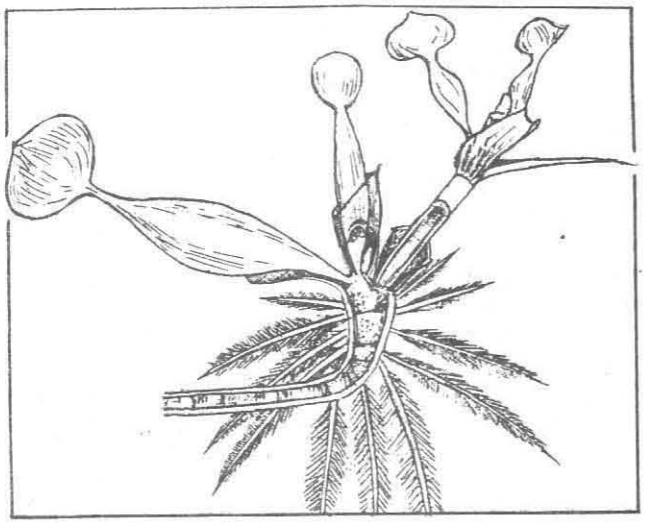
Indicator plants—a tool for mineral prospecting

PLANTS in general can indicate a deficiency or an excess of water and often such accompanying factors as mineral and salt content, etc. *Cacti, Agave, Yucca* and other xerophytes are associated with habitats of low water content, high temperatures and low humidity. Cattail *(Typha)* water hyacinth *(Eichhornia)* and other hydrophytes indicate an excessive water supply and poor aeration.



Avicennia, Rhizophora, Atriplex and other halophytes denote an excess of soil solutes and mineral salts. The fossils of these plants can undoubtedly indicate the environment in which they flourished in the past. Plants having distributions which correlate well with the content of some element in aquatic or terrestrial habitats are called indicator plants. They are used in monitoring water pollution and in the prospecting for ore deposits.

Water pollution indicators

Algal blooms are indicators of certain mineral enrichment in an area. Several research works have established the feasibility of using benthic algae as qualitative or quantitative indicators for heavy metal pollution. Brown algae have been frequently employed for coastal monitoring. They react physiologically and morphologically towards pollution due to heavy metals and herbicides which alter the photosynthetic efficiency and nutrient uptake levels. *Ascophyllum nodosum* and *Fucus vesiculosus* are the important indicators of zinc, cadmium and copper.

Mineral indicators

Botanical methods of prospecting for minerals include biogeochemistry (chemical analysis of vegetation and soil) and geobotany (geographical distribution of vegetation). The latter technique is very old and dates back to the 17th century; when it was known that there was a relationship between the nature of the substratum and the type and distribution of vegetation. Sand cultures and chemical analyses of some plants have shown that certain plant species accumulate specific type of minerals in large amounts and apparently require them for healthy growth. These indicator plants are, thus, important in locating and mapping the presence of such minerals. Table 1 shows a list of important indicator plants and their respective minerals.

Table 1. Some minerals and their indicator plants

Minerals	*Indicator plants*
Aluminium	*Hydrangea Macrophylla*
Barium	*Anthoxanthum odoratum*
Bromine	*Allium cepa*
Calcium	*Medicago sativa*
Chromium	*Nicotiana tabacum*
Cobalt	*Nyssa sylvatica* & *Andropogan virginicus*
Fluorine	*Chenopodium murale* & *Poa annua*
Iodine	*Lactuca sativus*
Lithium	*Citrus* & *Poppy*
Nitrogen	*Persea americana*
Selenium	*Astragalus albulus* & *A. Argillosus*
Strontium	*Arabis stricta* & *Carex humilis*
Vanadium	*Amanita muscaria a fungi*
Zinc	*Ambrosia artenaisiofolia*

The most interesting indicator plant for aluminium is *Hydrangea macrophylla* which produces blue flowers if aluminium is available in the soil, but pink flowers in the absence of the element. The important indicator plants for copper are *Haumaniastrum katangense* and *Becium homblei*. These cuprophytes are found exclusively on soils containing more than 5000 μg of copper per gram soil. They were used extensively in the 1950s for copper exploration because geobotanists noted that they never grew in soils containing less than 100μg copper per gram soil. *Chenopodium murale* and *Poa annua* are the best indicator plants for fluorine in soil. These plants are useful to diagnose fluoride air pollution as they develop characteristic foliar symptoms of fluoride injury.

Geobotanists rely strongly on the identification of plant

species or plant communities specific to certain types of mineralization and their task becomes much easier if an indicator plant can be identified. The remarkable distribution of *Haumaniastrum katangense,* a copper indicator has led to interesting archaeological discoveries in Zaire. The ancient copper mines of Zaire are identifiable by dense carpets of *H. katangense* or *H. robertii* which grow over them even now. Wide explorations are further needed in the field of indicator plants to unearth hidden resources like minerals, fossil fuels, etc., and also to forecast volcanoes and polluted areas.

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