

Carbon dating to measure age of organic material

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In news— A district court in Varanasi has recently allowed a petition seeking carbon dating of the structure inside the Gyanvapi mosque that the Hindu side has claimed is a 'Shivling'.

What is carbon dating?

- **Carbon dating is a widely-used method applied to establish the age of organic material, things that were once living.**
- Living things have carbon in them in various forms. The dating method **makes use of the fact that a particular isotope of carbon called C-14, with an atomic mass of 14, is radioactive**, and decays at a rate that is well known.
- The **most abundant isotope of carbon in the atmosphere is carbon-12** or a carbon atom whose atomic mass is 12.
- A **very small amount of carbon-14 is also present**. The ratio of carbon-12 to carbon-14 in the atmosphere is almost static, and is known.
- Plants get their carbon through the process of photosynthesis, while animals get it mainly through food.
- Because plants and animals get their carbon from the atmosphere, they too acquire carbon-12 and carbon-14 isotopes in roughly the same proportion as is available in the atmosphere.
- **But when they die, the interactions with the atmosphere stops. There is no further intake of carbon** (and no outgo either, because metabolism stops).
- Now, carbon-12 is stable and does not decay, while carbon-14 is radioactive. **Carbon-14 reduces to one-half**

of itself in about 5,730 years. This is what is known as its 'half-life'.

- So, after a plant or animal dies, the ratio of carbon-12 to carbon-14 in the body, or its remains, begins to change.
- This change can be measured and can be used to deduce the approximate time when the organism died.

Limitation of carbon dating-

- Though extremely effective, carbon dating cannot be applied in all circumstances. Specifically, it cannot be used to determine the age of non-living things, like rocks, for example.
- Also, the age of things that are more than 40,000-50,000 years cannot be arrived at through carbon dating. This is because after eight to ten cycles of half-lives have been crossed, the amount of carbon-14 becomes almost negligible and undetectable.
- There are other methods to calculate the age of inanimate things, but carbon dating can also be used in an indirect way in certain circumstances.
- For example, the age of the ice cores in glaciers and polar regions is determined using carbon dating by studying the carbon dioxide molecules trapped inside large ice sheets.
- The trapped molecules have no interaction with the outside atmosphere and are found in the same state as when they were trapped.
- How long a rock has been at a particular place can also be determined using similar indirect methods.
- If there are organic materials, dead plants or insects trapped beneath the rock, they can give an indication of when that rock, or any other thing, had reached that place.
- There are various other methods to date sedimentation around an object, for example, that are used depending

on the specific situation.

- Though a variety of methods exist to know the age of a certain object, **not everything can be dated**. The accuracy of the different methods also varies.

Further reading: <https://journalsofindia.com/gyanvapi-mosque/>