

PRIMARY AND SECONDARY GEOCHEMICAL DISPERSION PATTERNS

Dispersion Halos

Dispersion is the process of dispersing elements outward from a source. A dispersion halo is a zone around a mineral deposit where the metal values are less than those of the deposit but significantly higher than background values found in the country rocks around the deposit. Geochemical sampling and testing can be used to outline the “dispersion halo”.

Primary Dispersion Halos: Primary dispersion refers to dispersion which occurs in rocks at or near the time of formation of a mineral deposit. It is usually the result of “hydrothermal” (hot aqueous) fluids which are responsible for creating the deposit. Fluid movements in rocks are so variable that the halo formed by primary dispersion may or may not reflect the shape of the ore deposit itself. The extent of the primary dispersion halo can range from inches to hundreds of feet. The extent of the primary halo is dependent on very dependent on the nature of the rock. Extremely porous or highly fractured rocks usually develop more extensive primary dispersion halos.

Secondary Dispersion Halos: Secondary dispersion refers to dispersion which occurs in the secondary environment (soils, stream sediments or plants) long after the formation of a mineral deposit. This type of dispersion is usually the result of mechanical and/or chemical weathering. Mechanical weathering is caused primarily by breakage due to freezing and thawing. Chemical weathering is caused by chemical reactions between minerals and groundwater resulting in chemical decomposition of minerals. Chemical decomposition can also be caused by bacterial action.

The dominant means of chemical breakdown of minerals in the near surface environment is oxidation. Oxidation has dramatic effects on the behaviour of iron and sulfur, which happen to key elements in many types of ore deposits. After decomposition, the elements from the minerals are released into groundwater or surface water, which carries the elements outward. Halos caused by secondary dispersion are usually much more widespread than those caused by primary dispersion. For this reason, sampling of soils, stream sediments or plants can detect the presence of a mineral deposit from a much further distance.

Groundwater and surface waters migrate and transport metallic ions away from ore deposits. Weathering, oxidation and water migration also produce and transport iron and manganese ions, which are particularly abundant in and around ore deposits. Iron and manganese ions tend to precipitate easily once they leave acidic water conditions around a weathered ore deposit and come into contact with normal pH water conditions. They precipitate as hydroxides forming solid particles which are abundant in soils and silt size stream sediments. These hydroxides are negatively charged, and behave like magnets to metallic cations in solution, causing them to be precipitated also. This process, called adsorption, leads to small accumulations of metallic ions in soils and stream sediments (Figure 1).

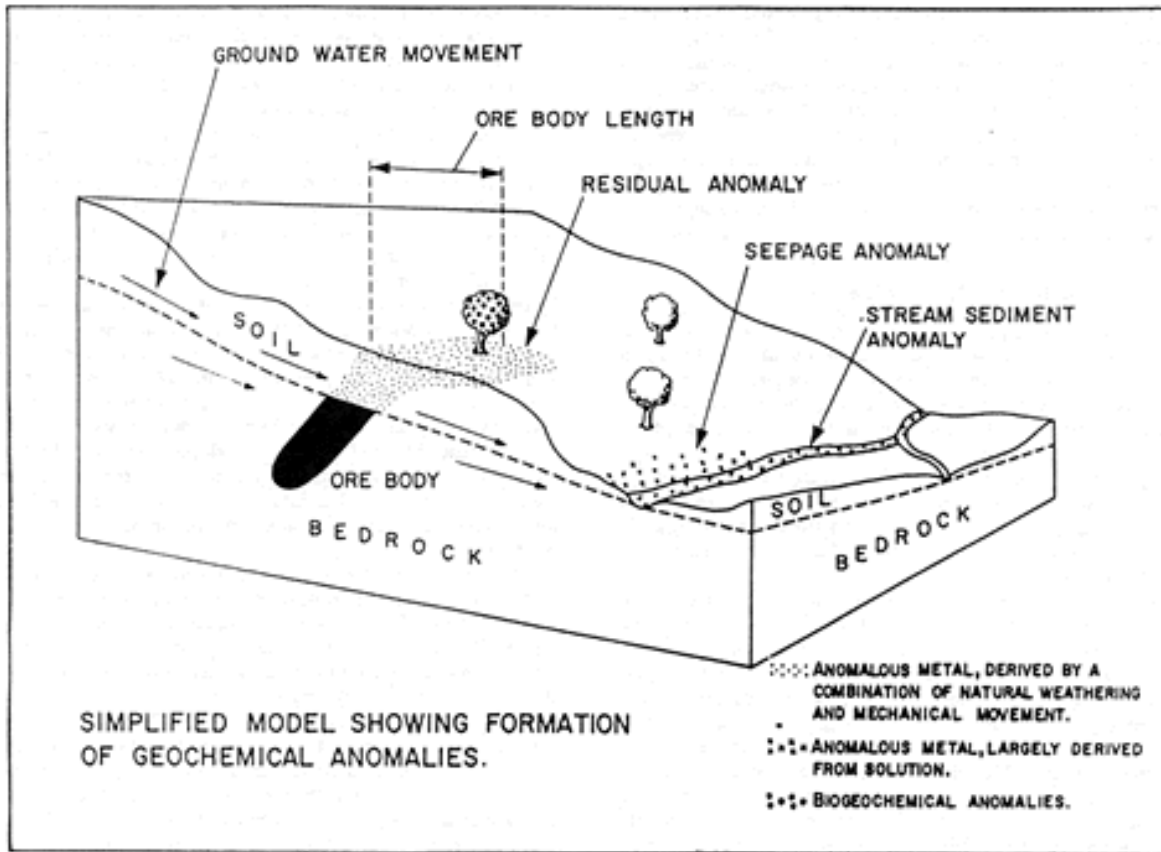


Figure 1- Dispersion of metallic ions in soils near ore body.

Dispersion results in the transport of metallic ions away from a source. Some of these ions are precisely the ones sought after, and others are called “pathfinder” metals or elements. Pathfinder elements are those which are closely associated with the metal of interest. High values of pathfinder elements may be more significant because they have better mobility, resulting in greater dispersion. For example, arsenic and bismuth are good pathfinders for gold.