

## ***Interactive comment on “Sea level 400 000 years ago (MIS 11): analogue for present and future sea-level” by D. Q. Bowen***

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### General Comments:

The Bowen manuscript is an interesting and compelling review of a variety of data from world-wide locations to determine the actual elevation magnitude of the MIS 11 sea-level highstand. Given the significant debate in the literature about the duration and elevation of the MIS 11 highstand, the manuscript provides “one stop shopping” to view a variety of data sets relating to the question. The manuscript has a few minor technical errors that need correction (listed below). The primary concerns of this reviewer fall into two categories. First, the elevation of dissolutional caves that are tied to fresh-water lens position, and hence sea level, are not presented as sea-level indicators, although these caves are discussed in that sense in several of the papers quoted by the author

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(e.g. Carew and Mylroie, 1995; 1999; Mylroie, 2008). Second, the author got a few of the facts incorrect when quoting from this reviewer's own work, which casts possible doubts on the accuracy of the reporting from the cited literature overall (these errors are also listed below). Despite these concerns, the author's argument is strong, and his general premise of MIS 11 being close to modern, and certainly no higher than MIS 5, agrees with the independent observations of this reviewer.

### Specific Comments

Because of this reviewer's extensive work in the Bahamas, some additional comments are presented.

The Bahamian data are perhaps the most significant, as the Bahamas are a tectonically stable series of platforms and pedestals. The banks are isostatically subsiding at 1 to 2 m per 100 ka (Carew and Mylroie, 1995; McNeil, 2005), so sea level indicators there must be revised upward one or more meters for a correction, as opposed to being moved downward to correct for uplift as with most other examples in the manuscript. The Bahamas are also a significant number of islands stretching over 1000 km, islands both large and small, on both large banks and small pedestals. Despite all the geologically available sites, no subtidal deposits from MIS 11 have been found anywhere in the archipelago elevated above or at the elevation of dated MIS 5 fossil corals. MIS 5 carbonate sediment production was voluminous, and it is possible that MIS 11 fossil corals are present but remain masked by younger deposits. However, despite all the many road cuts, quarries and sea cliffs present in the archipelago no such deposits have ever been described. Given the pervasive and abundant preservation of MIS 5 fossil corals and related subtidal deposits throughout the entire archipelago, the absence of MIS 11 diagnostic facies is difficult to explain, especially given the long duration of MIS 11. The author could make this point in his manuscript.

The cave data also impact on this discussion, in particular flank margin caves, which form in the distal margin of the fresh-water lens and so are excellent indicators of sea

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level (Myroie and Carew, 1995; Myroie and Myroie, 2007). The caves have phreatic dissolutional surfaces up to 7 m above modern sea level. Allowing for transient lens adjustments in elevations in response to major rainfall events, such phreatic surface elevations require a sea level at or near +6m, with the lens floating slightly higher. The assembled cave data from the Bahamas (Labourdette et al. 2007) show a pervasive pattern of cave development consistent with a MIS 5 origin. However, it has also been demonstrated that flank margin caves can form extremely rapidly (Myroie and Myroie, 2009), and the dissolutional surfaces at +7 m could represent a short excursion to +6m by MIS 5 sea level, or a consistent response to storm precipitation loading. The key factor here is that flank margin caves are not found at elevations above 7 to 8 m in the Bahamas (possible exceptions appear to be banana holes perched on terra rossa paleosol horizons), yet given the duration of the MIS 11 highstand, they should be present at elevations higher than those of the MIS 5 caves, especially if the MIS 11 highstand was at elevations of 15 to 20 m. The author could make this point in his manuscript.

Technical corrections or comments:

Page 2, lines 17-19, elevation of caves associated with the fresh-water lens margin (flank margin caves) is another indicator of sea level, one that is somewhat resistant to the post-genesis erosional denudation that can remove surficial sea level indicators such as fossil corals, coastal notches, and ramps. Continuing on to page 4, lines 25-29, and page 5 lines 1-9, the flank margin cave data suggest sea level at +6 m in the Bahamas for a duration of time sufficient to generate large chambers with volumes in the 105 m<sup>3</sup> range (Myroie and Carew, 1995). On page 13, line 29, notches are referred to when Myroie (2008) was referring to dissolutional caves breached by erosion.

Question re page 5, line 2, does "...+m..." mean 1 meter, or any value from 1 m down to zero m? Or has a number above the value of 2 been left out? Again on page 7, line 29, what is meant by "...-m at 42 ka.?" Does this statement merely mean "below modern", or is there a numerical value to be assigned here?

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Page 5, lines 4-9, As regards southern Australia, on Kanagroo Island cave data, supported by one paleo wave-cut terrace site, indicates that sea level has been as high as 30 to 35 m above modern level, but the age of these features is unknown, outside of their existence in Quaternary Bridgewater eolianites (Myroie and Myroie, 2009). None the less, these data indicate some significant uplift for Kangaroo Island in the Pleistocene, more than has been allowed by some authors (e.g. Twidale and Bourne, 2002).

Page 12, line 18, “howver” typo.

Page 12, lines 15-20, Hearty (1997) proposes a mega-tsunami deposit on Eleuthera, but does not agree with a mega-tsunami origin for a Bermuda deposit (Olson and Hearty, 2009).

Page 13, line 15, Carew and Myroie (1995, 1999) state that eolianites form during sea level highstands, when the platform is partially flooded, and not during lowstands as the author states here. Line 16, terra rossa paleosols form during sea level lowstands, when the platforms are emergent due to glacioeustatic sea-level lowstands; so cooler temperatures would be the case, not warmer as the author states. The sentence running from lines 20 – 24 begins and ends with a citation to the same single source; citing it once would be sufficient. The sentence is also ambiguous, the modern sands are not meant to be viewed by the reader as what Hearty saw, the modern sands merely show similar features to what is seen lithified nearby.

Page 22, line 24, Neuman and Hearty paper is 1996, not 1966.

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