

[Help](#)

Category:Carbon Isotope stratigraphy in the Chalk Group

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[Jump to navigation](#) [Jump to search](#)

Carbon isotope stratigraphy in the Chalk Group is concerned with examination of the ratio of the two commonly occurring isotopes of carbon, namely Carbon-12 (^{12}C) and Carbon-13 (^{13}C). Phytoplankton photosynthesis strongly discriminates against ^{13}C , preferentially incorporating ^{12}C into organic matter (Mitchell et al., 1996). Increases in ^{13}C therefore reflect removal of ^{12}C from the carbon cycle, which in turn reflects changes in organic productivity or the oxidation of organic matter (Mitchell et al., 1996). Thus, a peak in ^{13}C might be produced by high organic productivity or by inhibiting the recycling of organic material (e.g. by locking it up in black shale deposits), or both.

Recently, there has been much research on the causes behind changes in the ^{13}C signature. Mitchell et al. (1996) showed that major positive anomalies of ^{13}C in the Cenomanian correlated with sequence boundaries or transgressive surfaces (see Sequence Stratigraphy), and proposed a link between transgressive events, black shale formation and positive excursions of the ^{13}C signature.

Irrespective of the exact causes of variation in the ^{13}C signature, there is widespread agreement that carbon isotope stratigraphy is a powerful correlation tool. The recorded variations of ^{13}C appear to reflect original palaeoenvironmental variation, and have not been strongly affected by diagenetic changes (Jenkyns et al., 1994). Furthermore, the ^{13}C signatures from coeval successions that are widely separated show remarkable similarity. Gale et al (1993) demonstrated synchronicity of changes in the ^{13}C signature with respect to bio-markers at the Cenomanian-Turonian boundary in sections across the UK, and also with the coeval succession at Pueblo, western USA. Jenkyns et al. (1994) pointed out the remarkable similarity of ^{13}C curves for the UK Chalk Group and the coeval Scaglia facies near Gubbio, Italy, but noted that the correlation of the two profiles showed that there were major discrepancies in stage boundary definitions between the sections. Subsequently, Voigt & Hilbrecht (1997) showed that some of these problems were overcome by revisions to the criteria used to recognise stage boundaries in the Italian succession. These authors also demonstrated that the ^{13}C signature could be used to accurately correlate different Cenomanian-Coniacian successions across Europe, and that for the correlation of Boreal and Tethyan provinces, it 'is probably more accurate and reliable than any other stratigraphic technique'.

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[Category](#):

- [Stable Isotope stratigraphy of the Chalk Group](#)

Navigation menu

Personal tools

- Not logged in
- [Talk](#)
- [Contributions](#)
- [Log in](#)
- [Request account](#)

Namespaces

- [Category](#)
- [Discussion](#)

Variants

Views

- [Read](#)
- [Edit](#)
- [View history](#)
- [PDF Export](#)

More

Search

<input type="text"/>	<input type="button" value="Search"/>	<input type="button" value="Go"/>
----------------------	---------------------------------------	-----------------------------------

Navigation

- [Main page](#)
- [Recent changes](#)
- [Random page](#)
- [Help about MediaWiki](#)

Tools

- [What links here](#)
- [Related changes](#)
- [Special pages](#)
- [Permanent link](#)
- [Page information](#)
- [Browse properties](#)

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- [About Earthwise](#)
- [Disclaimers](#)

