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# Milankovitch-scale variabilility of stable carbon and oxygen isotopes off northern Chile during the last 1 Myr

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We identify and describe the temporal changes of the stable carbon and oxygen isotope records measured on planktic and benthic foraminifers (delta13Cp, delta13Cb, delta18Ob), off northern Chile at ˜25 degrees South, occurring during the last 1 Myr. This long record provides evidence of the presence of a Milankovitch time scale variability; the power in the delta18O and two delta13C records is concentrated in the well known eccentricity, obliquity and precession orbital bands (˜100, 41 and 23 kyr). Although the variance of the records is concentrated mainly in the 100 kyr period, some evidences suggest that the relationship between eccentricity and the response of the climate system in this site is more complex than expected; for example presence of multiple peaks near the 100 kyr, as well as strong variations in the delta13C records at times of lowest insolation in eccentricity, each 400 kyr, preceding the begin of the Mid-Pleistocene Revolution (˜0.8 Myr, MPR) and the Mid-Bruhnes Event (˜0.4 Myr, MBE). All these evidences suggest the presence of an internal feed-back mechanism in the climate system which may produce non-linear effects in addition to the external orbital forcing, therefore agreeing with other authors and precedent research on this theme (citarlos). In addition, the similarity of the site GeoB 3388-1 with other sites over the world, i.e. the Eastern Equatorial Pacific (ODP 846, 849), Western Equatorial Pacific (ODP Site 806) and South China Sea (ODP 1143) suggest that the delta13C records represent changes in the carbon reservoir. Since the the maximums

in delta13C records lead the MPR and the MBE, we conclude that the late-Quaternary period has passed through major stages that appears to represent a further step in ice cap development.