An Online Database for the East Pacific Rise 9° - 10°N

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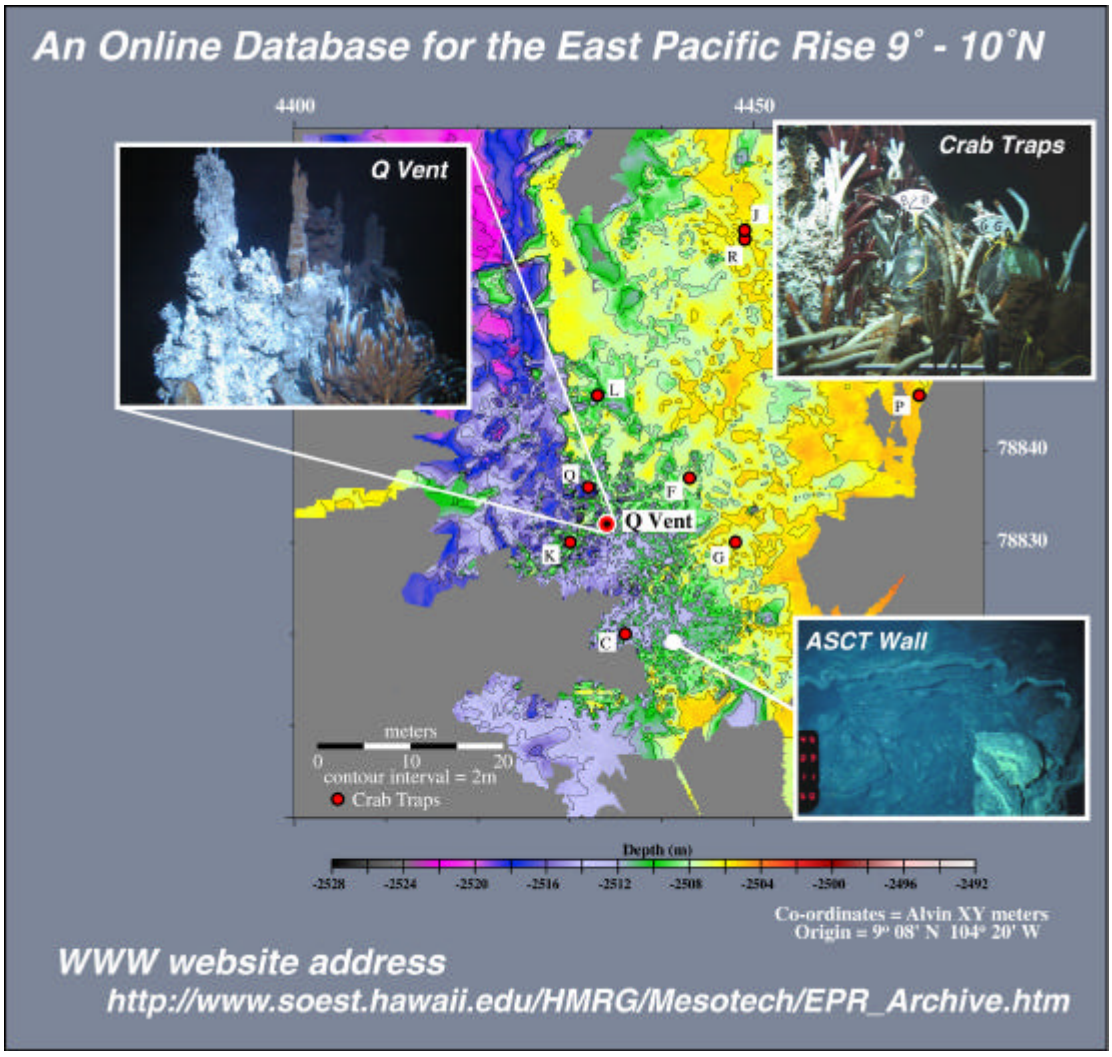

Cover Caption : High-resolution bathymetry map of the seafloor around the hydrothermal vent known as 'Q Vent' on the EPR axis, made using Mesotech The map provides meter-scale resolution of seafloor topography and geographic context for various vent-based research programs. Black dot with the red outline is Q vent location; the vent is pictured in the upper left corner. Red dots with black outlines show locations of crab traps placed by C. Cary, A. Dittel, C. Epifanio, and G. Perovich of the University of Delaware as part of the LARVE program research on vent crab larval dispersal. An example photo of the crab traps is in upper right corner.

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Mid-Ocean Ridge Databases

Over the past decade, a few key sites on the mid-ocean ridge (MOR) have been the focus of multidisciplinary research at both regional and local scales. The TAG area on the Mid-Atlantic Ridge [e.g., Humphris et al., 1996], Axial Seamount and the Endeavour and Cleft Segments of the Juan de Fuca Ridge [e.g., Embley and Chadwick, 1994], and the East Pacific Rise (EPR) in the segment between the Clipperton and Siqueiros transforms [e.g., Macdonald et al., 1984, 1992; Haymon et al., 1991, 1993] are all examples of well-studied MOR crests that have extensive datasets spanning the fields of marine geology and geophysics, petrology, geochemistry, hydrothermal systems, physical oceanography, marine biology and microbiology [e.g., Fornari and Embley, 1995, Humphris, 1995]. The submarine eruption at 9° 50'N on the EPR crest in 1991 [Haymon et al, 1993; Rubin et al., 1994] has led to scores of research cruises and well over 300 dives by the submersible *Alvin*, as well as dives by other submersibles such as the French Nautile [e.g., Macdonald et al., 1992; Fornari and Embley, 1995; Von Damm et al., 1995; Shank et al, 1997, Fornari et al., 1998a,b; Sohn et al., 1998; Cochran et al., 1999; Mullineaux et al., 1998; Kurras et al., 1998; in press]. Despite, or perhaps because of, the voluminous and multidisciplinary data sets collected from the 9° -10° N area there exists no single, organized repository of data, maps, sample positions, imagery, or even published results.

In order to facilitate ongoing research along the 9° -10° N EPR an online database < http://www.soest.hawaii.edu/hmrg/Mesotech/EPR_Archive.htm> has been created for organizing, displaying and downloading files that contain *Alvin* dive navigation, deep-sea camera sled navigation, near-bottom photographic imagery, multibeam bathymetry and high-resolution scanning altimeter bathymetry [Kurras et al, 1998] (Figure 1). This database focuses on a limited portion of the information collected at 9° -10° N EPR and offers the RIDGE community a foundation for establishing a more comprehensive online database. This article explains what data are currently available and the organization and implementation of the database and proposes a conceptual plan for its expansion.

Acquisition Systems and Data

Photographic, sonar and observational data contained in the online database were collected using the deep submersible Alvin and the Woods Hole Oceanographic Institution (WHOI) Towed Camera system [Fornari and Spencer, 1998; Fornari et al., 1998b]. The WHOI camera system is a self-contained digital and 35 mm camera sled towed from a surface ship. Typical tow speeds of ~0.25 knots (~8 m/min) produced a spacing of 1 - 2 m between pictures with 80 - 100% coverage in the along track direction. Navigation of the towed camera was accomplished using a layback calculation and P-Code GPS positions of the surface ship every 15 seconds, typical camera layback during the surveys was found to be 100 – 200 m behind the ship. The Mesotech scanning altimeter is a 675 MHz 'pencil beam' scanning sonar capable of resolving seafloor microtopography on the order of a few 10's of centimeters at altitudes of ~10 – 20 m [Chadwick et al., 1995; 1998; Singh et al., 1999; Yoerger et al., submitted]. The sonar head mechanically sweeps across the track of *Alvin* ensonifing a small section of the seafloor as it moves over the bottom. The resulting data consist of a slalom pattern of successive near-bottom slant-ranges, which are converted to vertical distance from the sub's 3-D reference plane. At a typical altitude of ~10 m (the approximate maximum distance above the bottom at which observers can still see the seafloor from *Alvin's* portholes), the width of the slalom path of altimetric data is ~30 – 40 m depending on slope angle and roughness. To produce true bathymetry, the Mesotech data must be: 1) combined with *Alvin's* pressure depth derived from the Paroscientific pressure gauge (resolution = 0.1 m), 2) located relative to the vehicle using the sub's attitude sensor suite (heading, resolution <1.0 deg; pitch and roll, resolution = 0.001 deg), and 3) geo-referenced relative to the position of the submersible.

Data from 65 *Alvin* dives and 28 camera tows collected over four cruises spanning Nov 1997 – May 1999 are publicly available from the online database, which is accessible through the Hawaii Mapping

Research Group (HMRG) website at http://www.soest.hawaii.edu/hmrg/HMRGonline_MainPage.htm. The following data products and datasets are available: 1) meter-resolution bathymetric maps of various EPR hydrothermal vent sites, 2) a compilation of hydrothermal vent locations, 3) photographic images of many of the vents and 4) selected images from the towed camera traverses that show the various volcanic terrains on the ridge crest and upper flanks. Three public domain SeaBeam bathymetry grids [Macdonald et al., 1992; Wilcocks et al., 1993; Cochran et al., 1999] are downloadable as either grid files or maps. Additionally, the database contains file formats, details of processing methods, instrumentation specifications, and background information. There is an 'Image Gallery' section with science-at-sea images for general use. A 9°-10°N EPR reference library is currently being solicited and will be placed online. Archived *Alvin* and Mesotech data collected previous to Nov 1997 and archived at WHOI may eventually be added to the database. Contributions of *Alvin* and Mesotech data, seafloor imagery, and camera tow data from future EPR cruises may also be added as time and funding permit. The invitation to submit these data sets is extended to all principal investigator's (PI's) conducting *Alvin* based investigations within the 9°-10°N EPR crestal region. Details of how to contribute *Alvin* and Mesotech data are found on the website under the 'Data Contribution' section.

Organization of the Database

The diversity, volume, and complexity of multidisciplinary 9° -10° N EPR datasets makes the establishment and maintenance of a centralized database run by a single group very difficult. The key to maintaining a unified community database for a specific regional field area is in building and supporting a general organizational structure linking separate databases through the World Wide Web (WWW). This structure must have the ability to locate specific types of data, provide contact and reference information so that the data may be properly evaluated, and provide access to raw data and processed data products so that newly acquired data may be merged with previously published data thereby fostering new scientific insights.

To address these goals, the database is designed around an expandable and collapsible menu-driven webpage interface. The webpage is divided into three separate frames (Figure 1) which present information

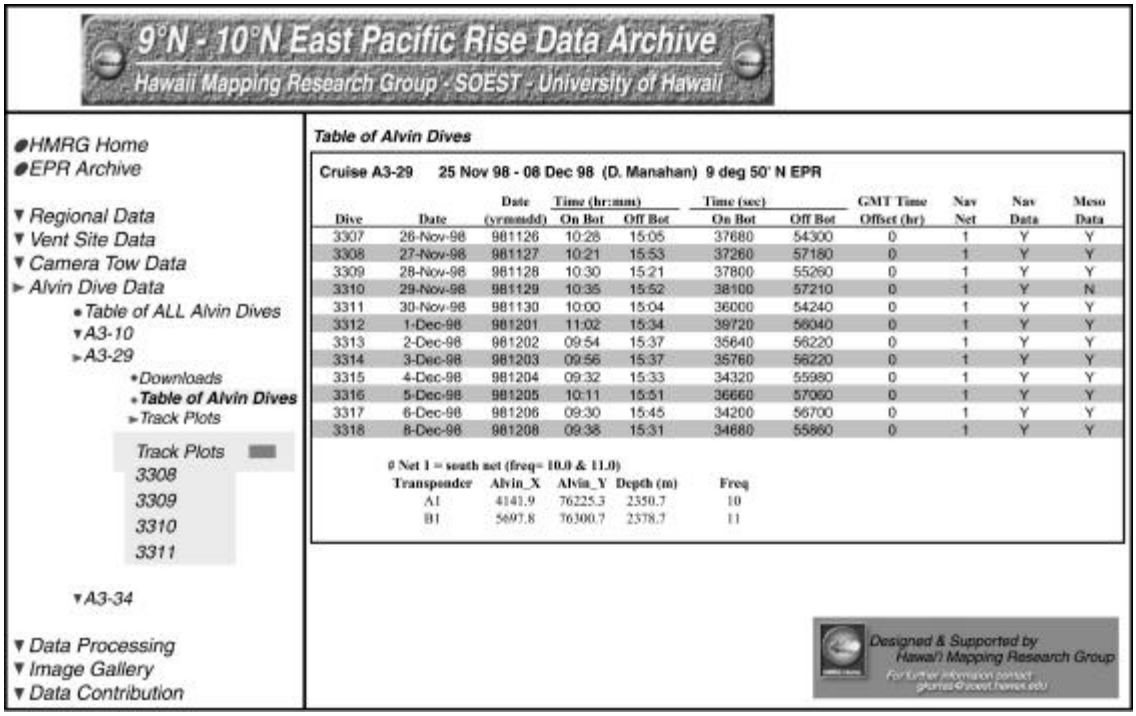

Figure 1 : The online database webpage interface http://www.soest.hawaii.edu/hmrg/Mesotech/EPR_Archive.htm. The webpage is separated into three frames; the top title bar indicates which database the user is connected to, the left menu frame is used to navigate through the databases, and the largest frame displays the requested information. In this example a 'Table of *Alvin* Dives' has been accessed for cruises A3-29 using the highlighted menu option in the menu frame.

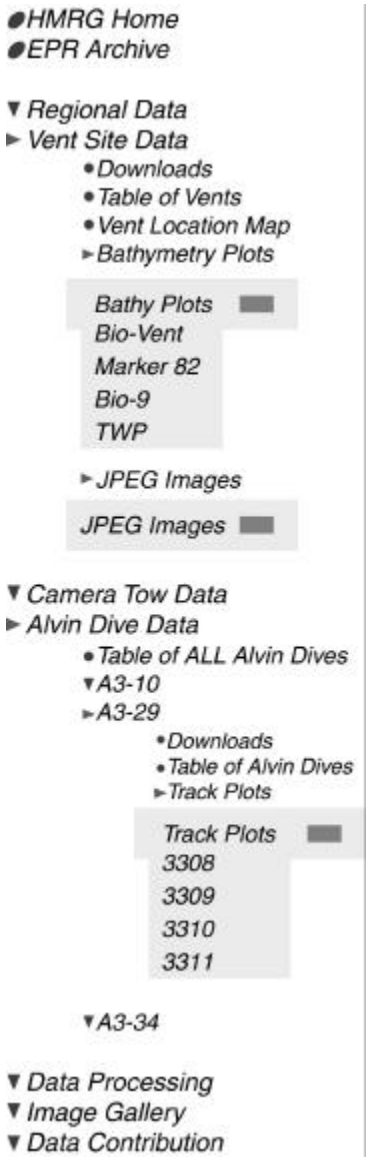

Figure 2 : The expandable and collapsible menu system. Users navigate through the database by expanding the menu system through different levels to the desired information. The menu allows users to browse, view, and download specific data, images and maps in many different formats.

to the user in an organized, easily accessible manner through a menu system, interactive maps, event logs in table format, and hyperlinks. The database navigation menu resides on the left frame. The upper frame, or ID header, informs the user which specific database is currently active. The third and largest frame displays the requested information. The interface is simple to use and familiar due to its similarity to the menu tree system employed by Apple and PC-type computers (Figure 2). The principal advantages of the menu system are: 1) the user always knows where they are within the overall database structure, 2) it allows quick navigation through diverse databases, and 3) multi-site links are transparent. A user may access multiple datasets scattered throughout the WWW; however, the user has only a single webpage interface and need not access multiple search engines or deal with the confusion of hundreds of weblink choices. The main interface is not a 'search engine,' it is a menu system designed to provide the user with a broad perspective on data and data availability while progressively leading to more specific sections of the database.

Conceptual Plan for Database Expansion

The online database presented here represents a small portion of the data publicly available for this segment of the global MOR. Development of a centrally organized online database requires a broader range of data and RIDGE community support. The establishment of database centers and the development of an overall website structure, and methods for integrating individual datasets are key points in creating a centralized database. The responsibility of collecting and providing data will continue to reside with individual investigators. The task of making data publicly accessible should be handled through a support staff using an established web structure. Establishing web links to a dataset residing within any individual PI's computer system would allow the PI complete control over the accessibility of the data. Alternatively, the PI could simply turn the processed data over to the appropriate database center. This proposed database is meant to be a repository of published data, not raw unprocessed data. Inquiries for raw data should be directed to those most qualified to discuss and disseminate the data; the PI's responsible for the collection and processing of the data.

Issues relating to data ownership and accreditation are often sighted as obstacles to the creation of a centralized database. The online database acts as a library, eliminating issues of proprietary data, proper referencing, and PI accreditation. In cases where a PI desires to make the data available without a specific publication reference, the website could be treated as the publication reference. The fundamental difference between datasets and data interpretations allows this style of referencing without undermining the peer review journal process.

Conclusion

The purpose of the online EPR 9°-10°N database is to provide processed high-resolution Mesotech bathymetric data, near-bottom imagery, *Alvin* and camera sled navigation, regional and meter scale bathymetric maps and supporting information for a segment of the MOR that continues to be a focus of multidisciplinary studies. The data are presented and are downloadable in many different formats (e.g. finished maps, processed data grids, processed bathymetry and navigation data). The menu system structure creates a user-friendly, easily navigable interface through which the processed data and scientific results are accessible to a broad spectrum of the RIDGE community. The site is designed to readily allow

future expansion of currently available data types and addition of other datasets through either weblinks or dataset incorporation. As such, this database has been put forth as a simple model for a more comprehensive online archive for the 9°-10° N region of the EPR crest.

Acknowledgements

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