Putting carbon into quarantine

Locking plant material inside mineral particles may be another answer to global warming, says S.Ananthanarayanan.

A group in Australia is working on locking carbon of the atmosphere into pockets of silica or calcium compounds, to put carbon out of circulation for very long periods. These pockets occur naturally in many plants and have been of interest in botany or even archeology, but the idea may now become an answer to environment degradation!

Phytoliths

This is the name for rigid microscopic particles, also called ***plantstones***, that are found in many plants. Plants take up minerals from the soil, silicon being one of them. Minerals are important for plants not only as traces for metabolism but also, mainly for support and structure. Silicon is a common participant in plant fibres, taken up by the roots and carried up to the shoot. It is finally deposited in the cell wall material in the form of a chain molecule consisting of silica and water. This forms double layers of silica with cuticle or cellulose on the surface of leaves, and stems and helps the plant stiffen and stand erect, to make the best of available air and sunlight.

Plants vary in the silicon they take up from the soil. A plant that hold more than 1 gram of silicon in a kg of dry weight is considered a *silicon accumulator*. The tomato, cucumber and soybean are poor accumulators but many plants, like wheat, oat, rye, barley, sorghum, corn, and sugarcane contain about 10 g/kg. The rice plant is the leader, with over 100 gm/kg.

And the mineral take-up forms granules, of different sizes and shapes, depending on the plant and in which part of the plant, as in the stem or on the leaves.

Functions

Apart from providing rigidity, phytoliths serve to protect the plants from predators by making the plant distasteful or grainy and prickly. In the case of cacti, which close their pores during the day to avoid loss of water, calcium oxalate phytoliths work as reservoirs of carbon dioxide, which the plant uses for photosynthesis. The baobab uses the carbon dioxide trapped in phytoliths to make its bark fire-resistant!

As phytoliths are made of minerals and are robust, they survive when the plant dies and decomposes. Phyolith residue is thus a durable record of where the plant has been. This has proved useful in archeology, as phytolith records reveal the kind of vegetation in bygone times or the crops that prehistoric peoples cultivated, or the kind of natural privation that destroyed vegetation and the animal species the vegetation supported.

Phytoliths are found not only where plants grew and died but also in prehistoric remains of teeth, cooking utensils or places of storage of food. These traces can reveal exactly the kind of crops cultivated, and hence the current economy, by the nature of phytoliths found.

Global warming

All counties are alive to the danger we face because of the carbon dioxide building up in the atmosphere, the rise of temperatures and other climatic and environmental changes. The cause is the release of carbon dioxide by burning fossil fuels, for transport and power generation. Containing carbon pollution has become the priority and methods of ***carbon sequestering***, or saving the carbon-rich effluents from mixing with the atmosphere are being developed. There are methods of trapping carbon dioxide gas in spent coal mines, in underground or underwater rock formations or in abandoned oil wells. The methods have high costs and are not entirely reliable, as they allow leakage and may even collapse.

Phytolith carbon trap

This is where carbon trapping phytoliths become interesting. By cultivating the right kind of crops over vast areas of land, great quantities of carbon dioxide could be locked into mineral grains, to stay trapped for centuries. Plants already perform the service of converting carbon dioxide into food and oxygen throughout daylight hours. Increasing green cover is by itself a means of controlling the CO_2 buildup. But choosing the plants that form phytoliths would actively reduce the CO_2 in circulation, with low costs and high reliability.