# COMPARATIVE STUDY OF RECONNAISSANCE STREAM SEDIMENT SAMPLING TECHNIQUES FOR GOLD: FIELDWORK* (93L)

By P. F. Matysek and D. W. Saxby

A study has been implemented to directly compare the effectiveness of a variety of stream sediment sampling techniques for regional gold exploration. This report describes the objectives, completed fieldwork and proposed sample processing.

## INTRODUCTION

Reconnaissance drainage surveys for gold deposits have historically employed two procedures, conventional stream sediment and heavy mineral sampling. However, gold concentrations indicated by such surveys, and their innumerable variations, have typically been erratic, nonreproducible in the field and difficult to interpret. Both sampling approaches have produced false anomalies and ensuing wasteful follow-up programs, but even more importantly, have in some cases failed to identify true anomalies.

There is substantial evidence from previous researchers that these problems of poor reliability principally arise from (1) low numbers of gold grains in stream sediments, causing high random sampling errors (Clifton *et al.*, 1969; Harris, 1982; Day and Fletcher, 1985), and (2) localized and variable distribution of high density gold grains as a result of selective hydraulic sorting (Wells, 1973 and Saxby and Fletcher, 1986).

Further insight on the general nature of these problems is gained from recent stream sediment studies on the within-site variability of two other heavy minerals, cassiterite (Fletcher *et al.*, 1985) and scheelite (Saxby, 1984). Both studies found that errors caused by particle scarcity and selective sorting of heavy minerals decrease with decreasing grain size and that sampling for finer grain sizes (-270 mesh, <60 microns) is therefore advisable.

Based on the above considerations, this study compares the reliability of conventional stream sediment and heavy mineral sampling for various sizes of gold particles. This is accomplished by using replicate samples from known anomalous and background drainages to estimate within-site variability, and hence the probability of obtaining a geochemical value indicative of a (1) true anomaly, (2) false (nonsignificant) anomaly, (3) false background (missed anomaly), and (4) true background.

## FIELDWORK: SAMPLE COLLECTION

Eighty bulk sediment samples were collected by the authors from nine streams draining Hazelton Group lithologies in northwestern British Columbia, NTS 93L (Figure 6-3-1). For the most part, sampling was restricted to single stations on secondary and tertiary streams draining areas averaging 8 to 15 square kilometres. Four of the sampled catchments contain gold mineralization and are undisturbed by large-scale placer or bedrock mining activity. Local geology of the anomalous drainages and some site characteristics are summarized in Table 6-3-1. Three additional stations were established at 2-kilometre intervals along one of the anomalous streams (Fedral Creek) to examine the downstream dispersion characteristics of gold for each sampling method. The remaining drainages sampled are assumed to represent background concentrations of gold, based on the absence of reported occurrences of any economic minerals in a readily accessible, well-explored area.

At all stations, replicate samples were collected from high and low energy environments, characterized by course gravel and fine gravel to sands respectively. Higher energy environments (for example, heads of stream bars), which are known to favour the accumulation of higher density minerals, were typical heavy mineral sample locations. Conversely, the less energetic environments (for example, tails of stream bars), which favoured the rapid collection of fine sands, were representative of conventional stream sediment sites. Plates 6-3-1 and 6-3-2 illustrate the contrasting textures of samples collected from high and low energy environments respectively. Four replicate samples were collected from each environment at sample stations in anomalous streams, and two were collected from each environment in background streams. All replicate samples within a given station were collected, on average, over a 25-metre segment of the stream course.

Samples were shovelled or scooped directly into an 11-litre steel pail, wet-sieved to -20 (1 millimetre) and stored in labelled plastic bags. Sample weight averaged about 14 kilograms wet.

Each site was photographed and a number of general observations recorded, including stream width, weight of material processed and elapsed time for sample collection. Sketches of sites included channel and bar configurations, and sample locations (Figure 6-3-2).

**TABLE 6-3-1**
**DESCRIPTION OF SAMPLED ANOMALOUS STREAMS**
***(see Figure 6-3-1 for locations)***

| Stream: NTS Sheet: Draining Mineral Occurrence: | Local Geology and Gold Mineralization | Site Characteristics[1] |
|---|---|---|
| Fedral Creek<br>93L/10E<br>Dome Mountain | Au-Cu-Pb quartz veins near upper contact of the Telkwa Formation | D = 3 km<br>R = 200 m<br>A = 10 km$^2$ |
| Richfield Creek<br>93L/09W<br>Topley-Richfield | Au-Zn-Pb quartz carbonate veins in Hazelton volcanics | D = 3 km<br>R = 175 m<br>A = 15 km$^2$ |
| Cabinet Creek<br>93L/11E<br>Hunter Basin | Au-Cu-Ag quartz veins cutting Hazelton volcanics | D = 4 km<br>R = 800 m<br>A = 18 km$^2$ |
| Glacier Gulch<br>93L/14W<br>Glacier Gulch (North and Bismuth) | Au-Mo-W-Bi quartz veins sheetings and stockworks | D = 3 km<br>R = 250 m<br>A = 12 km$^2$ |

[1] D = Distance downstream from mineralization.
R = Relief from mineralization to sample site.
A = Sampled drainage area.

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## PROPOSED SAMPLE PROCESSING

Sample preparation by a commercial laboratory will involve a series of splitting, sizing and heavy liquid separations to obtain samples which are representative of conventional stream and heavy mineral samples (Figure 6-3-3).

Initially, all -20 mesh bulk samples will be dried and then separated into 1/8 (1 to 1.5 kilograms approximately) and 7/8 (8 to 10 kilograms approximately) splits. Processing of the larger split will involve wet-sieving through a -60 mesh screen, a density separation by a two-stage heavy liquid treatment (tetrabromethane, S.G. = 2.96 and methylene iodide, S.G. = 3.3), and then sizing to prepare four heavy mineral concentrates (-60 + 150, -150 + 200, -200 + 270 and -270 fractions). Processing of the smaller split will involve dry-sieving through -80 mesh to prepare a typical stream sediment sample.

## FUTURE WORK

Processed samples will be weighed into plastic vials for estimation of gold and associated elements by neutron activation analysis at a commercial laboratory. Analytical results are expected early in 1987.

Results from this study will be used to assist in (1) quantifying the risks and benefits of re-analysis of archived Regional Geochemical Survey -80 mesh (<177 microns) stream sediment pulps for gold, and (2) selection of an appropriate stream sediment sampling technique for gold in future surveys. An Open File Report describing the results will be available in 1987.

## REFERENCES


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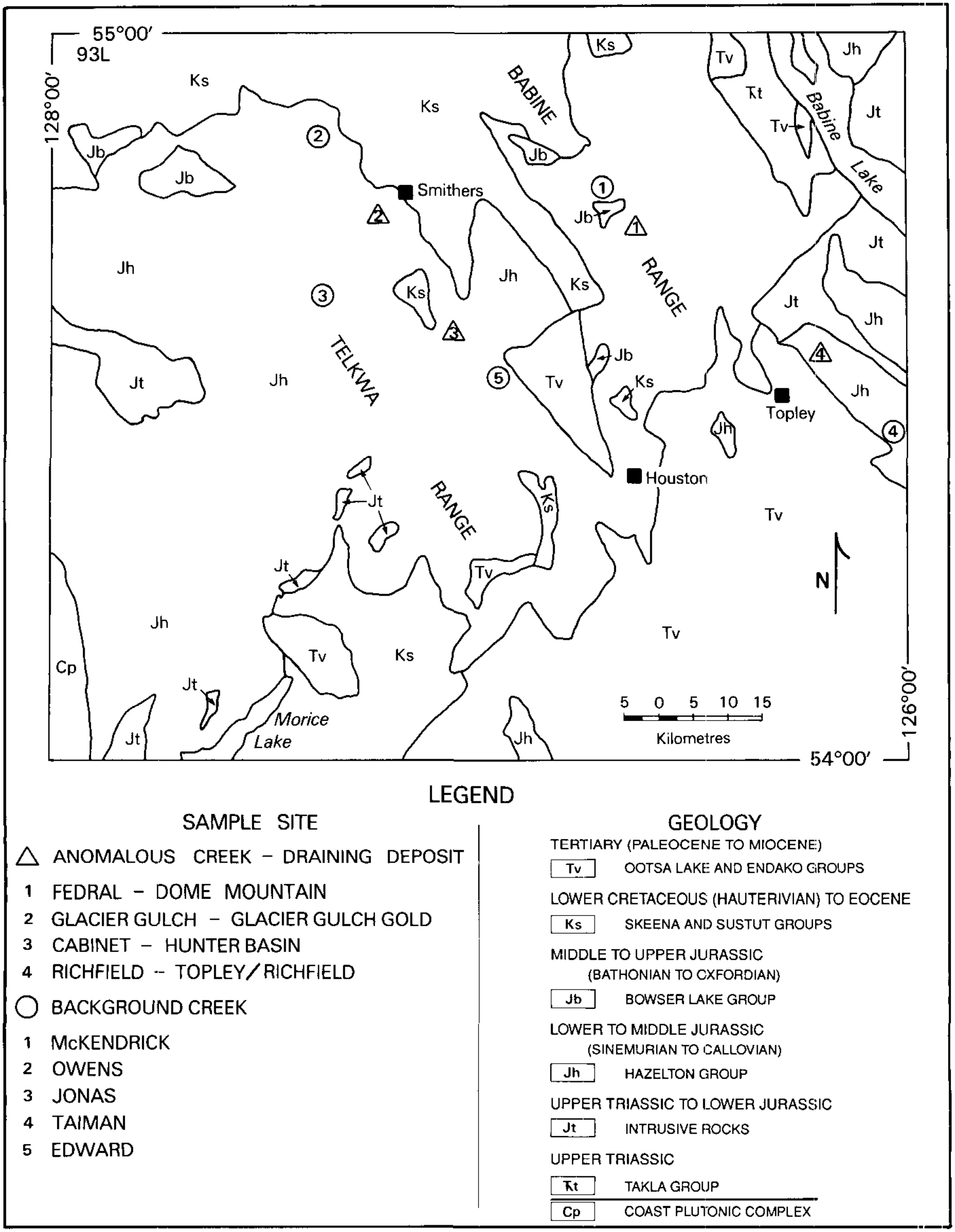


Figure 6-3-1. Sample site locations and general geology of the Smithers map sheet area.

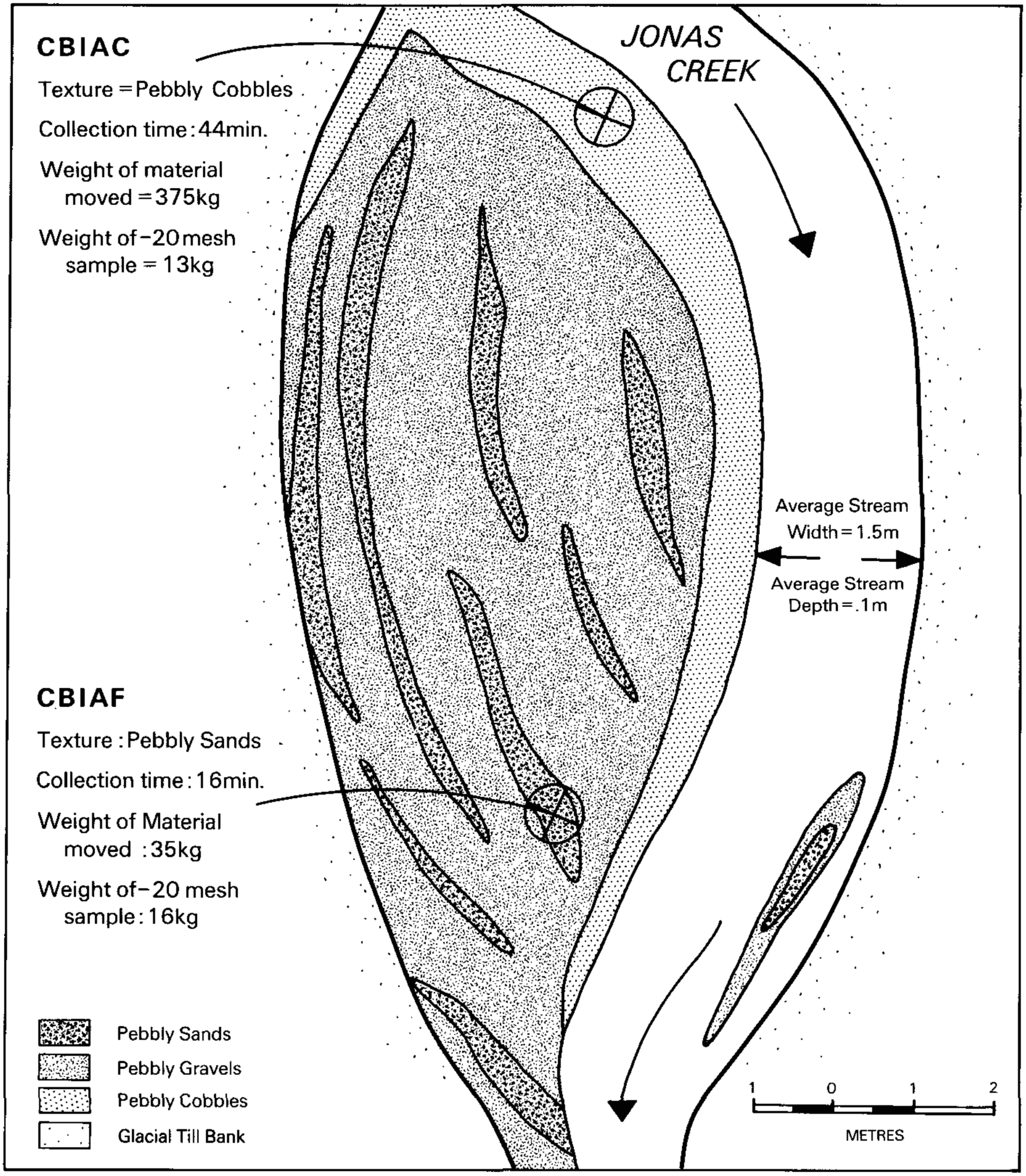


Figure 6-3-2. Detailed sketch map and sampling statistics for two bulk sediment samples collected from Jonas Creek.

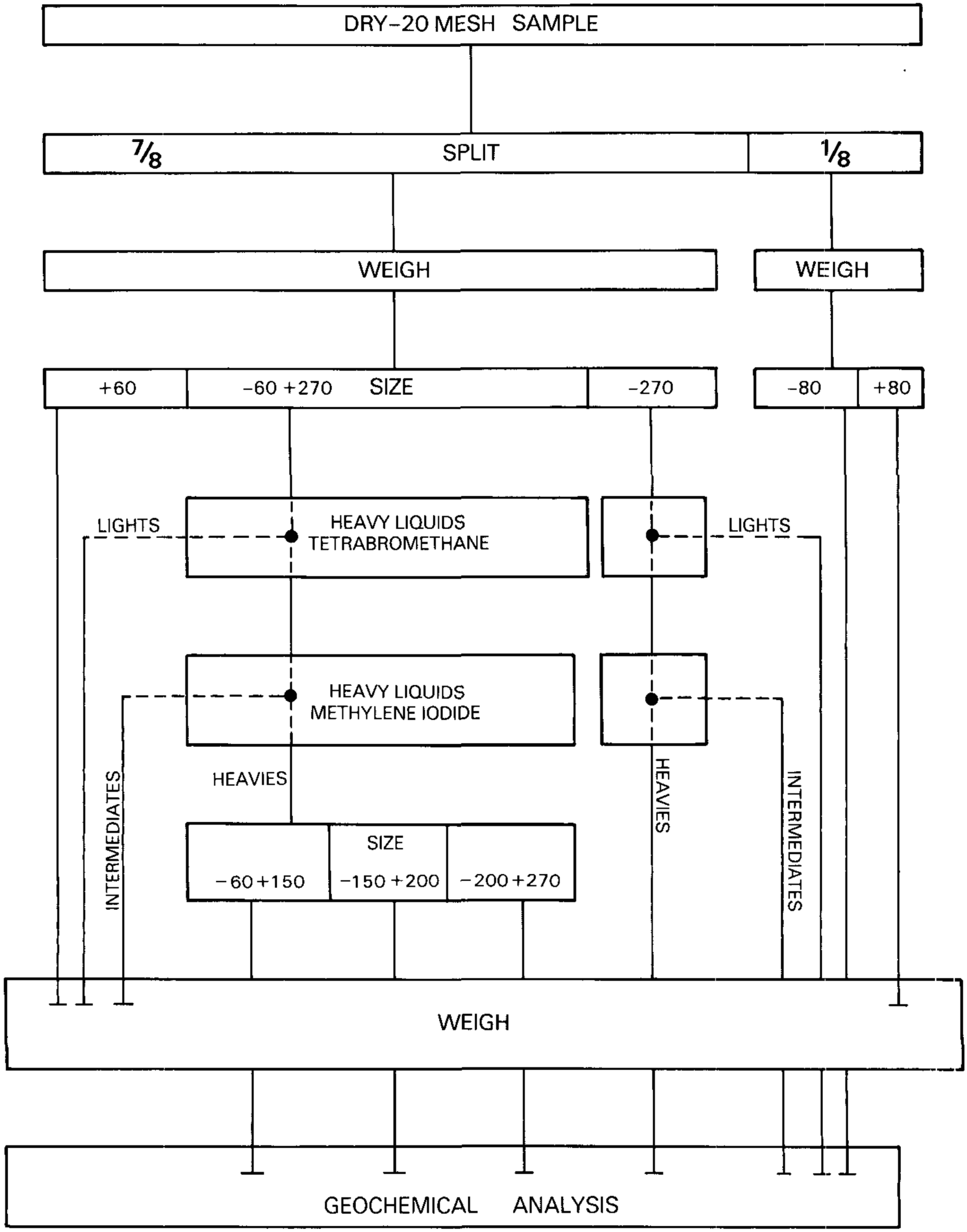


Figure 6-3-3. Bulk sample processing scheme.

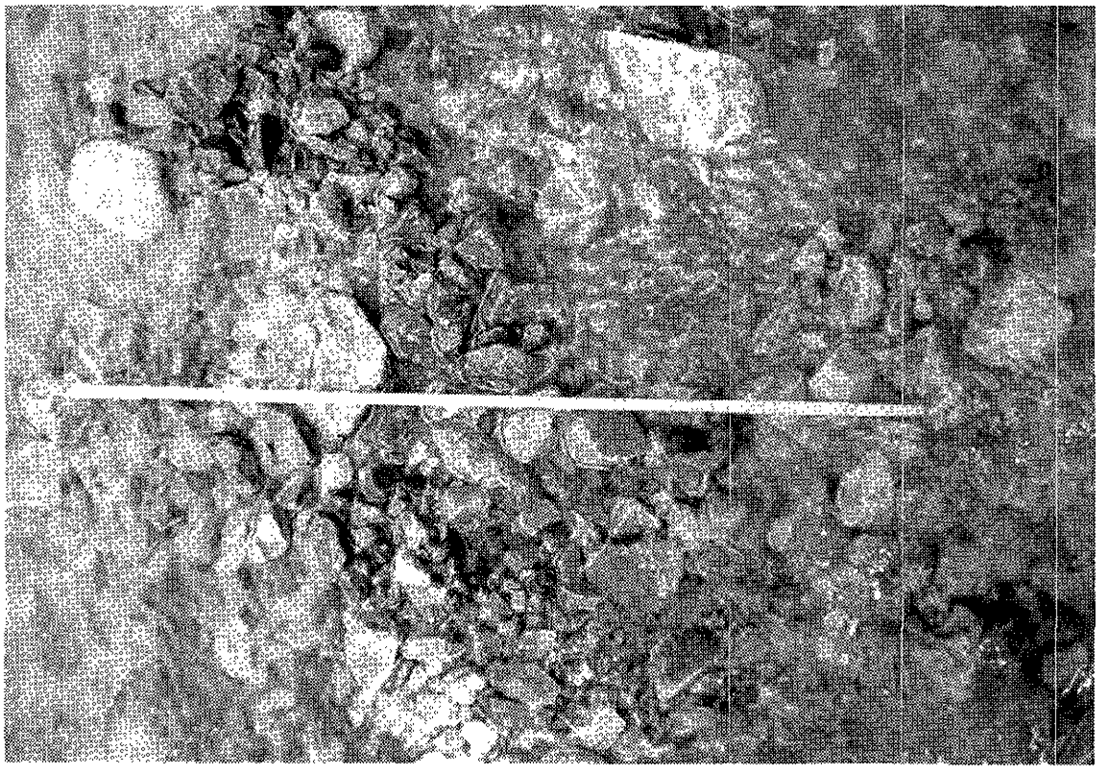

Plate 6-3-1. Typical textural characteristics of higher energy environments selected for bulk sediment sampling. Site photo of sediment sample GAICC.

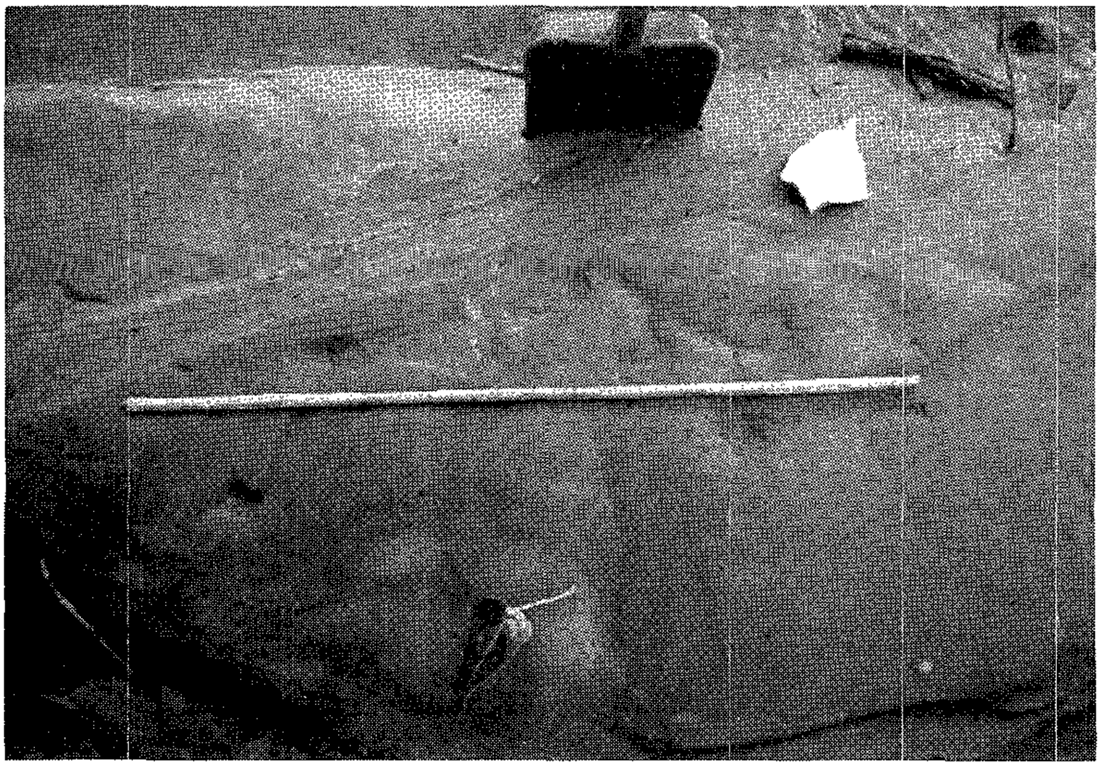

Plate 6-3-2. Typical textural characteristics of lower energy environments selected for bulk sediment sampling. Site photo of sediment sample GAICF. Note scale in both photos is 50 centimetres.