

# Lithostratigraphic Reconstruction in Coral Sequences (IODP Expeditions 310 and 325)



ICRS 1B-P002

## INTRODUCTION

This project focuses on logging data acquired from holes drilled in the Great Barrier Reef Marine Park during Integrated Ocean Drilling Program (IODP) Expedition 325

(<http://www.eso.ecord.org/expeditions/325/325.php>) (Figs. 1 & 2). The Great Barrier Reef is an ideal location to conduct sea-level studies owing to its location on a passive margin and its distance from any former ice sheets. Here we present a summary of the logging data acquired and its integration with data from the corresponding cores.

Fig. 1. Map showing locations of logged holes.

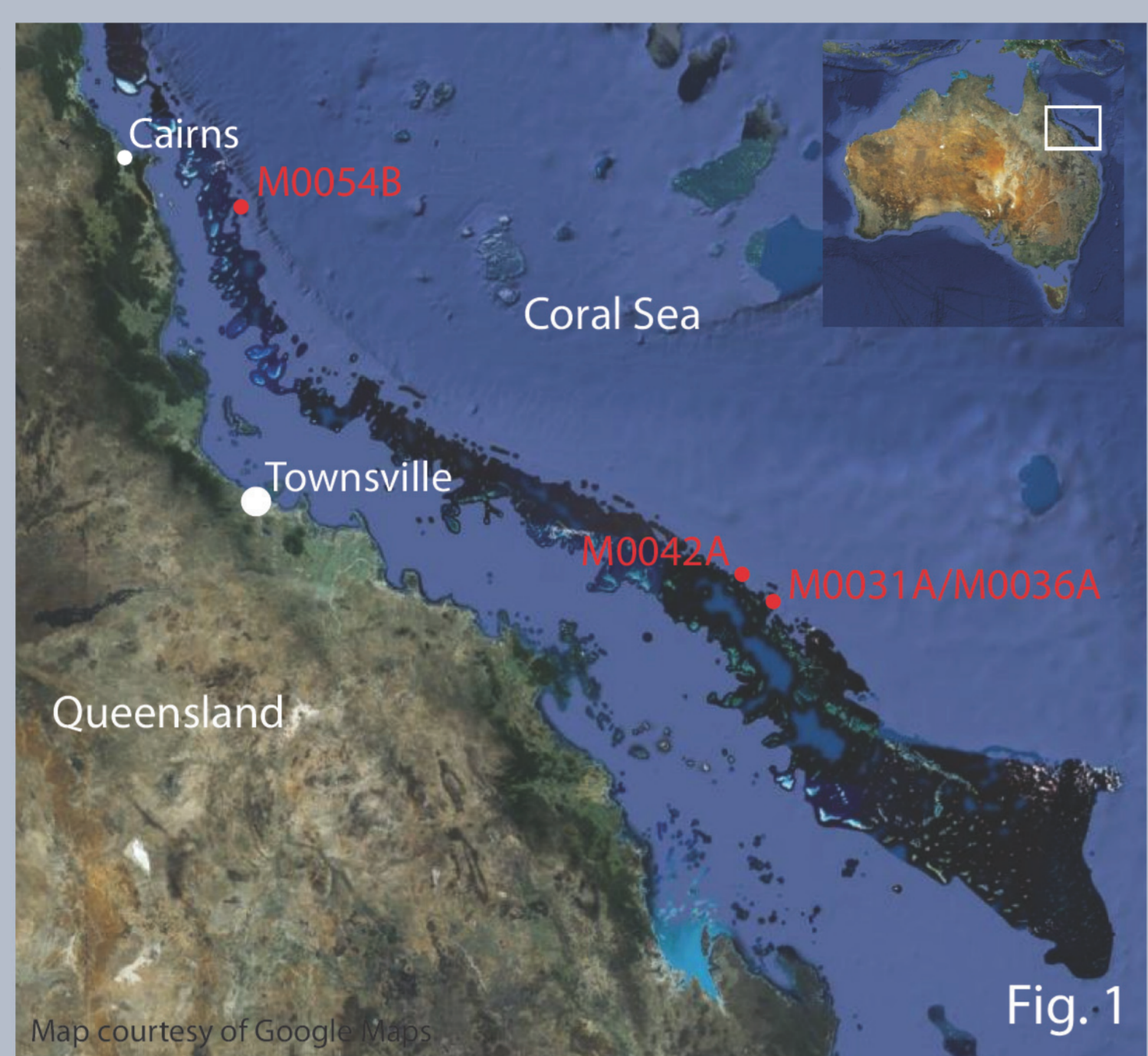


Fig. 1

Louise Anderson<sup>\*1</sup>, Sally Morgan<sup>1</sup>, Jenny Inwood<sup>1</sup>, Jody Webster<sup>2</sup>, and Tania Lado Insua<sup>3</sup>

<sup>1</sup>Borehole Research Group, University of Leicester, Leicester, LE1 7RH, UK

<sup>2</sup>Geocoastal Research Group, University of Sydney, Sydney, NSW 2006, Australia

<sup>3</sup>Dept. of Ocean Engineering, University of Rhode Island, Narragansett, RI 02882, USA

For correspondence email: [Ima9@le.ac.uk](mailto:Ima9@le.ac.uk)

Fig. 2. Schematic of wireline data obtained during IODP Expedition 325. Depth is given as metres below sea level (MBSL).

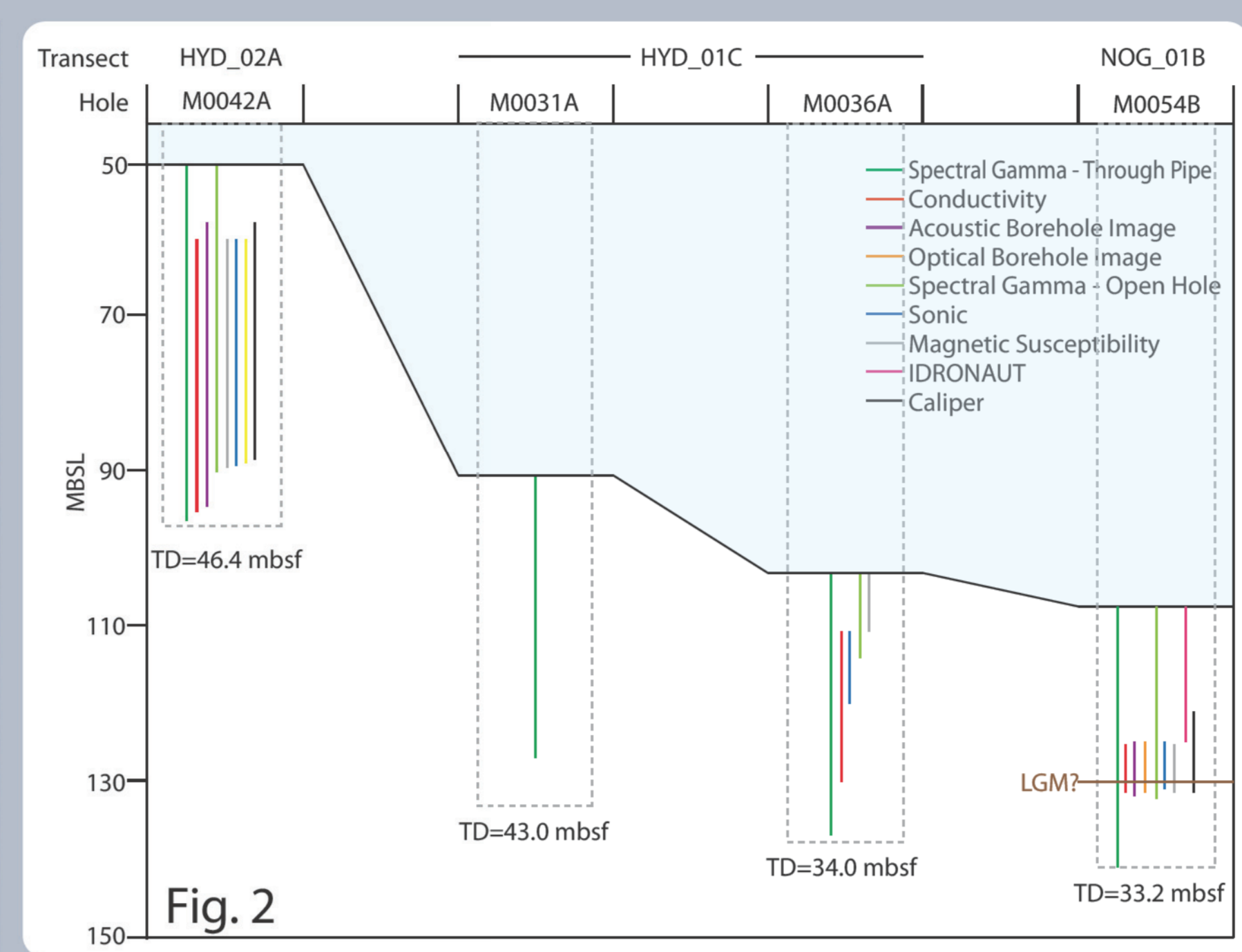


Fig. 2

## SCIENTIFIC CONTEXT

-IODP Expedition 325, which took place in 2010, aimed to establish the course of sea-level rise during the last deglaciation. Four of the 34 holes cored during the expedition are investigated here.

### OBJECTIVES

- To better constrain the depth of cores collected by integrating core data with the continuous logging dataset.
- To relate formation physical properties to recovered facies.
- To objectively examine trends in the downhole logging dataset.

Images of logging tools onboard the Greatship Maya.



Images courtesy of D. Smith (BGS)

## OBSERVATIONS - Great Barrier Reef Environmental Changes

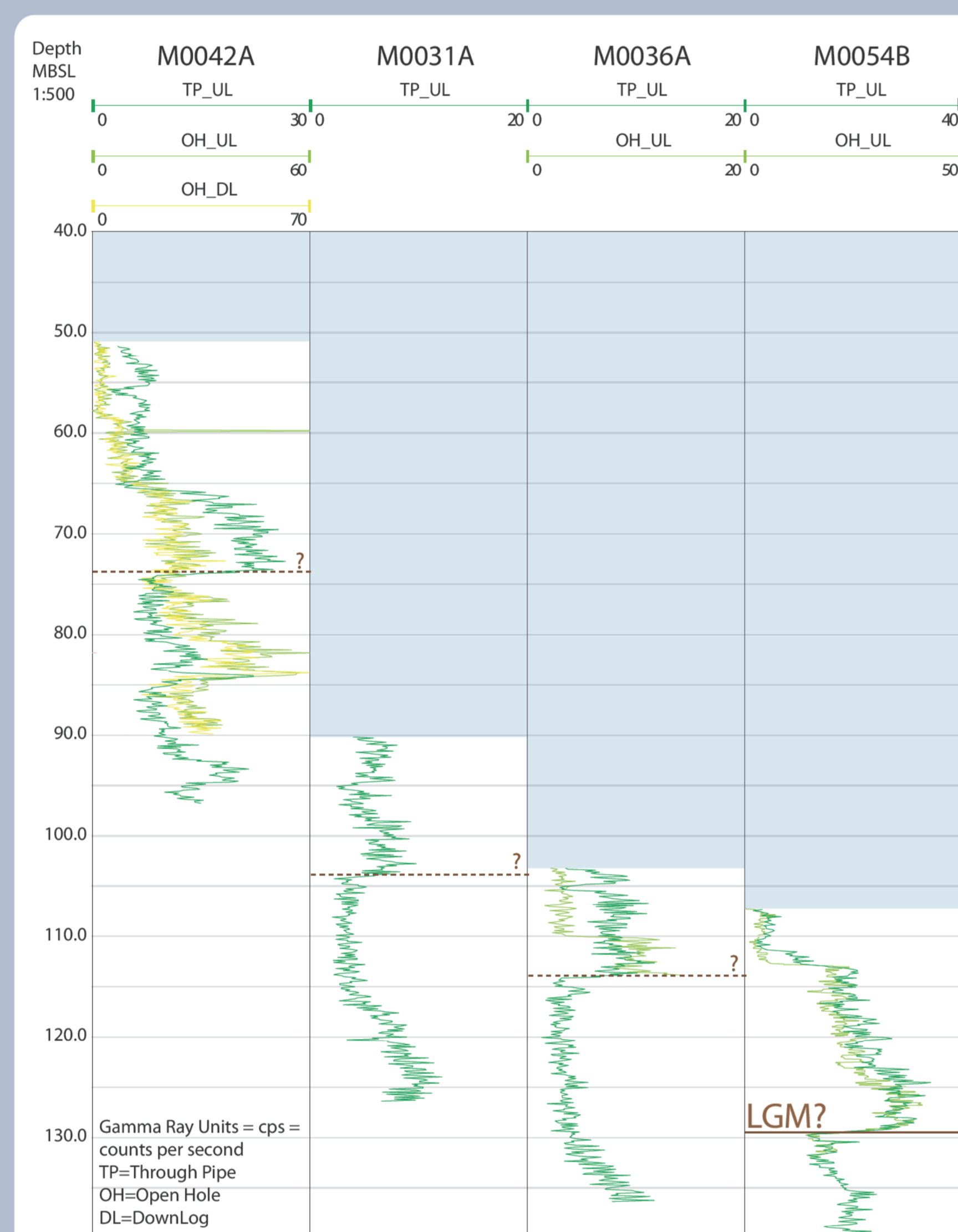


Fig. 3. Total Gamma Ray curves for the four holes logged during IODP Expedition 325. Kick in gamma ray may represent the location of the Last Glacial Maximum (LGM) over three of the four transects (see Fig. 5 for acoustic image over the boundary).

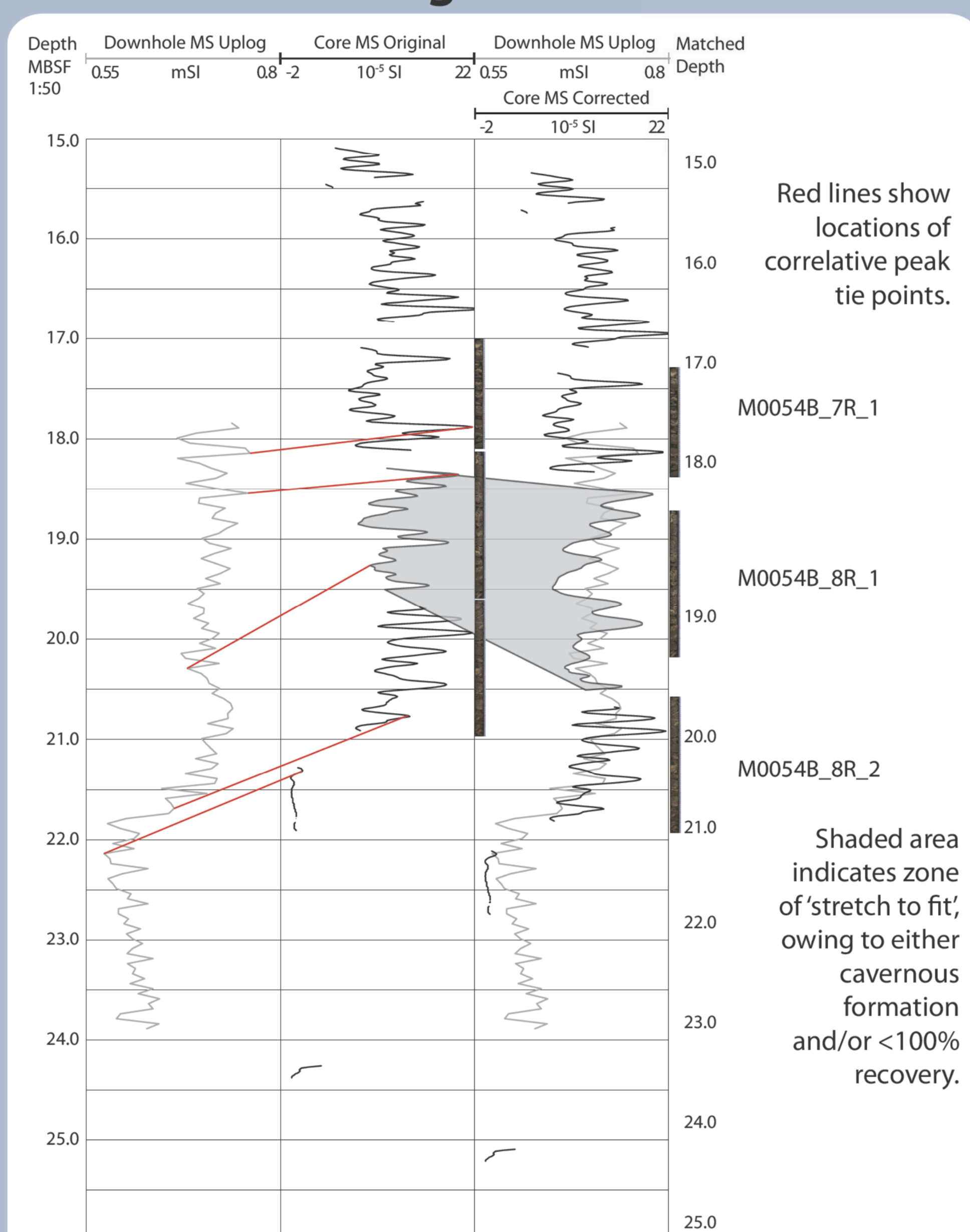


Fig. 4. Correction of core depth in Hole M0054B using wireline magnetic susceptibility (uplog) and magnetic susceptibility Multi-Sensor Core Logger (MSCL) data.

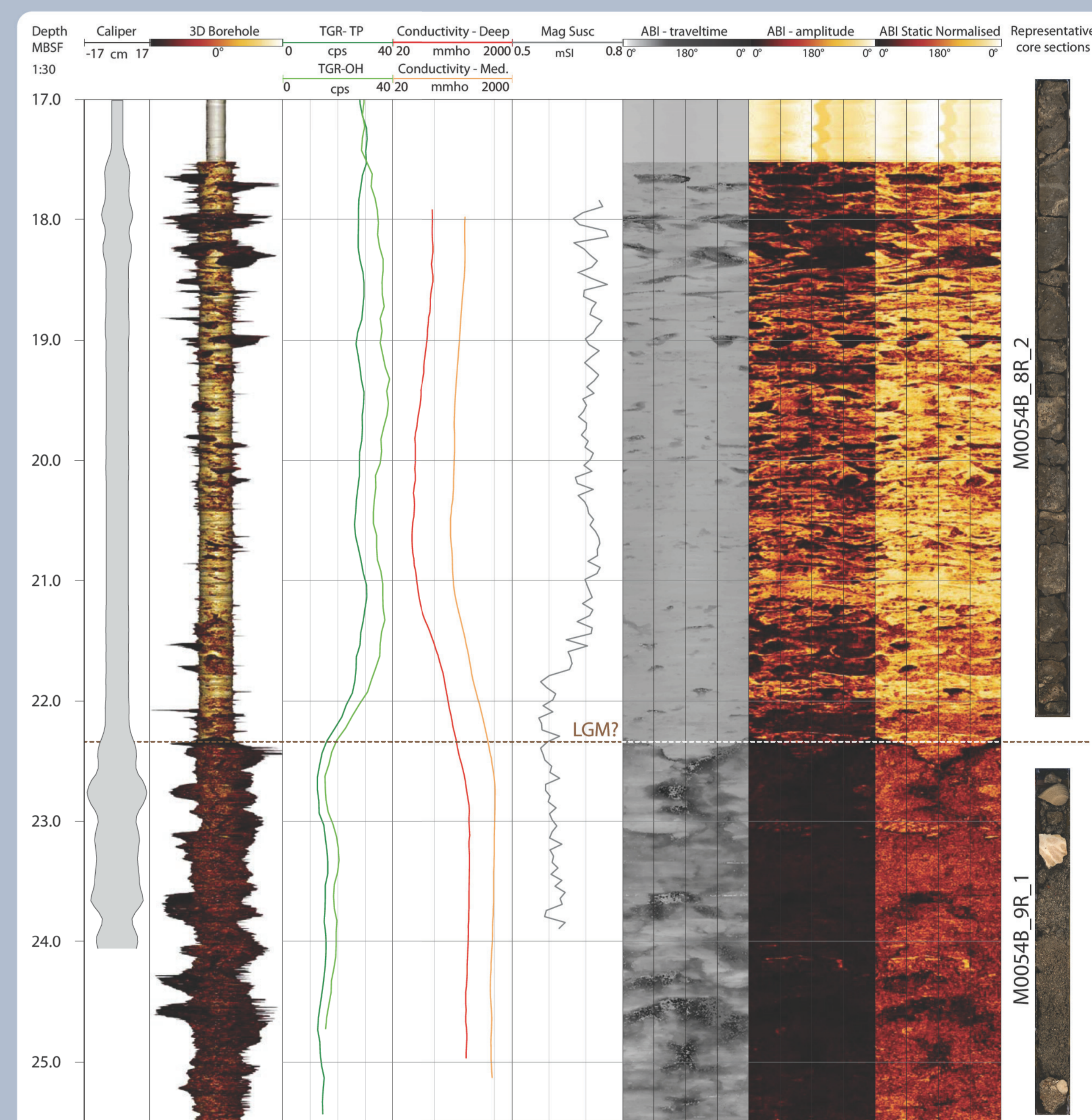


Fig. 5. M0054B - logs through Last Glacial Maximum (LGM).

## COMPARISON WITH TAHITI (EXP 310)

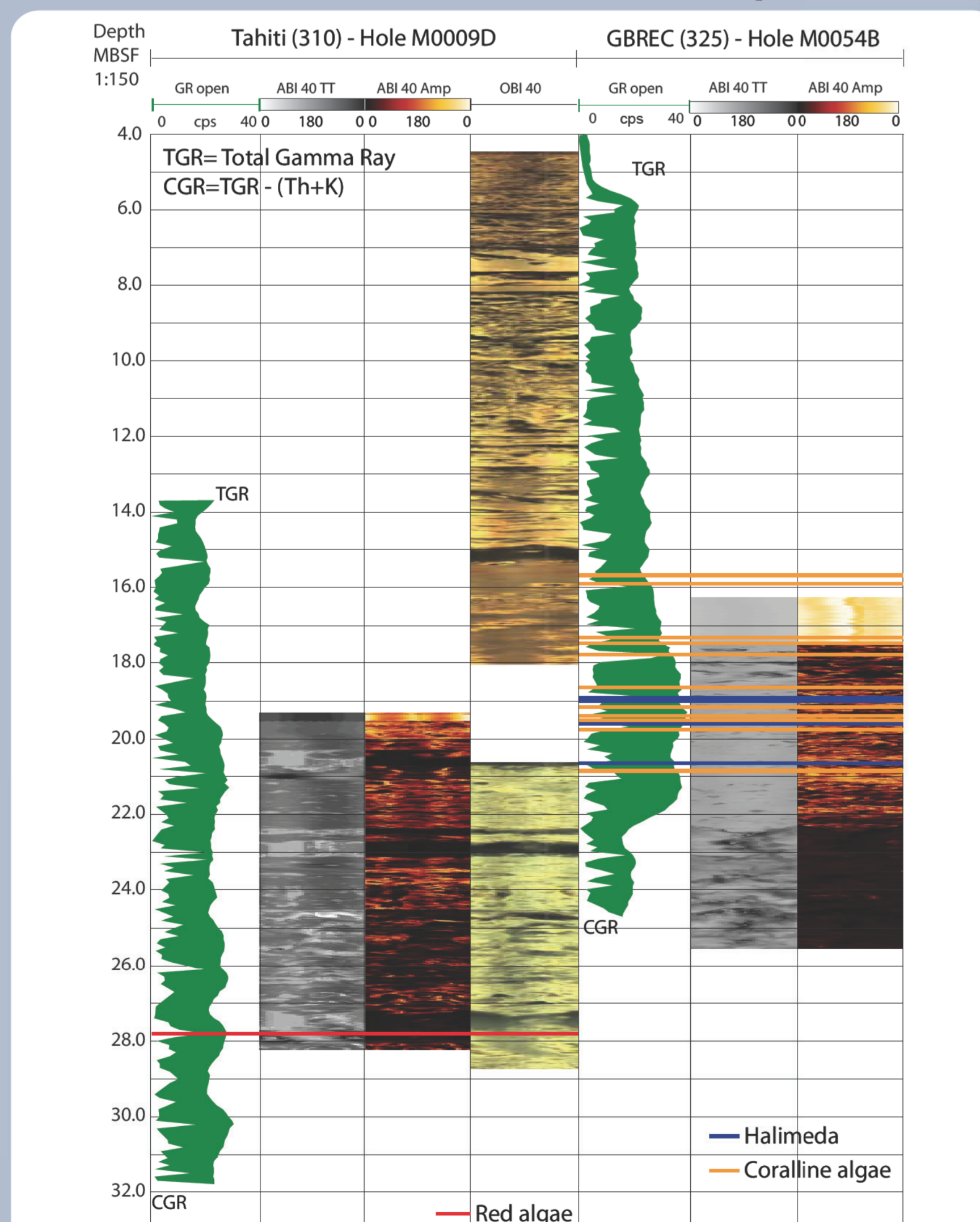


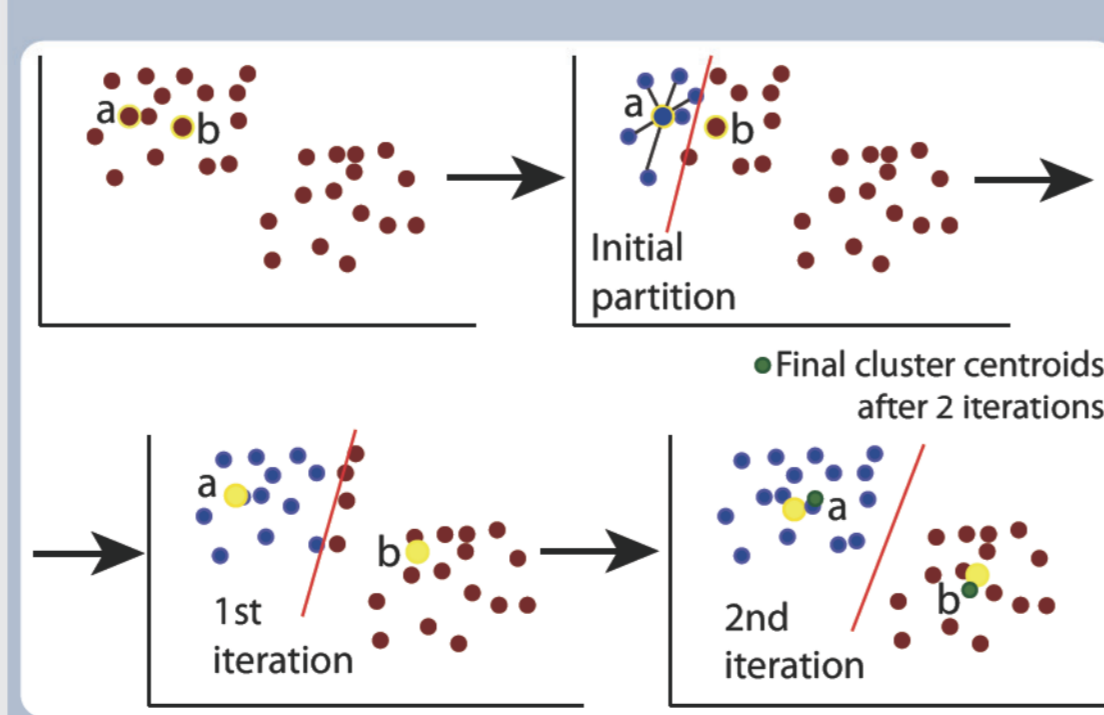
Fig. 6. Occurrence of algal material in holes M0009D and M0054B shown by peaks in uranium intensity.

## INCA - Iterative Non-hierarchical Cluster Analysis (Fortran program, P. Harvey et al.)

**BACKGROUND**  
This is a variant on K-means clustering, and is a method of analysis should one already have hypotheses concerning the number of clusters in one's data.

### Computations:

- INCA is like analysis of variance (ANOVA) "in reverse". K-means clustering, the program tries to move objects in and out of groups/clusters to get the most significant ANOVA results.
- Program starts with k random clusters, then moves objects between those clusters in order to:
  - 1) Minimise variability within clusters
  - 2) Maximise variability between clusters



- Choose clusters and 'seed' points.
- For seed points a and b allocate data points to their nearest seed.
- Final cluster centroids after 2 iterations
- Recompute the new centroid positions for the two groups.
- These are new seeds for the second iteration.
- Repeat procedure until no data points change cluster.

- Using Euclidian Distances between the points as measures of similarity (or 'closeness'). Each time a point is added to a cluster the centroids are recalculated.

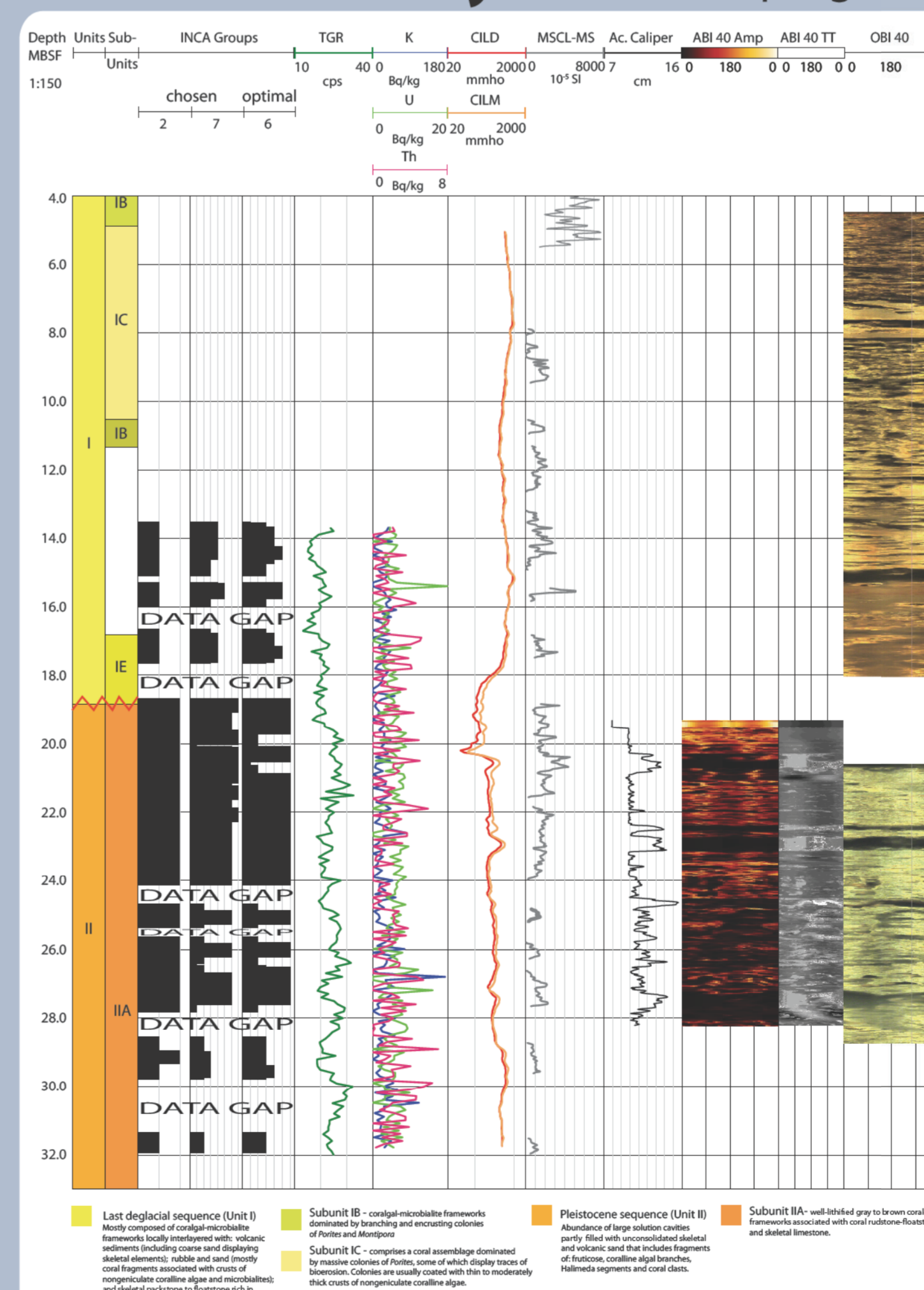


Fig. 7. Cluster analysis groups for Hole M0009D, Exp. 310. Data used: Total Gamma Ray, Deep Conductivity and core Magnetic Susceptibility.

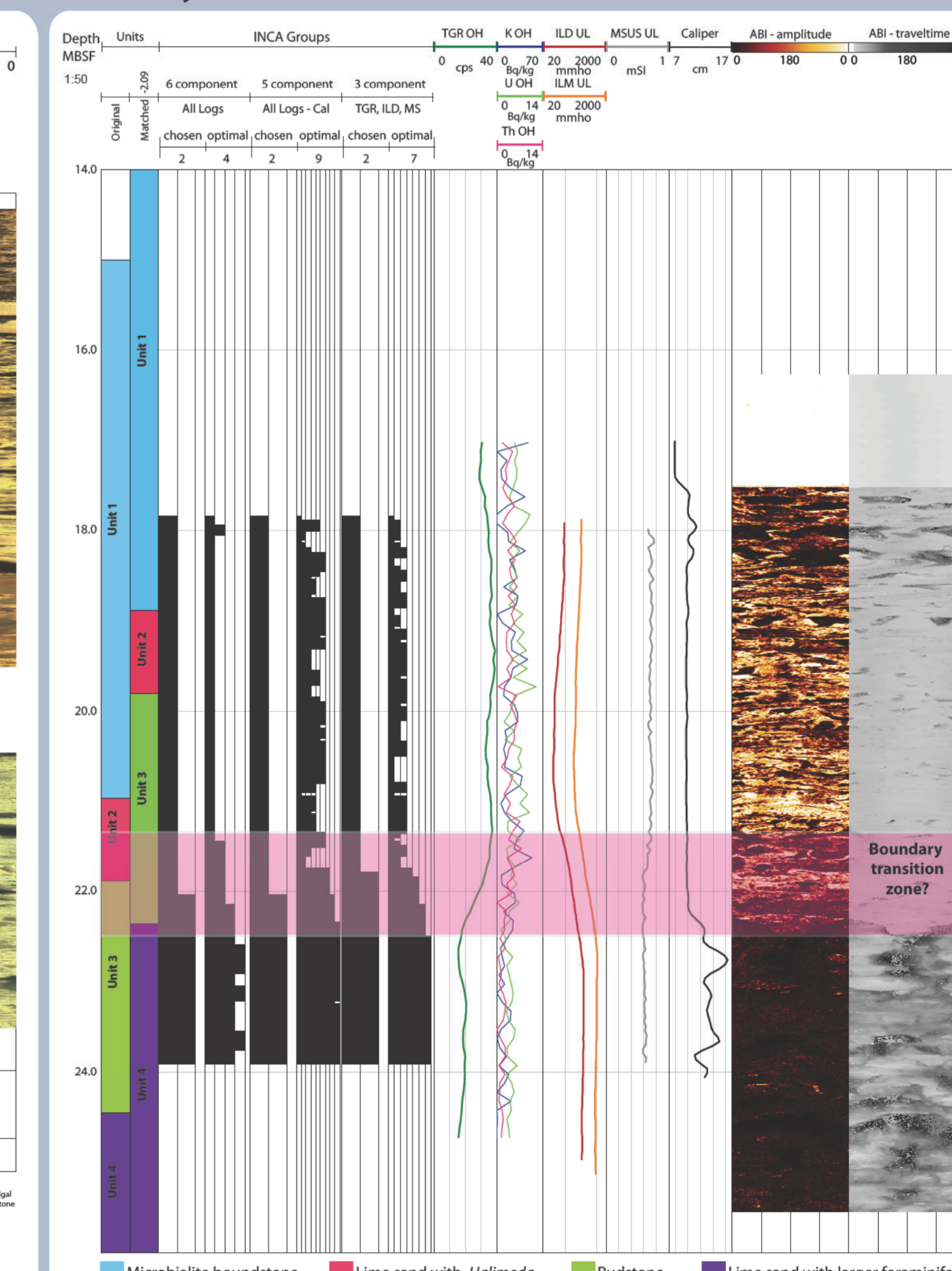


Fig. 8. Cluster analysis groups for Hole M0054B, Exp. 325. A variety of data combinations were used: 6, 5 and 3 component files.