Farah Garan mines (samples 243215-243219). Smith (1979) found similar disappointing results in his survey of pyritized, "intensely silicified quartz porphyry" in the Al Ashyab area, located 4 km south of the Farah Garan mines.

Secondly, this study served to reinforce strongly the notion that almost all significant mineralization is associated with exhalative dolomite. This association was also discussed by Smith (1979) (although he did not infer an exhalative origin for the dolomite), who also noted the association between mineralization and the nearby presence of "quartz porphyry," the "quartz-eye" quartz-sericite phyllite of this study.

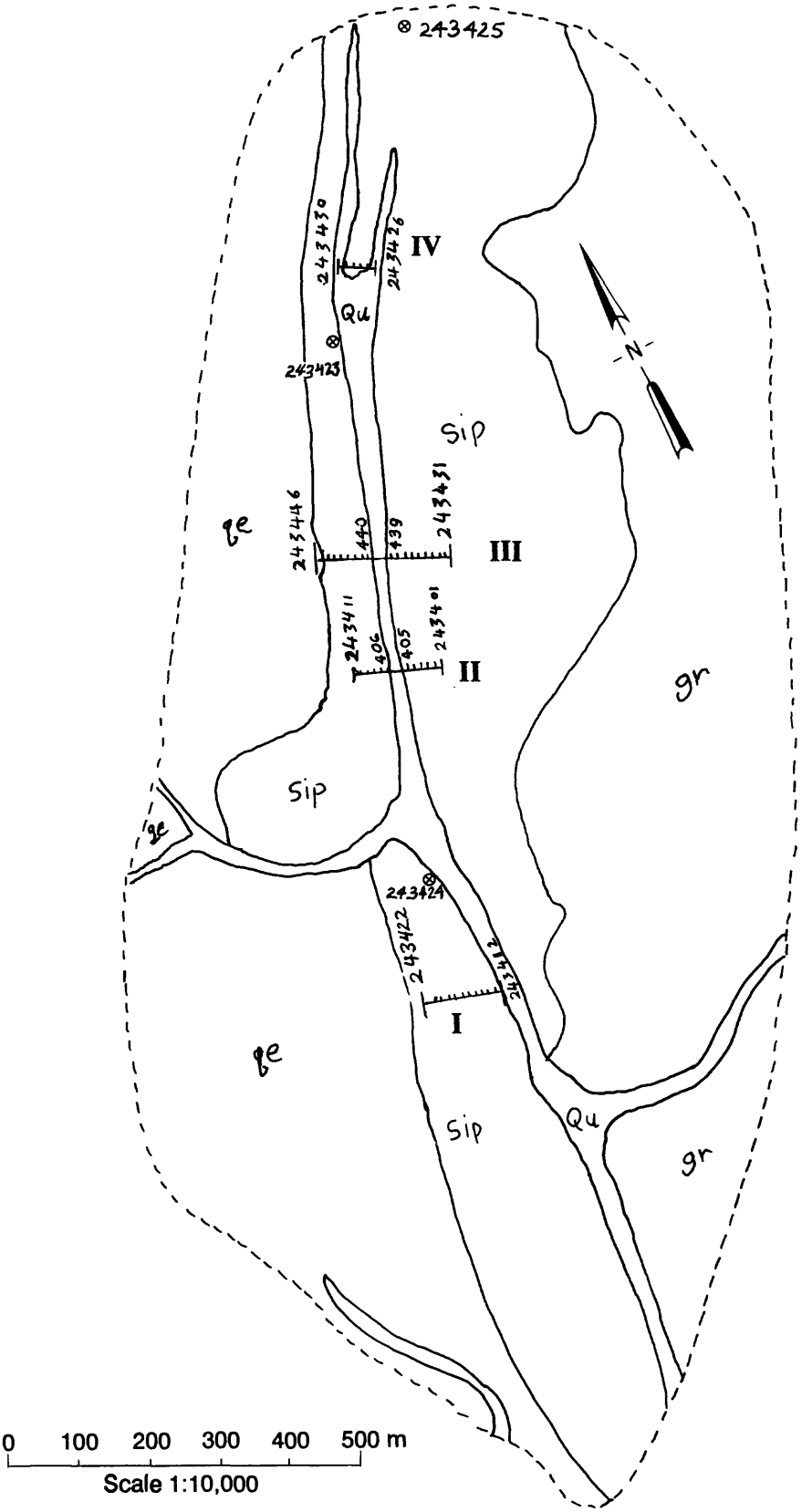

Figure 4.--Geologic map of the Khathl prospect, showing location of chip-sample traverses, marked I-IV. Individual sampling segments are 10 m long. Location of three other rock-chip samples also are shown. All assay values in tables are in ppm; 0 ppm indicates that the amount is below detection limits, which are: 0.002 ppm (Au), 0.05 ppm (Ag), 5 ppm (Cu), 5 ppm (Pb), 5 ppm (Zn), 5 ppm (As), and 0.005 (Te; value is shown to nearest 1 ppm). Geology by Jannadi and El Komi.

EXPLANATION

Qu — QUATERNARY DEPOSITS UNDIVIDED--Mostly alluvium

gr — GRANITOID ROCKS OF HADADAH PLUTON--Gneissic and granitoid, massive-weathering, dark- to light-gray, zoisite-biotite quartz diorite, granodiorite, and quartz monzonite; potassium metasomatized locally (description from Anderson, 1978)

sip — PYRITIZED, SILICIFIED ROCK--Mostly gray, very well indurated, very fine to medium grained, strongly silicified rock containing as much as about 10 percent finely disseminated pyrite; protolith mostly quartz-sericite phyllite, into which it grades; massive to moderately well foliated; weathers reddish brown to brick red

qc — QUARTZ-SERICITE PHYLLITE--Gray to light-grayish-green, well-foliated rock locally containing conspicuous quartz "eyes;" weathers light to dark brown; probably metamorphosed dacitic or rhyolitic submarine tuff and (or) tuffaceous sediment

——— CONTACT

243442 ⊢·····⊣ 243412 — TRAVERSE LINE--Chip sampled from east to west in 10 m intervals. RASS sample numbers (intervals) on traverse I are 243412-243422, traverse II are 243401-243411, traverse III are 243431-243446, and traverse IV are 243426-243430; numbers at beginning and end of traverse only are shown

⊗ 243425 — GRAB-SAMPLE LOCALITY--Includes RASS number

Traverse I

Sample Number	Au	Ag	Cu	Pb	Zn	As	Te
243412	0	0	0	0	35	15	0
243413	0	0	5	0	10	10	0
243414	0	0	0	0	30	15	0
243415	0	0	0	0	30	30	0
243416	0.004	0	0	0	50	5	0
243417	0	0	0	0	25	35	0
243418	0.003	0.1	0	0	15	385	0
243419	0	0	5	0	20	90	0
243420	0	0.1	5	5	10	65	0
243421	0	0	10	0	10	50	0
243422	0	0	5	5	70	105	0

Traverse II

Sample Number	Au	Ag	Cu	Pb	Zn	As	Te
243401	0	0	0	0	15	0	0
243402	0	0	5	0	15	0	0
243403	0	0	0	0	30	0	0
243404	0	0	0	0	30	0	0
243405	0	0	10	0	70	0	0
243406	0	0	10	0	10	0	0
243407	0	0	0	0	0	0	0
243408	0	0	10	0	10	0	0
243409	0	0	0	0	0	0	0
243410	0	0	5	0	10	10	0
233411	0	0.1	10	0	80	0	0

Traverse IV

Sample Number	Au	Ag	Cu	Pb	Zn	As	Te
243426	0	0	10	0	70	0	0
243427	0	0	5	0	5	15	0
243428	0	0.15	0	0	10	50	0
243429	0	0	0	0	10	0	0
243430	0	0	10	0	10	0	0
234423	0	0	0	10	10	10	0
234424	0	0	0	0	20	10	0
234425	0	0	10	5	30	15	0

Traverse III

Sample Number	Au	Ag	Cu	Pb	Zn	As	Te
243431	0	0	0	0	10	20	0
243432	0	0.15	0	0	10	5	0
243433	0	0	0	0	15	0	0
243434	0	0	5	0	15	0	0
243435	0	0	0	0	10	0	0
243436	0	0.05	10	0	10	0	0
243437	0	0.10	0	0	10	0	0
243438	0	0	5	0	10	0	0
243439	0.009	0	0	0	20	0	0
243440	0	0	15	0	35	0	0
243441	0	0	10	0	15	0	0
243442	0	0	0	0	0	0	0
243443	0	0	0	0	0	0	0
243444	0	0	10	0	10	0	0
243445	0	0	10	0	15	0	0
243446	0	0	0	0	35	0	0

DATA STORAGE

DATA FILE

Field and laboratory data for this report, including field notes, sample-site maps, and analytical results, are stored in Data File USGS-DF-09-9 in the Jeddah office of the U.S. Geological Survey.

MINERAL OCCURRENCE DOCUMENTATION SYSTEM

New occurrences were established and entered into the Mineral Occurrence Documentation System (MODS) file for the following prospects: the Raiah prospect (MODS 04852), the Al Misadij prospect (MODS 04853), the Kuhaym prospect (MODS 04854), and the Khathl prospect (MODS 04855).

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