



## **The signature of inner core nucleation on the geodynamo**

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Energy considerations indicate that the power delivered to the present-day geodynamo comes mainly from the growth of the solid inner core, through light element and latent heat releases. However, estimates of present-day core heat loss predict that inner core nucleation (ICN) likely occurred within the past 1.5 Gyr, implying that the geodynamo operated over most of its history without the help of inner core growth. We use numerical dynamo simulations linked by thermochemical evolution of the core to identify signatures of ICN in the paleomagnetic field and possible ICN footprints in paleomagnetic data. We select a set of dynamo simulation parameters that generates a magnetic field structure compliant with the present-day geomagnetic field. We then use thermochemical evolution to project this dynamo into the past, backward-evolving the inner core size and the dynamo forcing parameters. We obtain a time average dipole moment prior to ICN comparable to the post-ICN dipole moment, consistent with paleointensity measurements, despite a power reduction of nearly two orders of magnitude. Our results predict that the surface geomagnetic field was dominated by an axial dipole prior to ICN, although it contained an axial octupole component stronger than present-day. This stronger octupole was induced by polar downwellings prior to ICN, which might be resolvable using paleomagnetic directions.