SERVICES & FACILITIES ANNUAL REPORT - FY April 2010 to March 2011

SERVICE	FUNDING	AGREEMENT	ESTABLISHED as S&F	TERM
British Ocean Sediment Core Research Facility (BOSCORF)	**Block**	**NOC SLA R8/H10/41**	**1997**	**5 years**

TYPE OF SERVICE PROVIDED:

BOSCORF is the UK's national deep-sea core research facility and provides a unique and strategic service to the UK scientific community. It provides an advanced state-of-the-art non-destructive core logging and analysis capability that is unique in the UK. BOSCORF also provides specialised long-term core storage facilities, so that sediment cores collected by NERC ships, and NERC-funded researchers, can be kept under optimum conditions to ensure long-term preservation, and availability to the scientific community. BOSCORF promotes secondary multiple usage of the core material in its care ensuring cost-effective exploitation of an important national scientific resource. It is also responsible for long-term curation of core-based data relating to its holdings and from core-based national marine programmes in compliance with NERC data management policy. Further information on the facility is provided on the BOSCORF website (**www.boscorf.org**).

The BOSCORF facility provides an essential service vital to the UK's contribution to the global science effort because:

- Sediment cores and samples are the fundamental data source for information on seabed character and global environmental change.
- Cores are very expensive to collect and the cores held by BOSCORF represent a considerable investment of many millions of pounds already spent by the UK in Earth Science research. Cores dry out and fracture within months unless stored under optimum conditions, limiting their value for further research.
- As new measurement techniques and instrumentation become available and new concepts evolve, existing cores can be re-sampled to add to the knowledge base. BOSCORF maintains a state-of-the art, high-quality instrumentation suite for community use for analysing cores to extract maximum high-resolution environmental information.
- BOSCORF plays a major role in training postgraduates and post-doctoral scientists in core analysis, and provides specialist training workshops and courses. It has a wide user base within the earth sciences, which has grown in recent years to include geographers and archaeologists.
- No other facility offers community use of equivalent advanced logging tools or sophisticated x-ray analytical facilities. There is no other national repository for storing deep-sea cores in the UK.

The BOSCORF core collection currently consists of 1555 sediment cores, although data is held on 2104 sample stations. Currently the facility holds over 8 km of core in total. The BOSCORF core storage facility differs from that of BGS in providing long-term refrigerated storage for deep sea and lake environmental and process records.

ANNUAL TARGETS AND PROGRESS TOWARDS THEM

To submit a high-quality renewal bid to the SRG2011 to secure facility funding from April 2012. A renewal bid, approved by the BOSCORF SC, was submitted to NERC in December 2010, reviewed in March 2011 and well-received by the SRG.

To maintain high usage of the facility and ensure delivery of quality-assured data. A record number of samples were distributed by the facility this year and use of the BOSCORF core loggers has also been high. User feedback suggests users have been very satisfied with the service provided, with customer surveys this year showing that 80% of respondents rated BOSCORF service as 'Excellent'. BOSCORF's core logging instrument portfolio remains amongst the best in Europe.

To develop plans to secure additional refrigerated storage space to preserve core acquired over the next 10-15 years. During the year BOSCORF has closely liaised with NERC/NOCS Facilities Management and building consultants Drivers Jonas Deloitte to draw up plans for a new core store. The new core store will provide the community with World-class facilities.

SCORES AT LAST REVIEW (each out of 5)			Date of Last Review:	January 2006
Need	**Uniqueness**	**Quality of Service**	**Quality of Science & Training**	**Average**
5	**4.5**	**4.5**	**4**	**4.5**

CAPACITY of HOST ENTITY FUNDED by S&F	Staff & Status	Next Review (March)	Contract Ends (31 March)
	Curator (NERC B4) 100% established		
	Assistant Curator (NERC B6) 100%		
100%	Other Staff: UoS PExO 30%	**2011**	**2012**

FINANCIAL DETAILS: CURRENT FY

Total Resource Allocation £k	Unit Cost £k				Capital Expend £k	Income £k	Full Cash Cost £k
	Sediment samples distributed	ITRAX metres logged	MSCL-XYZ metres logged	MSCL-S metres logged			
311.11	0.025	0.2	0.1	0.12	0.00	10.6	400.88

FINANCIAL COMMITMENT (by year until end of current agreement) £k

2011-12	2012-13	2013-14	2014-15	2015-16
£ 311.11k	No alloc.	No alloc.	No alloc.	No alloc.

STEERING COMMITTEE	Independent Members	Meetings per annum	Other S&F Overseen
BOSCORF SC	5 (Chair: Prof. D. Kroon, Edinburgh)	1-2	None

APPLICATIONS: DISTRIBUTION OF GRADES (current FY — 2010/11)								
	α5	α4	α3	α2	α1	International Users	R*/Pilot	Reject
NERC Grant projects*		8						
Other academic		19				2		
Students		2	14					
Pilot							3	
TOTAL		29	14			2	3	
APPLICATIONS: DISTRIBUTION OF GRADES (per annum average previous 3 financial years —2007/2008, 2008/2009 & 2009/2010)								
	α5	α4	α3	α2	α1	International Users	R*/Pilot	Reject
NERC Grant projects*		10					1	
Other Academic		13				6		1
Students			16					
Pilot		1						
TOTAL		24	16			6	1	1

PROJECTS COMPLETED (current FY – 2010/11)							
	α5	α4	α3	α2	α1	β	R*/Pilot
NERC Grant projects*	All BOSCORF sampling/logging requests made during the year were completed. Information on NERC Grant/academic project completion is not collected.						
Other Academic							
Students							
Pilot							

Project Funding Type (current FY – 2010/11) (select one category for each project)										
Grand Total	Infrastructure					PAYG				
	Supplement to NERC Grant *	Student NERC	Student Other	NERC C/S	Other	NERC Grant*	Student NERC	Student Other	NERC C/S	Other
48	8	6	10	10	14					
Project Funding Type (per annum average previous 3 financial years - 2007/2008, 2008/2009 & 2009/2010)										
Grand Total	Infrastructure					PAYG				
	Supplement to NERC Grant *	Student NERC	Student Other	NERC C/S	Other	NERC Grant*	Student NERC	Student Other	NERC C/S	Other
48	6	6	10	8	18					

User type (current FY – 2010/11)				
Academic	Centre/Survey	NERC Fellows	PhD	Commercial
22	10	0	16	0
User type (per annum average previous 3 financial years - 2007/2008, 2008/2009 & 2009/2010)				
Academic	Centre/Survey	NERC Fellows	PhD	Commercial
23	8	0	17	0

OUTPUT & PERFORMANCE MEASURES (current year)										
Publications (by science area & type) (calendar year 2010)										
SBA	ES	MS	AS	TFS	EO	Polar	Grand Total	Refereed	Non-Ref/ Conf Proc	PhD Theses
	59					6	65	31	30	4
Distribution of Projects (by science areas) (FY 2010/11)										
Grand Total	SBA	ES	MS	AS	TFS	EO	Polar			
48		45					3			
OUTPUT & PERFORMANCE MEASURES (per annum average previous 3 years)										
Publications (by science area & type) (Calendar years 2007, 2008 &2009)										
SBA	ES	MS	AS	TFS	EO	Polar	Grand Total	Refereed	Non-Ref/ Conf Proc	PhD Theses
	43					4	47	17	26	4
Distribution of Projects (by science areas) (FY 2007/2008, 2008/2009 & 2009/2010)										
Grand Total	SBA	ES	MS	AS	TFS	EO	Polar			
48		45					3			

Distribution of Projects by NERC strategic priority (current FY 2010/11)							
Grand Total	Climate System	Biodiversity	Earth System Science	Sustainable Use of Natural Resources	Natural Hazards	Environment, Pollution & Human Health	Technologies
48	13	1	15	0	15	2	2

NOTE: All metrics should be presented as whole or part of whole number NOT as a %

OVERVIEW & ACTIVITIES IN FINANCIAL YEAR (2010/11):

During the reporting period, the BOSCORF facility has continued to be well-used by external and internal users and a total of 882 m of core were logged during the reporting period (Fig. 1). The number of BOSCORF users continues to be high and the significant increase in users seen after acquisition of the ITRAX corescanner in 2003 was maintained (Fig. 2). During the reporting period, 20 researchers from 10 institutions/university departments (including 1 researcher from overseas) sampled BOSCORF cores taking a total of 11,677 samples, a record number of samples taken at the repository. In addition, 16 users from 8 institutions/university departments used the ITRAX XRF core scanner to log 171.5 m of core. Eight users from 4 institutions used the BOSCORF XYZ multi-sensor core logger (MSCL-XYZ) to log cores with a combined length of 412.6 m. A further 4 users from 2 institutions used the standard MSCL-S to log 298 m of core. BOSCORF staff were also consulted by a number of other scientists (including researchers based overseas) on a number of core-related issues and for data requests, and also provided users with post-visit support in data visualisation and analysis. The high number of Ph.D. students supported by BOSCORF was maintained (Fig. 3). During the reporting period, BOSCORF acquired 106 new cores, totalling an extra 576 m. This represents a 7% increase in repository holdings. A large number of visitors (approximately 260 individuals) received tours of the repository during the reporting period.

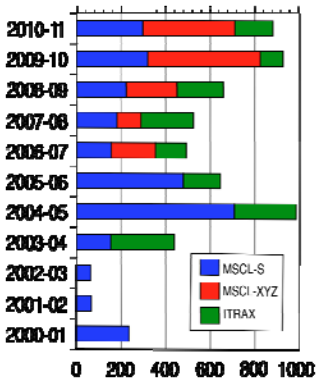


Fig. 1. Metres of core logged 2000-11

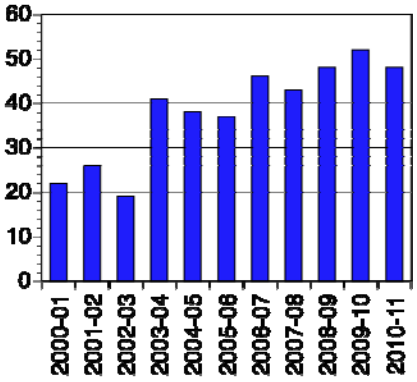


Fig. 2. Number of BOSCORF users 2000-11

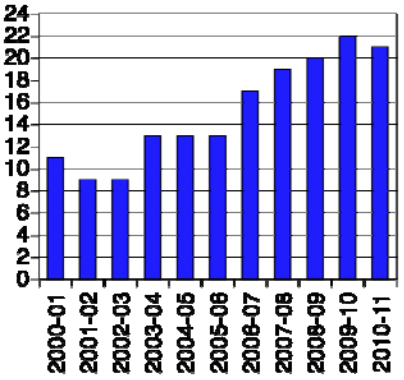


Fig. 3. Number of Ph.D. students supported 2000-11

BOSCORF convened an international workshop for ITRAX users '*ITRAX 2010 - Applications, innovations and future developments*' in Lipari, Italy, in April 2010. This meeting attracted significant industrial sponsorship and was attended by over 30 senior scientists from ITRAX-owning institutions who enjoyed a stimulating programme of 29 talks and poster presentations. The proceedings will be published by Springer Environmental Sciences in their *Developments in Paleoenvironmental Research* book series (volume edited by the BOSCORF Curator an Professor Ian Croudace, University of Southampton) with publication planned for 2012. This promises to be a benchmark publication for micro-XRF studies of sediment cores. The BOSCORF ITRAX has proved to be a very efficient tool for rapidly mapping the impact of anthropogenic heavy metal pollution and is making an important contribution to the emerging field of environmental forensics. Recent work has included mapping heavy metal contamination in a bay in Sicily (research commissioned by an Italian environmental agency as part of a legal challenge against polluting companies) (Fig. 4) and zinc pollution in sediments offshore of a zinc smelting works in the Venice Lagoon, Italy (for the Venice Water Authority). In November, BOSCORF ran a second course on *Core data analysis and visualisation* for the Department of Geography, Royal Holloway, University of London, with an emphasis on using ITRAX data from varved sediments for establishing high-resolution geochronologies. This was attended by 13 postgraduate students, many of them NERC-supported. A protocol for extending BOSCORF's remit to store and curate lake cores collected with NERC funds was developed for consultation. The first issue of the *BOSCORF Newsletter was* circulated by email to over 170 users and potential users. A poster advertising BOSCORF and its facilities was produced and distributed on visits to University departments. A new repository has been designed, with expanded and enhanced core storage, laboratory and teaching facilities and taken to completion of RIBA Stage D (detailed scheme design) and planning permission obtained in February 2011.

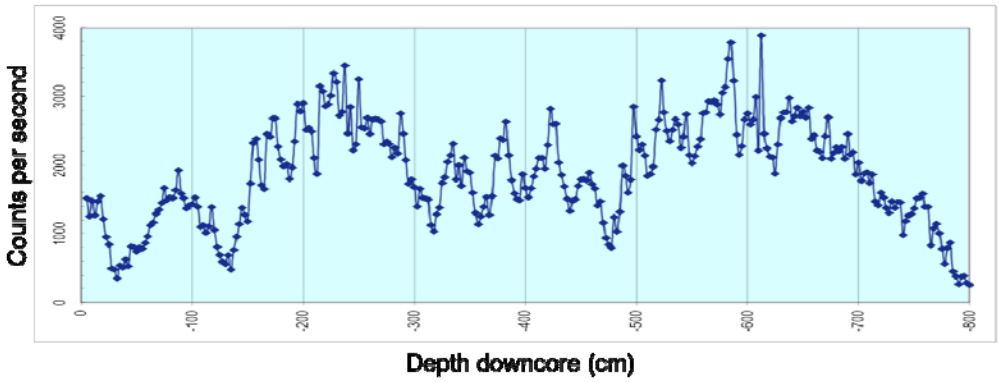


Fig. 4. ITRAX-generated mercury profile through a heavily polluted core from Augusta Bay, Sicily. Calibration of the curve by WD-XRF analysis shows that the high peaks of over 3000 counts per second equate to over 600 mg Hg per kg of sediment. According to Canadian marine sediment quality guidelines, mercury may become a hazard to sediment-dwelling organisms at concentrations above 0.13 mg kg^{-1}, while CEFAS considers dredged material with Hg contamination greater than 3 mg kg^{-1} as unsuitable for disposal at sea. The above profile illustrates the ITRAX's value in the emerging field of environmental forensics for rapidly mapping contaminant distribution. (Courtesy Professor Ian Croudace, University of Southampton).

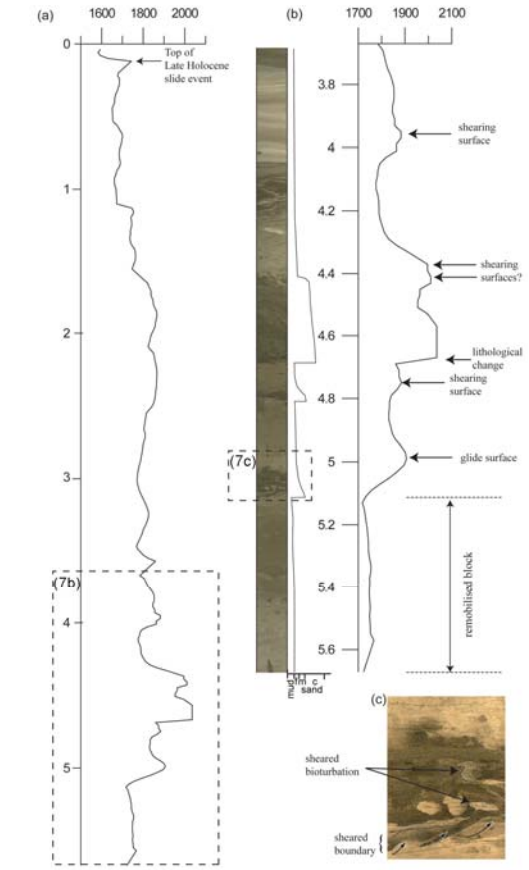
BOSCORF
April 2010 - March 2011
Key Figures

Number of samples taken: 11,667
Number of metres logged: 882
Number of Ph.D.s supported: 21
Total number of users: 48
New cores acquired: 106
Increase in core holdings: 7%

Total cores held: 1555

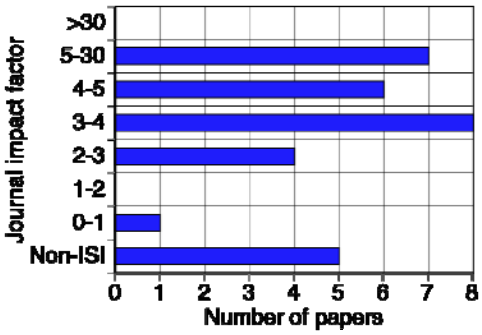
SCIENCE HIGHLIGHTS :

BOSCORF is key to enabling research on the cores we recover from the deep ocean, which are critical for UK climate research. During the year 2010, at least 65 publications (including 31 in refereed literature and at least 4 Ph.D. theses) were either wholly or partly engendered by the BOSCORF facility (these are listed in Annex 6). A number of papers published in previous years, but not reported, were also identified (see Annex 6). Notable amongst these were two papers in *Documenta Praehistorica* that used the palaeoenvironmental record of BOSCORF core LC21 to relate climatic forcing to a postulated phase of internecine warfare and population collapse at Late Neolithic/Early Chalcolithic sites in southwestern Turkey (Clare et al. 2008, *Documenta Praehistorica*, **35**, 65-92) and document wider prehistoric social change related to Rapid Climate Change events in the Eastern Mediterranean (Weninger et al., 2009, *Documenta Praehistorica*, **36**, 7-59). Analysis of BOSCORF cores were also used to characterise deep-sea tsunamiite deposits (Cita, 2008, *Tsunamiites - features and Implications*, 185-202, Shiki and Cita, 2008, *ibid*, 203-215), research which provides fundamental data for identifying frequency and extent of these destructive events.



Some specific highlights for 2010:

- The Portuguese margin is considered a prime location for tracing millennnial-scale variability and interhemispheric coupling. Foraminiferal isotope and pollen records from a BOSCORF core here have been used to reconstruct surface- and deep-water hydography and atmospheric changes during the last and penultimate glacial cycles. This work has shown the importance of the hydological cycle in setting the strength of Atlantic meridional overturning circulation and north Atlantic stadial durations (Margari et al., 2010, *Nature Geoscience*, **3**, 127-131).
- Pollen, cuticle fragments and dinoflagellate cysts in a BOSCORF core offshore western equatorial Africa have been used to elucidate environmental change in the African hinterland over the last 26,000 years, showing significant palaeoenvironmental changes, and changes in atmospheric dynamics, affecting both the oceanic and continental domains. This study illustrates the wide geographical reach of the BOSCORF core archive (Kim et al. 2010, *Palaeogeography, Palaeoclimatology, Palaeoecology*, **297,** 428-438 (doi:10.1016/j.palaeo.2010.08.026).
- The BOSCORF ITRAX has been used to investigate sediment substrate redox conditions to rapidly assess regional substrate variation along a core transect in the Central Pacific Ocean. These data have been used to assess potential environmental impacts due to manganese nodule extraction and indicate less likely impact of mining in the Penrhyn Basin, where only oxic sediments will be resuspended, than in the Peru Basin where sub-oxic sediments will be disturbed (Cronan et al., 2010, *Marine Georesources and Geotechnology*, **28**, 207-221).



*Left top: Multi-sensor core logger acquired density log of a core through the head of the Sahara slide, NW African margin, clearly showing shear and glide surfaces, pointing to retrogressive failure. Detailed core analysis shows the slide to be linked to rising sealevel, suggesting such geohazards may be more prevalent during global warming (*Georgiopoulou, et al. 2010, *Geochemistry Geophysics Geosystems*, **11**, (7), Q07014. (doi:10.1029/2010GC003066). *Research at BOSCORF is providing a strategic view of geohazards.*

Left bottom: Papers engendered by BOSCORF during 2010 categorised according to journal impact factor (n=31). Non-ISI publications are largely book chapters and peer-reviewed articles in foreign language online journals.

FUTURE DEVELOPMENTS/STRATEGIC FORWARD LOOK

BOSCORF is hosting the 15th Meeting of the US-based Core Curators Group in May 2011. This will be the first time that this important biennial meeting has been held outside the USA since meeting inception in 1977. BOSCORF intends to use this opportunity to facilitate closer European involvement in international collaboration in promoting core data accessibility and strengthen BOSCORF's international visibility and leadership. The BOSCORF core store is now full and if funding to build the new repository is further delayed, there will be significant difficulties in storing and accessing new core acquisitions, which ultimately may lower quality of service delivery. Plans for the new core store include new laboratory space for acquisition of new analytical instruments according to community need and when funds allow, and a dedicated classroom and display area, allowing BOSCORF to grow its outreach and training activities. Realising the new build is now the primary operational priority. Further priorities are to photograph the core collection and build an accessible digital image archive, and to link core photographs and summary core logs to metadata on BOSCORF cores held by the World Data Centre to promote informed access to the core archive.