Exploration Geochemistry Workshop
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Introduction to Exploration Geochemistry: Part II

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Geochemical Exploration Program Design

There is a need to understand both the exploration objectives and the economic parameters when designing a exploration program .

The design process involves careful analysis and synthesis of available relevant information on the type of mineralization sought, geology, soil type(s), geomorphology, dispersion characteristics of the target and/or pathfinder elements, access, etc. in the proposed survey area.

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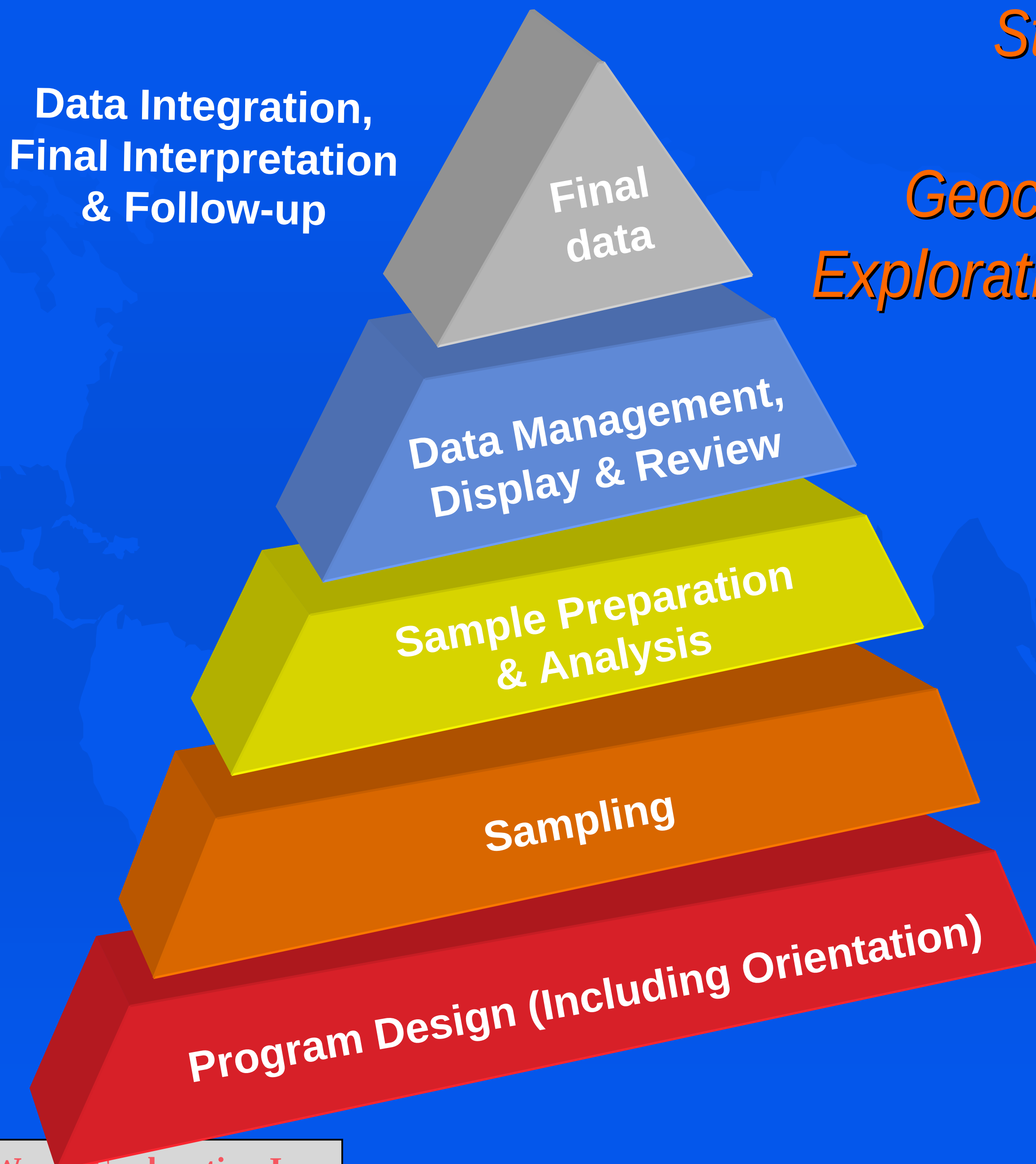
In new areas, even with good information, the acquistion of all necessary information could require a series of preliminary field and lab investigations known as *orientation studies*, of selected parts of the general area of interest.

It is essential, in the absence of area specific data, and even when extensive case history data exist (which can prove misleading in detail), that careful orientation field, lab and interpretational studies be considered and if necessary implemented.

Stages of a Geochemical Exploration Program



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Orientation surveys should determine:

- **The nature and extent of dispersal/ion patterns associated with, preferably undisturbed, mineralization of the type being sought.**
- **The distribution and behaviour of elements of potential interest in unmineralized background areas, with otherwise similar conditions to the mineralized area.**

Factors to be considered for different sample media, for optimizing and evaluation, during geochemical surveys are:

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Sediment:

- Optimum material (sediment from seepages, stream channels, flood plain, centre-lake, near-shore lake);
- Optimum fraction (size, heavy minerals, organic);
- Most effective extractant or method of anomaly enhancement;
- contrast of anomaly at source;
- Metal content of bank material;
- Correlation with Fe-Mn-oxides, organic matter.

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Water:

- **Optimum material (ground water vs surface water);**
- **For ground water, the relation to recharge areas, difference between aquifers, controls on water flow and availability of sampling points;**
- **For lake waters, possible variations with depth and type of lake;**
- **pH, Eh, precipitants, absorbents;**
- **Relation to total dissolved solids and major elements.**

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Major factors to be optimized and evaluated by an orientation survey in residual soil or transported overburden

- **Optimum contrast between samples at a mineralized zone, representative of that being sought, as compared to a range of background conditions in the survey area, considering the factors below;**
- **Determination of the most suitable indicator element or elements, either ore elements or pathfinder elements or both;**
- **Range of background and intensity of anomaly near mineralization;**

Residual Soil - Transported Overburden con't.:

- **Nature of overburden:**
  - **Residual vs transported, and transport mechanism and direction;**
  - **Soil profile development;**
  - **Depth variation of indicator elements;**
  - **Effects of topography, drainage, vegetation, rock types**
- **Optimum depth of sampling;**
- **Optimum size or density fraction (clays, silts, heavy minerals, etc.)**

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Residual Soil - Transported Overburden con't.:

- **Most suitable analytical procedure:**
  - **- Extraction method (total, hot-acid extractable, cold-extractable, etc.)**
  - **- Determination method (detection limit, interferences, cost);**
- **Shape, extent and homogeneity of anomaly, using preferred method and one or two traverses across mineralization (line, grid or contour sampling);**
- **Reproducibility of sampling and analysis;**
- **Possibility of contamination.**

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Check list of factors to be determined during biogeochemical orientation surveys

- **Optimum species based on distribution (must be widespread), contrast of anomalies, homogeneity of anomalies, ease of recognition, ease of sampling and depth of root system;**
- **Part of plant to be sampled (twigs, leaves, fruits, bark, wood);**
- **Best indicator elements or elements;**

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Biogeochemistry con't.:

- **Effects of aspect (sunlight), drainage, shading, antagonistic effects of other elements;**
- **Amount of vegetation needed to give adequate ash;**
- **Contamination from dust or other sources;**
- **Sampling pattern and interval.**

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Check list of factors to be optimized by an orientation survey preparatory to rock sampling.

- **Type of sample (rock, vein material; comparison with soil or drainage samples);**
- **Size and character of sample (single large chunk, many small chips, channel sample, length of drill core);**
- **Best indicator elements (ore element, pathfinder elements, major elements, rare earth elements, element ratios-equation, plots);**
- **Applicability of separated minerals (sulphides, limonite, biotite, calcite, etc.);**

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Rock Sampling con't.:

- Effects of weathering, rock type, hydrothermal alteration and other geological variables on background and contrast of anomalies;
- Shape, extent and homogeneity of anomalies and reproducibility of anomalies from a single site;
- Method of sample decomposition and analysis (total analysis, sulphide- or oxide-selective leach, acid digest);
- Sources of contamination (metal from collecting and crushing equipment, dust, drill steel, drill grease or muds, circulating waters, smelter fumes)

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Field Survey Procedures

Effective geochemical field programs require trained personnel capable of recognizing and describing the correct sample material and sample site characteristics.

Samplers should be able to recognize and avoid contamination or physicochemical conditions that could produce spurious or unusual results.

Work should be supervised by a geochemist, or if not possible by a geologist with adequate geochemical training and experience in the survey environment.

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Scale of Mineral Exploration

Sample Medium	Region	District	Area	Target
Rock	x	x	xx	xx
Soil	x	x	xx	xx
Stream/Lake Seds. and/or Water	xx	xx	x	
Groundwater	xx	xx	x	
Glacial Deposits	xx	xx	xx	x
Biogeochemistry		x	xx	x
Geobotany	x	x	x	
Gas			x	x

Note: xx - Commonly used in suitable environments

x - Occasionally used in suitable environments

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Care should be taken to ensure that:

- **sampling equipment is constructed of non-contaminating materials**
- **samples have no contact with gasoline**
- **samplers wear no contaminating dress (rings, etc)**
- **samplers wear no bug dope - sun screen (soil gas)**

Sample containers – proper for material being sampled:

- **kraft paper envelopes**
- **zip lock plastic bags**
- **plastic bags**
- **cloth bags**

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All samples should be allocated a simple unique sequential number:

- Pre-numbered "Sample Collection Record Books".

- have tear off tag

- auto-randomizing of samples

- locational information

- standardized field observational data

- leave sample numbers open for lab duplicates and standards (need pre-planning)

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It is essential that clear instructions to the lab, and a record thereof, as well as the sample numbers shipped, be included with all sample shipments and kept by the shipper.

LABORATORY DISPATCH SHEET

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Although geochemistry techniques can generally contribute significantly to most exploration programs, it is stressed that an integrated multi-disciplinary approach to mineral exploration is best so that potential targets can be delineated with far greater efficiency and confidence as well as more cost effectively.

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