

## Cosmic ray events shown in $^{14}\text{C}$ data

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Cosmic rays falling on the Earth mainly come from outside the solar system (Galactic Cosmic Ray: GCR) and the sun (Solar Cosmic Ray: SCR). Incoming cosmic rays interact with the atmosphere, whence cosmic rays produce cosmogenic nuclides such as  $^{14}\text{C}$ . Carbon-14 is oxidized to form  $^{14}\text{CO}_2$  shortly thereafter its production, and is incorporated in tree-rings. Therefore,  $^{14}\text{C}$  contents in tree rings would be a proxy of past cosmic ray intensities.

Several past cosmic ray increase events including the AD 775 event have been detected as a rapid increase of  $^{14}\text{C}$  contents in tree rings, namely “ $^{14}\text{C}$  spike”. It is considered that an origin of these events is an extreme Solar Proton Event (SPE) originated from large solar flares and coronal mass ejections. An existence of  $^{14}\text{C}$  spikes is important not only to understand the solar activities but also to offer an annual time marker in  $^{14}\text{C}$  data which can be applied to an annual radiocarbon dating and a dendrochronology. Recently, such application studies have been performed, e.g. annual age determination of a volcanic eruption of Mt. Baitoushan (AD 946) and historical wood sample of a Switzerland chapel using the AD 775 event.

In this presentation, I will introduce detected rapid  $^{14}\text{C}$  increase events, their origins, and application studies of  $^{14}\text{C}$  spikes.

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