

The Formation, Alteration and Preservation of Flood Deposits on the Pacific Northwest Continental Margin

Robert A. Wheatcroft
College of Oceanic & Atmospheric Sciences
Oregon State University
Corvallis, OR 97331
phone: (541) 737-3891 fax: (541) 737-2064 e-mail: raw@coas.oregonstate.edu

Grant Number: N00014-99-1-0006

LONG-TERM GOALS

The ultimate objective of this research program is to obtain a predictive understanding of the physical and biological processes responsible for the formation, alteration and preservation of sedimentary event deposits. The general approach is the development and testing of theory mainly through field observations and measurements.

OBJECTIVES

This is a project to study the formation, post-depositional alteration and preservation of flood deposits on the Pacific Northwest continental margin. Five related activities are being pursued: (1) continuation of time series measurements of the areal distribution and small-scale properties of the 1995 and 1997 Eel River flood deposits, (2) statistical analysis of the small-scale spatial variability of flood bed thickness and geometry at stations K60 and S60, (3) x-radiographic examination of piston cores for past flood deposits, (4) testing of simple conceptual ideas of event layer alteration and preservation using the above data sets, and (5) examination of patterns of sediment accumulation and event-layer preservation offshore of other Pacific Northwest rivers.

APPROACH

A box corer is the primary seafloor-sampling device used in this research. Cores are taken in two different modes: (1) replicate time-series sampling, and (2) broad, large-scale coverage of river margins. Subsequent sources of data include digital x-radiographs, microresistivity profiles, profiles of the radionuclides, Pb-210, Cs-137, Be-7 and Th-234, and macrofaunal community composition, abundance and biomass. Past sampling has focused on sites offshore the Eel River (northern California) and several other major rivers in the Pacific Northwest (e.g., Russian, Klamath, Umpqua), and now, over the past year, the Po River margin in the northern Adriatic Sea.

WORK COMPLETED

FY 01 was intended to be an analysis and writing year with no planned field activities. However, a historically significant flood on the Po River occurred in late October 2000. Because this flood occurred in one of the likely field areas of the nascent EuroSTRATAFORM Program, and because of its intrinsic value toward understanding flood layer formation and alteration, an event-response sampling effort was mounted. Cruises were conducted in early December 2000 and June 2001. During these cruises a series of roughly 30 stations were occupied adjacent to the mouths of the Po River. Box cores collected at these stations were subsampled for a range of measurements (see above).

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 30 SEP 2001		2. REPORT TYPE		3. DATES COVERED 00-00-2001 to 00-00-2001	
4. TITLE AND SUBTITLE The Formation, Alteration and Preservation of Flood Deposits on the Pacific Northwest Continental Margin				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) College of Oceanic & Atmospheric Sciences,,Oregon State University,,Corvallis,,OR, 97331				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT The ultimate objective of this research program is to obtain a predictive understanding of the physical and biological processes responsible for the formation, alteration and preservation of sedimentary event deposits. The general approach is the development and testing of theory mainly through field observations and measurements.					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 5	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

RESULTS

The Po margin event-response cruises were extremely successful, and results from these cruises provide important contrasts to the Eel River flood deposits (Wheatcroft et al., 2001). Both the Eel and the Po flood deposits have unique (relative to the ambient sediments) sedimentological and geochemical properties. In particular, both are extremely fine-grained (clay-rich), have a high porosity and are enriched in Be-7 (an indicator of terrestrial sediment). Important small-scale differences between the Eel and Po flood deposits include the presence of a much greater diversity of physical sedimentary structures (e.g., soft-sediment deformation structures, laminations, thick beds) in the Po flood deposit (Figure 1). The most significant difference between the two flood deposits is their large-scale distribution. The centers of mass of the Eel River flood deposits are displaced roughly 15 km from the river mouth. In addition, the Eel flood deposits tend to have gentle thickness gradients that suggest active redistribution during their emplacement. In contrast, the center of mass of the Po flood deposit is immediately offshore of the river mouths (within a few km) and there are sharp thickness gradients. The latter suggests little redistribution during emplacement. The primary cause of the difference between the Eel and Po flood deposits is likely to be the size of the river basin, whereby small systems such as the Eel discharge their sediment during the storm that produced the flood. In contrast, large systems like the Po can deliver their flood sediment into oceanographically quiescent settings.

IMPACT/APPLICATIONS

Documenting the initial distribution and subsequent modification of sedimentary event beds, as well as patterns of sediment accumulation will provide key insight for modelers of strata development on continental margins.

TRANSITIONS

None.

RELATED PROJECTS

Po margin coring has been a joint effort with Nittrouer (UW), Hill (Udal) and Milligan (BIO), as well as personnel at the Istituto di Geologia Marina (CNR) in Bologna, Italy (Miserocchi and Trincardi).

REFERENCES

Wheatcroft, R.A., C.A. Nittrouer, S. Miserocchi and F. Trincardi. 2001. A comparison of floods and flood deposits on the Eel and Po River margins. AGU Chapman Conference on Sedimentary Margins, Ponce, Puerto Rico, June.

PUBLICATIONS

Wheatcroft, R.A. and C.A. Butman. 1997. Spatial and temporal variability in aggregated grain-size distributions, with implications for sediment dynamics. *Continental Shelf Research*, 17: 367-390

Wheatcroft, R.A., C.K. Sommerfield, D.E. Drake, J.C. Borgeld and C.A. Nittrouer. 1997. Rapid and widespread dispersal of flood sediment on the northern California continental margin. *Geology*, 25: 163-166

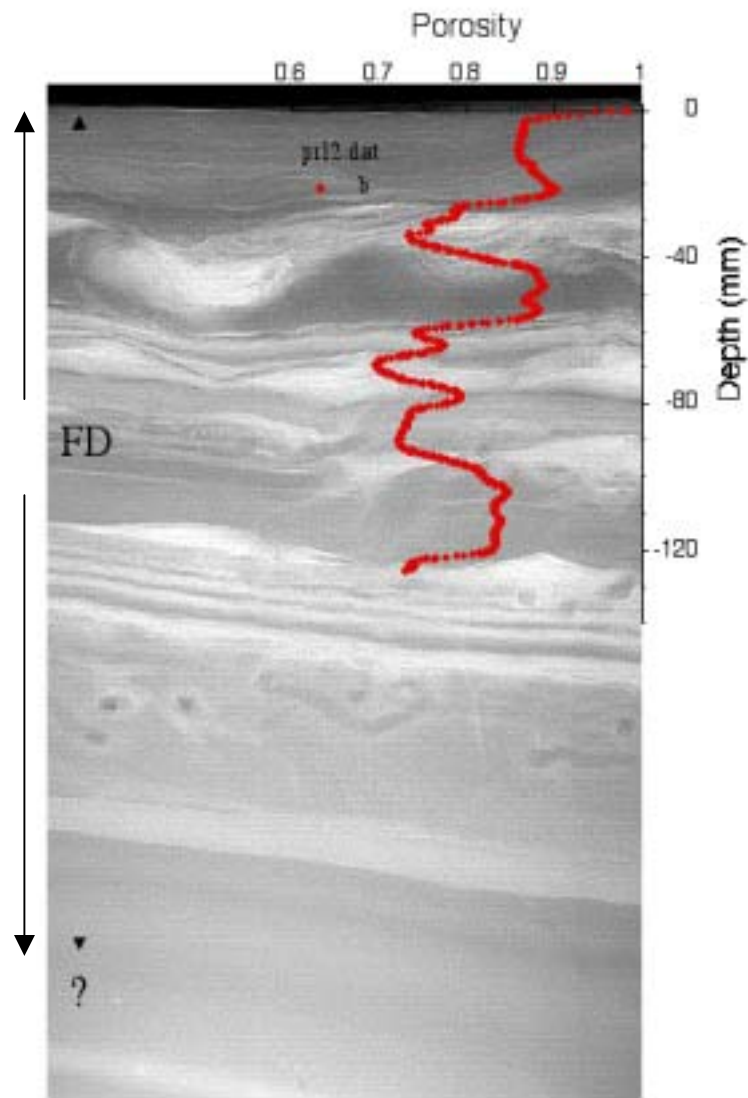


Figure 1. A digital x-radiograph of the Po River flood deposit (12-m station off the main river mouth) showing multiple layers with soft-sediment deformation structures, lenticular bedding and very few biogenic structures. Superimposed on the x-radiograph is a trace of porosity showing the extremely high values within the flood deposit.

- Wheatcroft, R.A., V.S. Starczak and C.A. Butman. 1998. The impact of population abundance on the deposit-feeding rate of a cosmopolitan polychaete worm. *Limnology and Oceanography*, 43: 1948-1953
- Fries, J.S., C.A. Butman and R.A. Wheatcroft. 1999. Ripple formation induced by biogenic mounds. *Marine Geology*, 159: 289-303.
- Wheatcroft, R.A., and J. C. Borgeld. 2000. Oceanic flood layers on the northern California margin: Large-scale distribution and small-scale physical properties. *Continental-Shelf Research*, 20: 2163-2190.
- Wheatcroft, R.A. 2000. Oceanic flood sedimentation: A new perspective. *Continental-Shelf Research*, 20: 2059-2066.
- Sternberg, R.W. , K. Aagaard, D. Cacchione, R.A. Wheatcroft, R.A. Beach, A.T. Roach, and M.A.H. Marsden. 2001. Long-term near-bed observations of velocity and hydrographic properties in the northwest Barents Sea with implications for sediment transport. *Continental Shelf Research*, 21: 509-529
- Richardson, M.L., 38 other authors and R.A. Wheatcroft. 2001. An overview of SAX99: Environmental considerations. *IEEE Journal of Ocean Engineering*, 26: 26-53.
- Goff, J.A., R.A. Wheatcroft, H. Lee, D.E. Drake, D.J.P. Swift and S. Fan. 2002. Spatial variability of shelf sediments in the STRATAFORM natural laboratory, northern California. *Continental-Shelf Research* (in press).
- Wheatcroft, R.A. In situ measurements of near-surface porosity in shallow-marine sands. *IEEE Journal of Ocean Engineering* (submitted).
- Sommerfield, C.K., D.E. Drake and R.A. Wheatcroft. Shelf record of climatic changes in flood magnitude and frequency, north coastal California. *Geology* (submitted).
- Decho, A.W., T. Kawaguchi, M.A. Allison, E. Louchard, C. Stephens, R.P. Reid, K. Voss, R.A. Wheatcroft, B. Taylor. Sediment properties influencing up-welling spectral reflectance signatures: The "biofilm gel effect" *Limnology and Oceanography*, (submitted).