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Uniform, rapid, open access database for shipboard IODP/ODP/DSDP images

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1. Rationale and Objectives

Over the last 50 years, scientific ocean drilling by the International Ocean Discovery Program (IODP) and its predecessors (IODP/ODP/DSDP) have collected an unrivaled archive. Nonetheless, the shipboard data is underutilized, notably with respect to the core images.

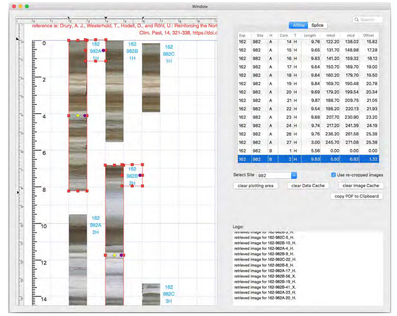
Currently, core images are available through the open access LORE (IODP) and JANUS (ODP/DSDP) databases. However, collating and utilising images for entire sites/expeditions through the existing infrastructure is cumbersome, as it cannot handle large data volumes quickly.

Here we present a prototype open access database housing the original high-resolution core box photos and cropped section images for selected IODP, ODP and DSDP expeditions. This database aims to provide rapid access to high-resolution section and composite core images.

3. Current database utilisation

- **IODPCoreImage** (macOS only; available on Earthsequencing website) displays core tracks concatenated from section images available from the Earthsequencing Image Database
  - Display ODP image strips and CODD section images (re-cropped images)
  - Images are downsampled
  - If previously viewed, images are pre-generated, cached and load quickly
  - Users can zoom in and copy core tracks PDFs for use in other imaging software

IODPCoreImage



https://paloz.marum.de/confluence/display/ESPUBLIC/IODPImageSplicer.

- The concatenated core tracks can be viewed and downloaded through a browser
- The database can rapidly handle large data volumes and is enabled for command line URL access.

4. Outlook

- The database is especially suitable for rapidly access all images from entire sites/expeditions.
- Further integration of CODD resources:
  - As more sites are processed, these section images will be included.
  - Lighting corrected composite core images will be included at a later stage.
- We aim to optimise integration and utilisation of the Earthsequencing Image Database into specialized software tools

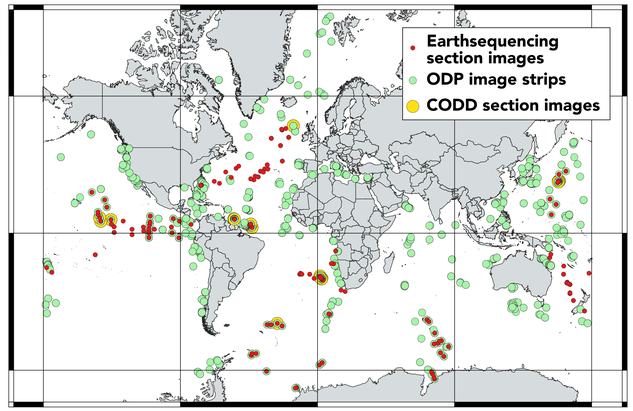
References: *IODPCoreImage - https://paloz.marum.de/confluence/display/ESPUBLIC/IODPImageSplicer.*
Jenkins, 2008: ODP Image Strips, Chris Jenkins (INSTAAR, Univ Colorado Boulder) - http://instaar.colorado.edu/~jenkinsc/IODPimagestrips/
Wilkens et al., 2017, Climate of the Past (CODD - https://www.codd-home.net.

2. Earthsequencing Image Database: cropped DSDP/ODP section images

The **LORE and JANUS databases** contain all DSDP/ODP/IODP shipboard core images, which are extremely useful for informing sampling strategy or identifying coring disturbances/hiatuses. Likewise, derived composite core images can be useful for investigating major lithological shifts and cyclic sedimentary variations.

To compile composite core images, cropped section images are required, which are available in LORE for IODP Exp. 317 onwards. However, JANUS only contains low-resolution core box photos for DSDP/ODP Legs 1-197 and uncropped line scan section images from Legs 198-210/Exp. 302-312. Manually cropping individual sections with traditional imaging software is highly labor intensive.

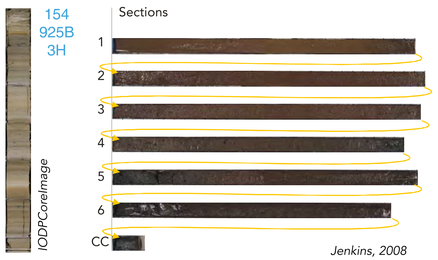
In the new **Earthsequencing Image Database**, we have compiled high-resolution core box photos, thereby unifying previously divergent outputs from JANUS and LORE. We have additionally included cropped section images that were previously extracted using the **CODD software package** (Wilkens et al., 2017) and through the **ODP Image Strips** project (Jenkins, 2008). Crucially, the database will include the **EARTHSEQUENCING Section Images** for key ODP and DSDP Legs, which were cut from the core box photos/uncropped line scan images by identifying and recording their pixel location.



ODP Image Strips

We incorporate the ODP Image Strips, which were automatically extracted from the core table photos by Chris Jenkins (INSTAAR, Univ Colorado at Boulder). For more information see Jenkins (2008) *http://instaar.colorado.edu/~jenkinsc/IODPimagestrips/*.

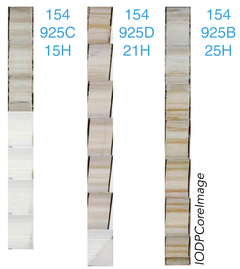
This archive represents a complete cataloge of all 653 ODP sites (Sites 625-1277), with a extensive geographic coverage.



Jenkins, 2008

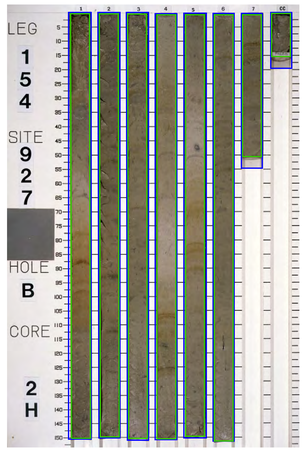
Limitations:

- Strips often include core liner
- Strips sometimes skewe true sediment orientation
- Process did not always distinguish between section and core table



NEW - EARTHSEQUENCING Section Images

The Earthsequencing Image Database includes the newly cropped section images from 147 key palaeoceanographical DSDP/ODP Sites. The sections were cropped from high-resolution core box photos using a two step Matlab script procedure.



1) Automatic recognition of core images

Images were converted to grey scale and rotated using a Hough transform to remove any skewness in the core image.

The recognition was based on 'bar-code reading' by detecting the extremes of the second derivative of the cumulative grey level. This process could be guided by an initial manual parameterisation (i.e., the typical layout of a Leg's core table photos).

2) Manual correction

Coordinates identifying section images were manually adjusted to correct any inaccurate identifications. The output coordinates allow later extraction of each section image.

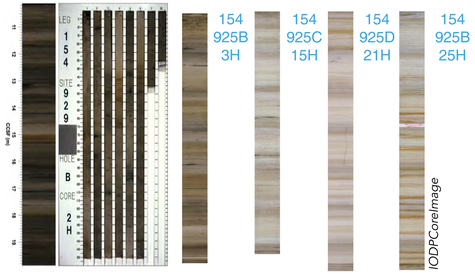
This process uniquely removes any skewness of the section image within the core box photo, thereby accurately displaying the true sediment orientation.

Section-specific rotation

CODD Section Images

CODD (Code for Ocean Drilling Data; Wilkens et al., 2017) allows users to easily cut section images from core table top images and then assemble a lighting corrected composite core image.
For more information see *https://www.codd-home.net*.

Wilkens et al., 2017



The core liner is usually excluded, resulting in continuous composite core images that are ideal for further analysis.

To date, 20 DSDP/ODP sites have been processed using CODD, published and included in the Earthsequencing Image Database.

Limitations:

- Sections are manually extracted
- Section images are mostly only available after publication
- Section images are not rotated and therefore sometimes skewed relative to actual sediment orientation.