UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Some Preliminary Findings of a Reconnaissance Geochemistry Study West Shasta District, California

By

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Introduction

In response to a Freedom-of-Information Act request, this paper releases to the public preliminary data on the West Shasta district as presented at an informal, USGS in-house meeting in Redding, Calif., November 1, 1982.

The presentation at Redding was a brief, 4-minute summary of preliminary findings (progress report) of a reconnaissance geochemistry study, one of several geochemical studies in the district. Only data from the central and northern portions of the West Shasta district were shown at the Redding meeting. This paper presents only that same data. However, for the convenience of the reader, additional captions are provided for illustrations originally presented as colored, 35-mm slides. Data on figures 5, 6, and 7 were originally presented on a single slide.

Method of study

Pan concentrated and bulk stream-sediment samples and water samples were taken across the West Shasta district (see fig. 1). Panned concentrates (see fig. 2) underwent heavy-liquid separation (bromoform, s.g. 2.85) and electromagnetic separation (Frantz; forward slope 25°, side slope 15°; amp setting: 0.1 and 1.0). Three fractions were obtained and were analyzed by semiquantitative emission spectroscopy (analyst: S. J. Sutley):

1) A fraction magnetic at 0.1 amp (magnetite fraction which includes material removed during a preliminary hand magnet separation.

2) A fraction magnetic at 1.0 amp (M-1 fraction).

3) A fraction nonmagnetic at 1.0 amp (NM-1 fraction).

The bulk sediment sample was sieved to four size fractions, three of which were spectrographically analyzed (analysts: B. M. Adrian, B. F. Arbogast, and S. J. Sutley):

1) -150 mesh (fine fraction)

2) -80 + 150 mesh (intermediate fraction)

3) -20 + 80 mesh (coarse fraction)

Both an untreated water sample and a filtered (0.45 μ) and acidified (pH <2, HNO_3) sample were taken and analyzed by a variety of methods including inductively coupled plasma-atomic emission spectroscopy (analyst: J. M. Motooka), atomic absorption spectrophotometry and ion chromatography (analysts: W. H. Ficklin and J. B. McHugh).

Results

Preliminary results from the central and northern portions of the West Shasta district show that any of the sample media would suffice to find the district:

A) Water - Some useful constituents for reconnaissance are copper, specific conductance, and sulfate. The distribution of sulfate in water is shown in figure 3. Other constituents such as cadmium (fig. 4) were found only in streams with strongly acid waters.

B) Sieved sediments - The fine fraction has more intense values, but anomalous values occur only on the acid-water streams. The coarse fraction shows widest distribution and is a better fraction for reconnaissance work. These size relationships apply to Cu (see figs. 5-7), Ag and Zn; Pb and Mo show no size relations. Data from the sieved sediments show the entire region to be enriched in zinc.

C) Concentrates - The NM-1 fraction has the most intense values and the most contrast. The M-1 fraction shows broader, more diffuse patterns than the NM-1 fraction. The magnetite fraction has restricted patterns. Distribution patterns of elements in the concentrate fractions show the region to be zoned (figs. 8-13):

1) In the NM-1 fraction, the main part of the district has restricted patterns of enhanced Cu (at high levels), Co, Cd, As, Pb (at moderate levels) and Zn. Superimposed patterns that are also open to the south are Ag, Cu (at moderate amounts), and Sn. Fringing the main part of the district are enhanced amounts of Ba (to the north), B, Mo, and Pb (at high levels).

2) The M-1 fraction shows a superimposed (open to the south) pattern of Co/Ni ratio $\geq$ 0.8, and shows a fringing zone of Mn.

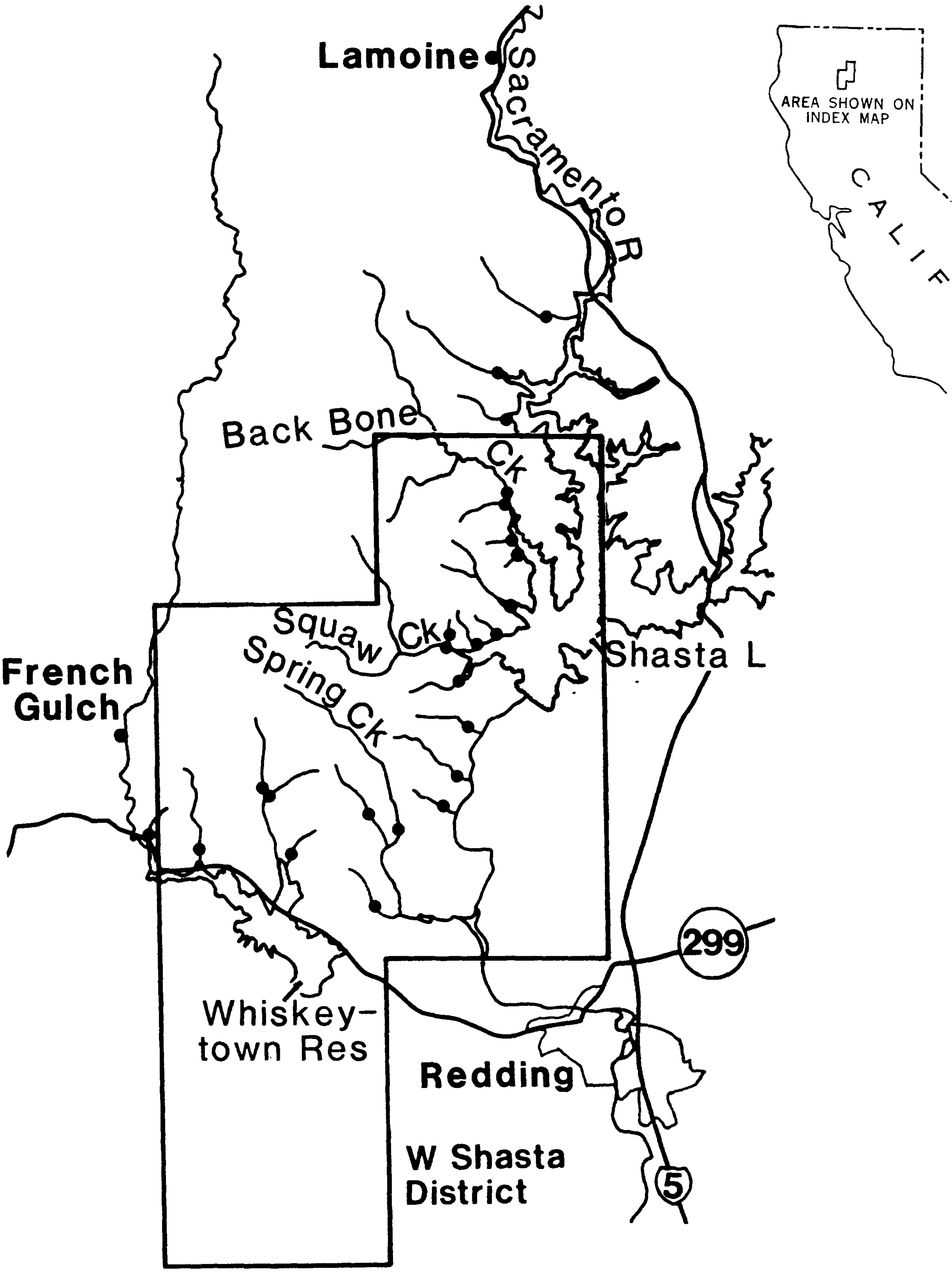

Figure 1. Index map showing location of sample sites. Base from the Redding NTMS quadrangle, scale 1:250,000.

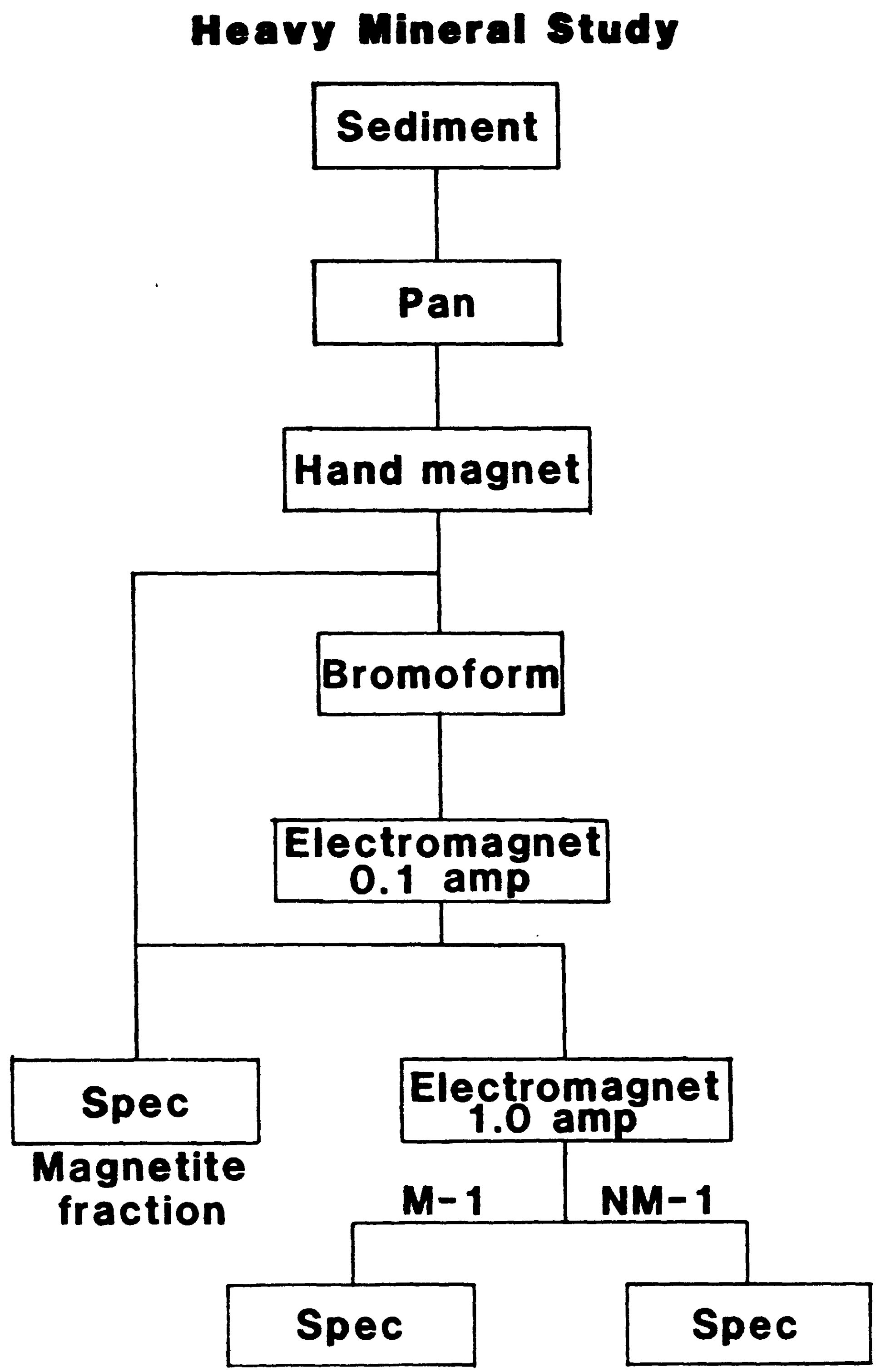

Figure 2. Flow chart of processing steps in the heavy-mineral study.

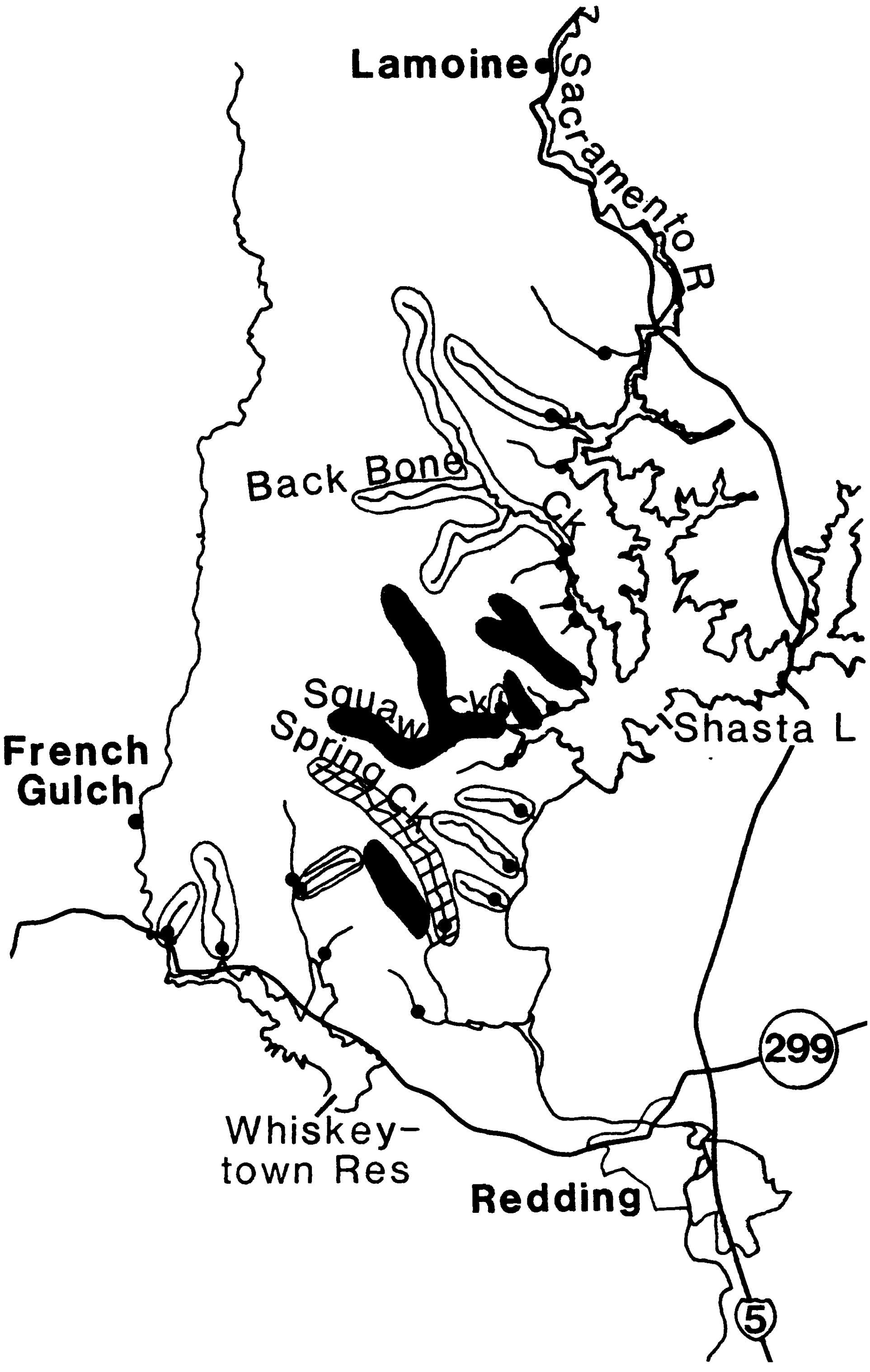

Figure 3. Sulfate in water. Streams containing 10-40 ppm sulfate, open outline; 40-100 ppm, diagonal line pattern; >100 ppm, solid color.

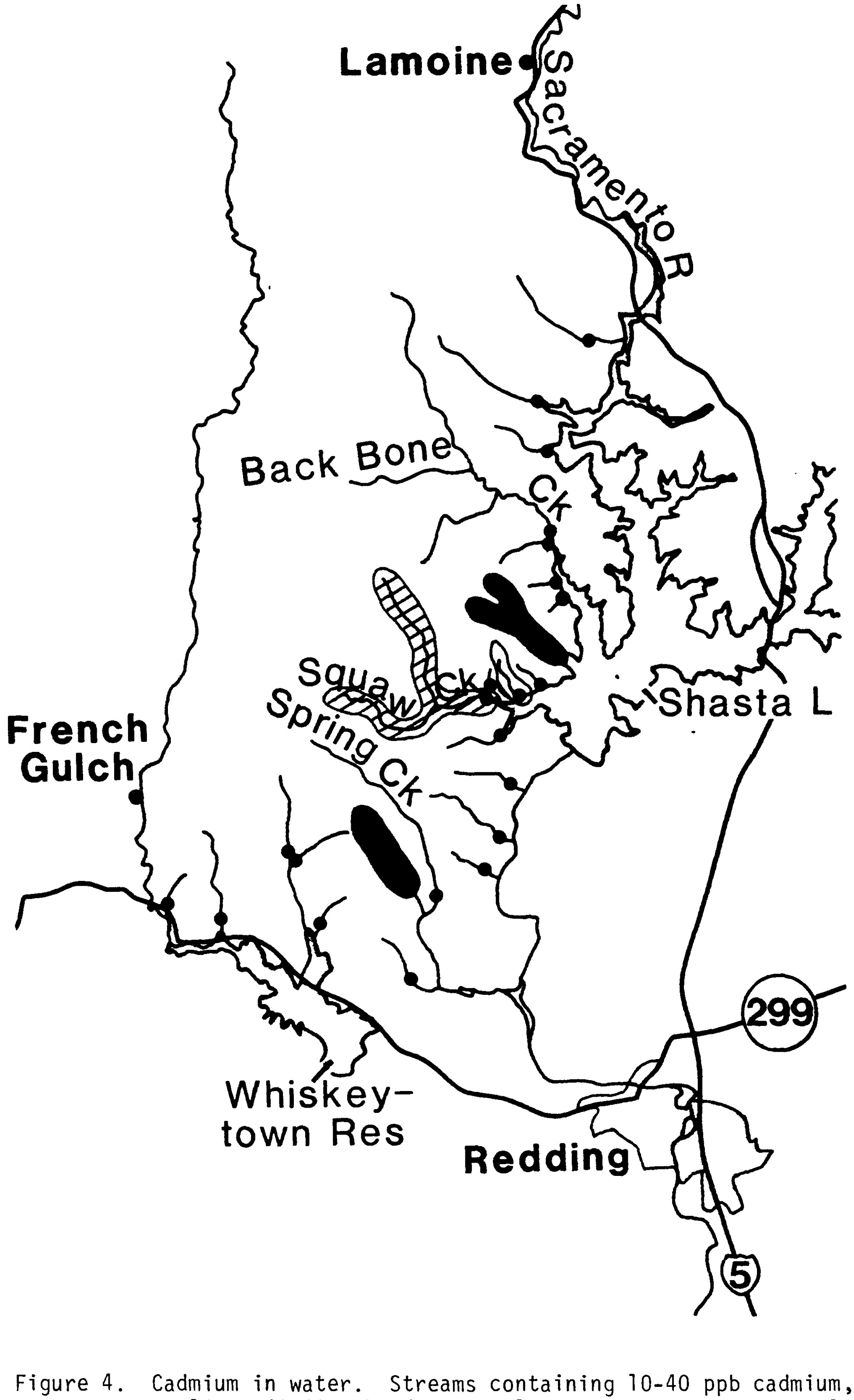

Figure 4. Cadmium in water. Streams containing 10-40 ppb cadmium, open outline; 40-80 ppb, diagonal line pattern; >80 ppb, solid color.

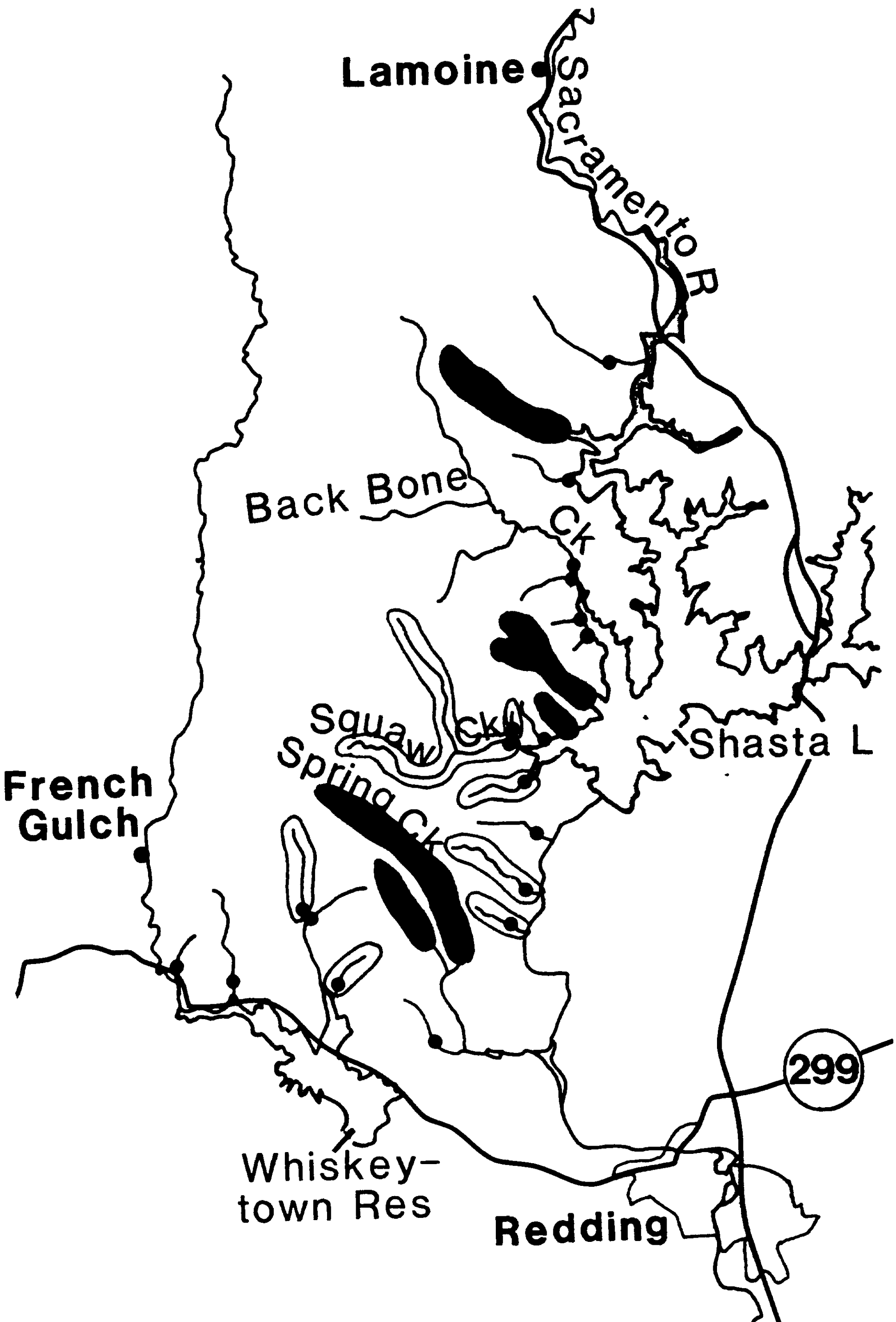

Figure 5. Copper in sieved sediments, -20 to +80 mesh. Stream drainages containing copper in amounts ≥ 100 ppm, open outline; ≥ 300 ppm, solid color.

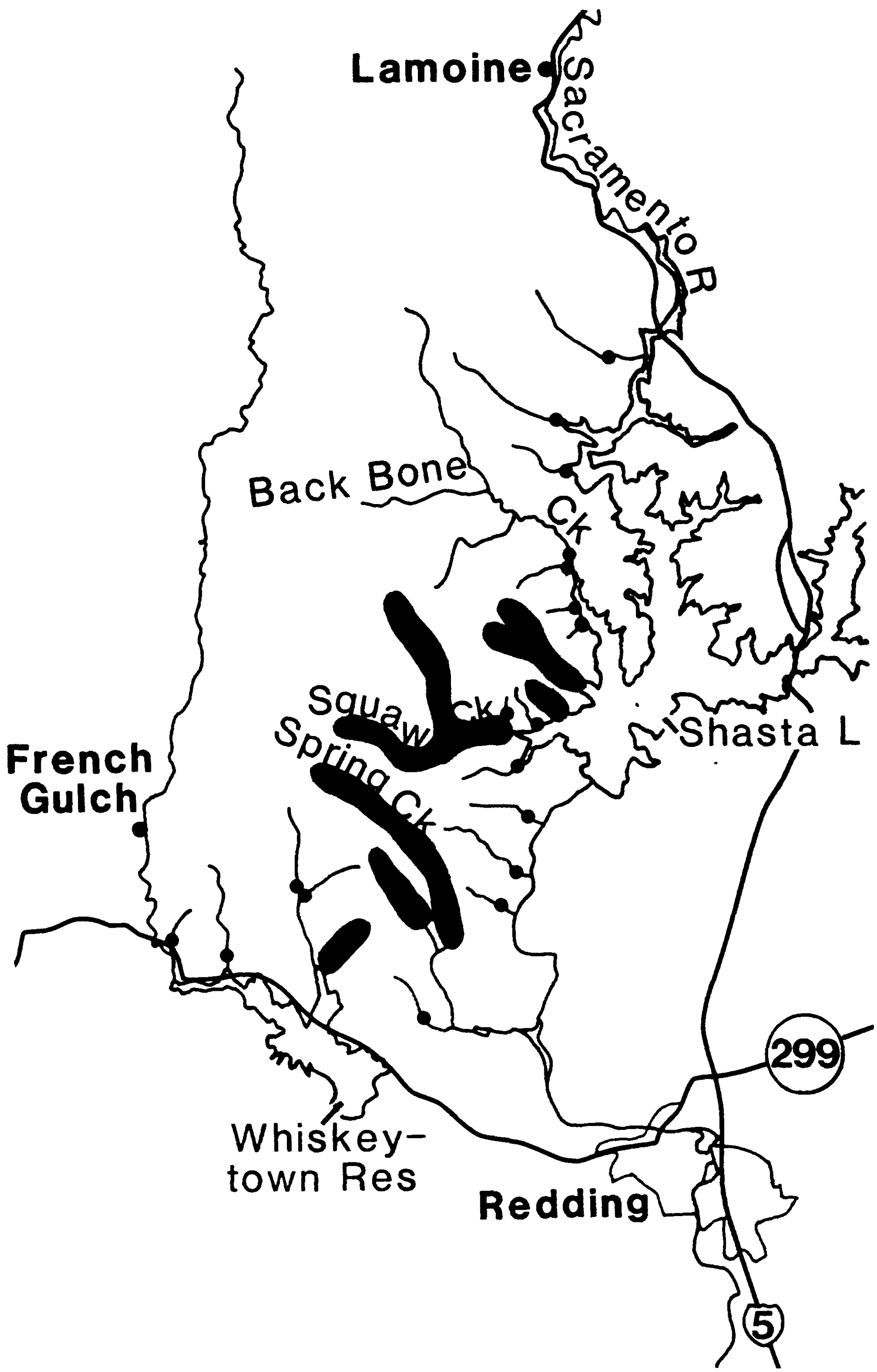

Figure 6. Copper in sieved sediments, -80 to +150 mesh. Stream drainages containing copper in amounts ≥ 100 ppm, open outline (none); ≥ 300 ppm, solid color.

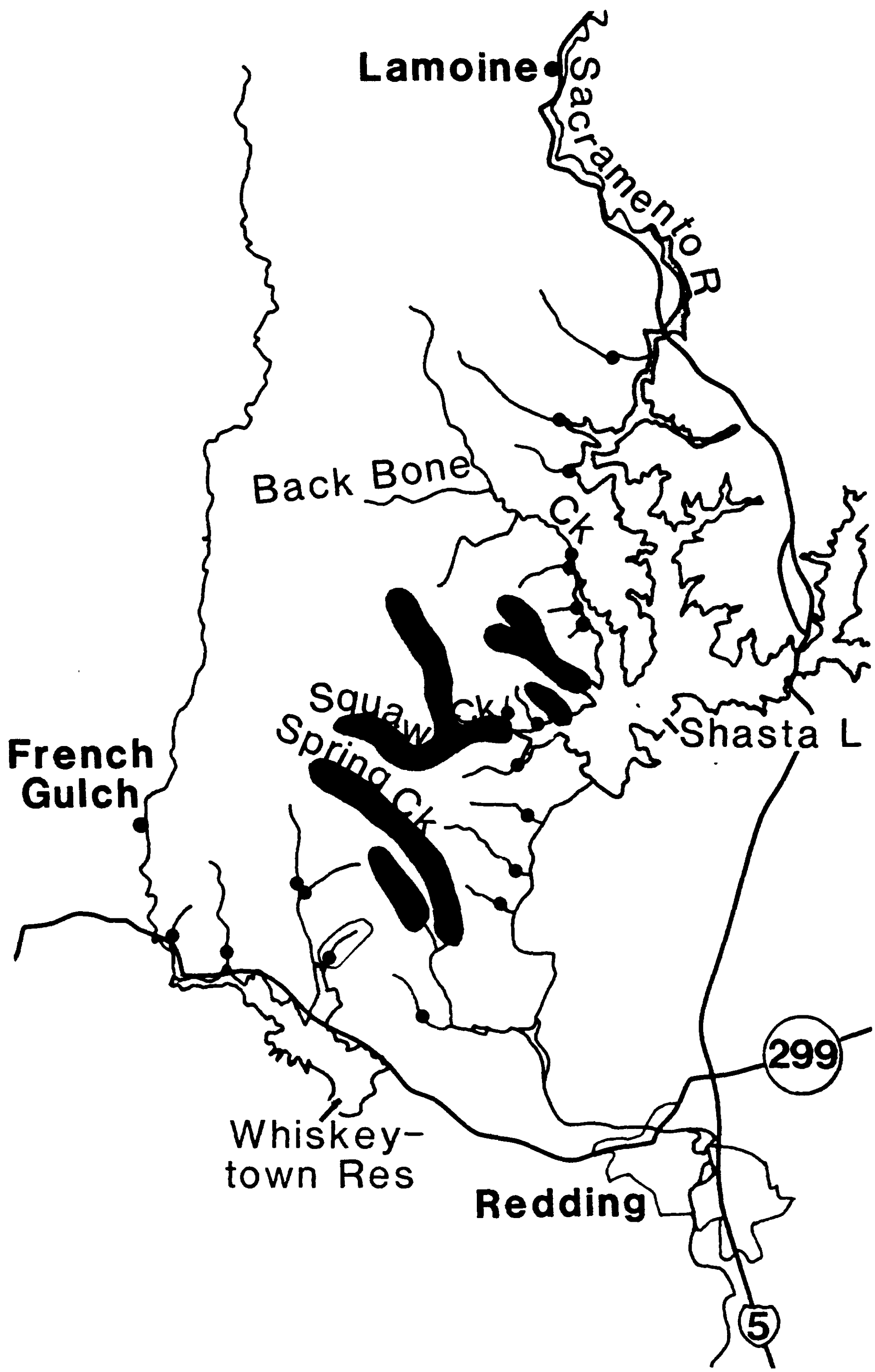

Figure 7. Copper in sieved sediments, -150 mesh. Stream drainages containing copper in amounts ≥ 100 ppm, open outline; ≥ 300 ppm, solid color.

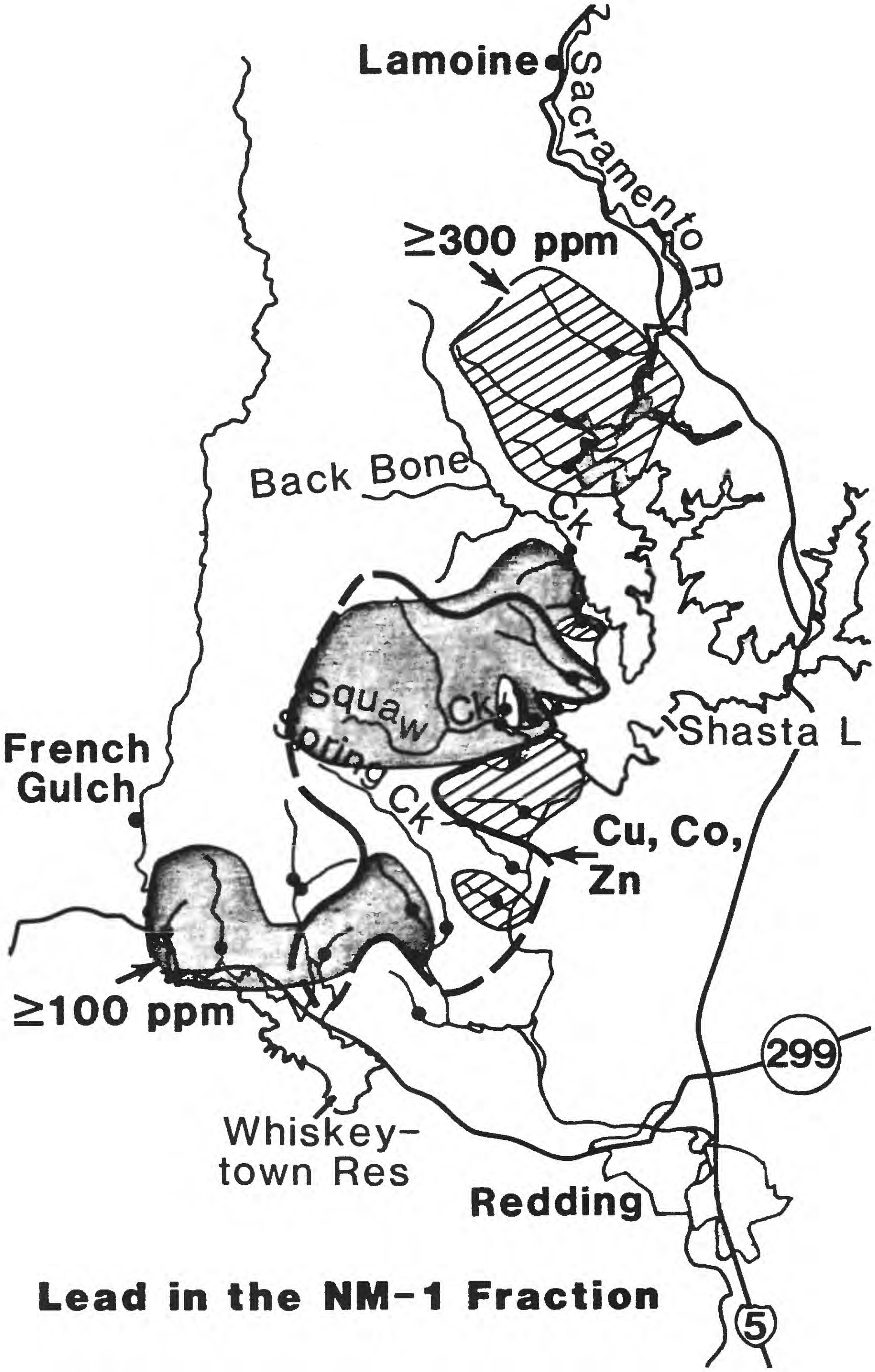

Figure 8. Distribution of lead (≥ 100 ppm, shaded; ≥ 300 ppm, diagonal line pattern) relative to a central zone of copper (≥ 500 ppm) cobalt (≥ 50 ppm) and zinc (≥ 500 ppm) in the nonmagnetic (NM-1) fraction.

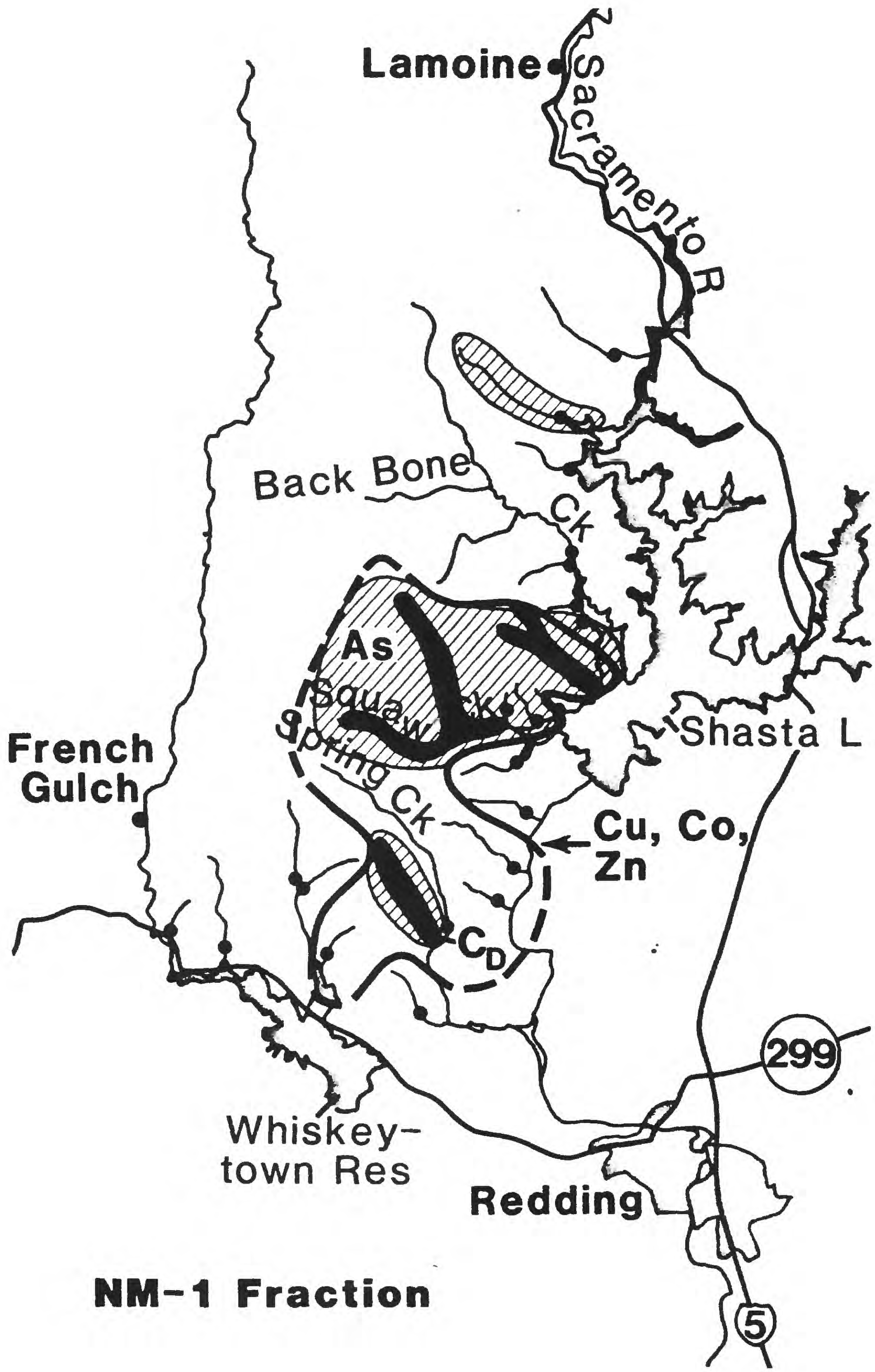

Figure 9. Distribution of arsenic (≥ 500 ppm, diagonal line pattern) and cadmium (≥ 50 ppm, solid color) relative to a central zone of copper (≥ 500 ppm) cobalt (≥ 50 ppm) and zinc (≥ 500 ppm) in the nonmagnetic (NM-1) fraction.

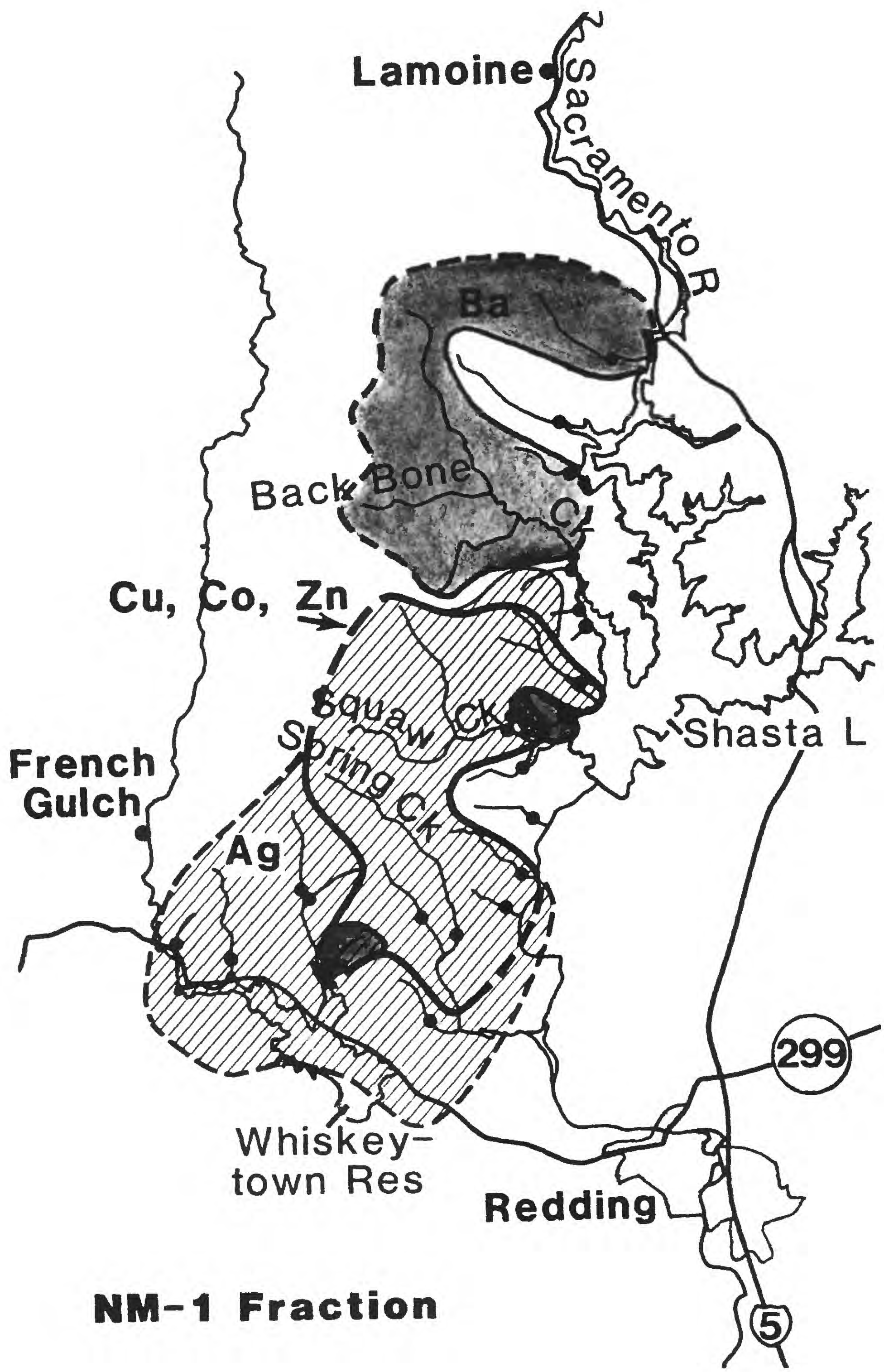

Figure 10. Distribution of barium (≥ 10,000 ppm, shaded) and silver (≥ 1 ppm, diagonal line pattern) relative to a central zone of copper (≥ 500 ppm), cobalt ≥ 50 ppm) and zinc (≥ 500 ppm) in the nonmagnetic (NM-1) fraction.

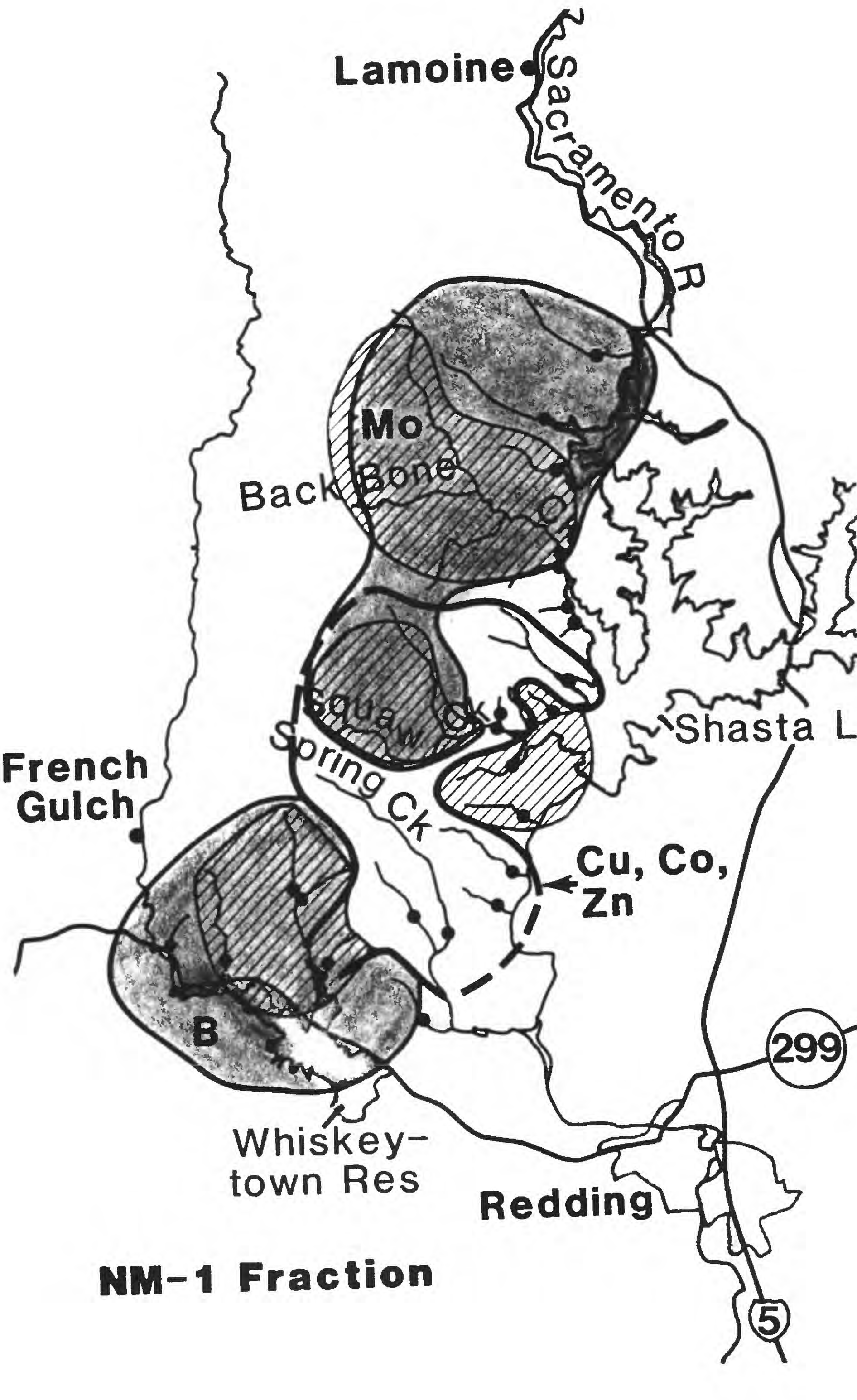

Figure 11. Distribution of boron (≥ 70 ppm, shaded) and molybdenum (≥ 10 ppm, diagonal line pattern) relative to a central zone of copper (≥ 500 ppm) cobalt (≥ 50 ppm) and zinc (≥ 500 ppm) in the nonmagnetic (NM-1) fraction.

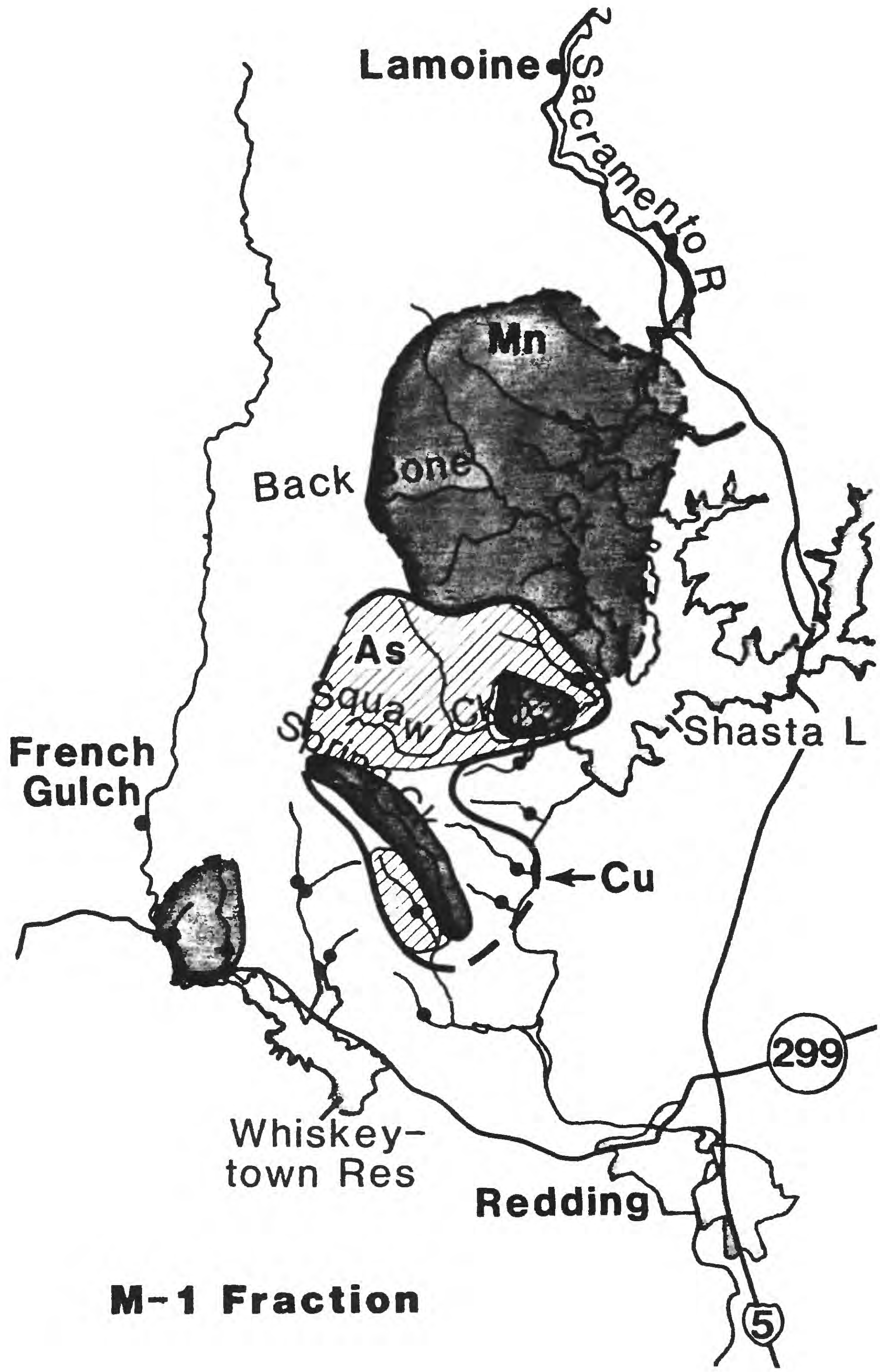

Figure 12. Distribution of arsenic (≥ 500 ppm, diagonal line pattern) and manganese (≥ 1000 ppm, shaded) relative to a central zone of copper (≥ 500 ppm) in the magnetic (M-1) fraction.

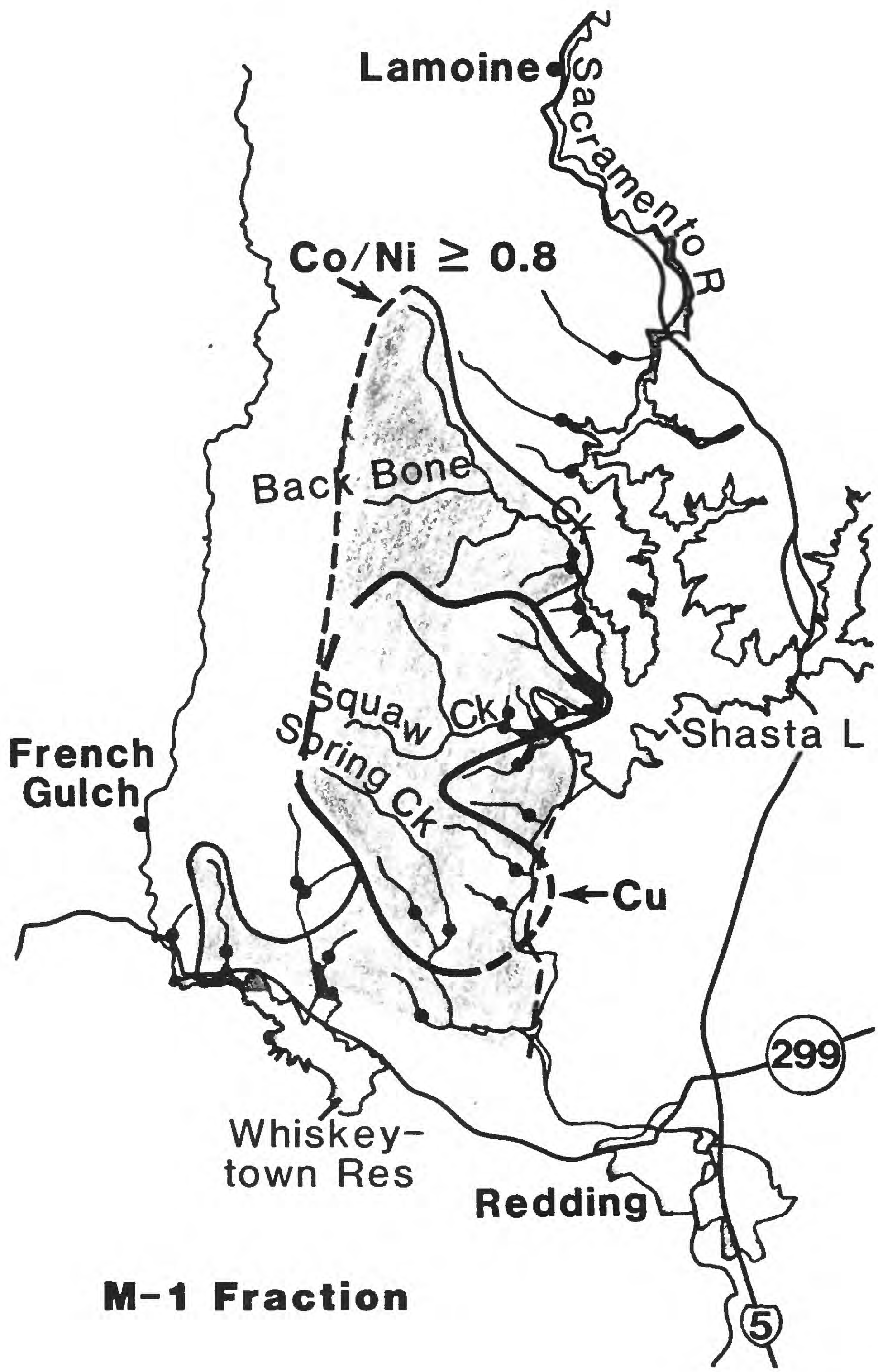

Figure 13. Distribution pattern of a cobalt/nickel ratio ≥ 0.8 relative to a central zone of copper (≥ 500 ppm) in the magnetic (M-1) fraction.