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The Kalkarindji Large Igneous Province and the Early–Middle Cambrian Extinction.

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Despite being one of the largest large igneous provinces (LIP) on Earth, the recently discovered Kalkarindji LIP, Australia, has received only very little attention (e.g., Glass & Philips, 2005; Evins et al., 2009). This province is located across the Northern Territories and Western Australia and covers a currently known area of $\geq$ 2.1x106 km^2 (Evins et al., 2009) with hints that it stretches as far as the southernmost part of South Australia (equivalent to a total area of $\geq$ 3x106 km^2). The province includes flows, intrusions and volcanic tuffs.
The age of the province is currently based only on three robust 40Ar/39Ar apparent ages ranging from 504.6 $\pm$ 2.5 to 507.5 $\pm$ 1.6 Ma (Glass & Philips, 2005; Evins et al., 2009). This province is of particular interest as it seems to coincide with a global anoxic event (Hough et al., 2006) and more importantly, the Early–Middle Cambrian (EMC) extinction where 50% of the genera (e.g. Archeocyaths, Trilobites) went extinct. The age of the EMC extinction has been estimated at $\sim$510 Ma according to the revised timescale of 2009 but so far, attempts to date the extinction level have not yielded any precise date. Considering the now well-established 40K decay constant bias (Min et al., 2000), the 40Ar/39Ar ages obtained so far suggest an emplacement age of the Kalkarindji province between $\sim$509 and $\sim$512 Ma, thus apparently synchronous with the EMC extinction. However, due to the paucity of available ages, it is still not clear if the Kalkarindji LIP was emplaced during only few hundred ka, or rather was more sluggish over few Ma.
The Kalkarindji basalts are overlapping thick sulfate-rich evaporite layers and carbonate rocks of the Precambrian central Australia basins. Evaporite and carbonate metamorphism might have been responsible for a significant source of CO2, SO2 and halocarbons as demonstrated for the Siberian traps (Svensen et al., 2009). In addition, the occurrence of pyroclastics eruptions as indicated by the presence of tuff layers might have played a crucial role in the injection of volatiles in the stratosphere. Last but not least, mantle derived CO2 and SO2 emitted during volcanic eruptions might have played a significant role as well.
Here, we will present new plagioclase and sanidine 40Ar/39Ar data to better understand the emplacement sequence of the oldest Phanerozoic province and its timing relative to the EMC extinction, and we will investigate the importance of mantle- and contact-metamorphism gas emissions during Kalkarindji emplacement and their consequences for the climate and ecosystems.

Evins et al., Lithos 110, 2009 - Glass & Philips, Geology 34, 2005 - Hough et al., Terra Nova 18, 2006 - Min et al., Geochim. Cosmochim. Acta 64, 2000 - Svensen et al., Earth Planet. Sci. Lett. 277, 2009