MIDAS
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MANAGING IMPACTS OF DEEP SEA RESOURCE EXPLOITATION

Winter 2014/15 Issue 3

The two-vessel cruise to Portman Bay, SE Spain: a breakthrough experience

Miquel Canals and cruise shipboard party

The MIDAS team from GRR Marine Geosciences University of Barcelona, together with researchers from CONISMA and external partners CEntre de Formation et de Recherche sur les Environnements Méditerranéens (CEFREM, Perpignan) and the Spanish Institute of Oceanography carried out an ambitious research cruise off SE Spain to investigate the mine tailings deposit of Portman Bay, near Cartagena.

Portman Bay presents one of the most extreme cases of impact on the marine ecosystem by the disposal of mine tailings in Europe. As a shallow water analogue, the study of Portman Bay aims at contributing to the overarching objective of MIDAS to determine the potential impact of deep-sea mining on marine ecosystems. The analogies of the Portman Bay study case with deep-sea mining mainly relate to the character of the exploitation (open pit); the ore type (sulphides, similar to those in ocean ridges and submarine hydrothermal sites); the generation of large volumes of tailings, their subsequent disposal on the seafloor and their composition; and, possibly, the behaviour of the suspensates resulting from mining activities, both during and after extraction (e.g. resuspension from tailing deposits). Furthermore, Portman Bay is a low energy setting in terms of hydrodynamics, similar to most deep-sea areas. The main differences are the shallow water depth, the limited extension and the communities and species living in of Portman Bay compared to the deep-sea settings with mining potential.

Extensive open pit mining of sulphides such as galena (PbS), sphalerite (ZnS) and pyrite (FeS_2) and a complex suite of other minerals took place along the 25 km-long Sierra Minera near Cartagena from the 1950's up to 1990 (Figure 2). During this

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time, an estimated 25 million cubic metres of hazardous mine waste rich in lead, zinc, arsenic and other metals was generated and had to be dumped somewhere. The most convenient and cheapest 'solution' was the direct disposal of the tailings via a pipeline into the sea near to the beautiful, crescent-shaped Portman Bay. The low grade of the sulphide deposits meant that only 15 kg of galena, 20 kg of sphalerite and 50 kg of pyrite were obtained per tonne of ore. In other words, for every 1000 kg of ore mined, 915 kg was discarded.

The tailings were the output of the largest froth floatation concentration plant in Europe at the time, known as 'Lavadero Roberto' and built by the French multinational mining company Peñarroya. By the late 1980's, about 10,000 tonnes of ore were processed every day in the 'lavadero', which was located a short distance from the old shoreline. The differential floatation process produced concentrates of galena and then sphalerite, accompanied by a first generation of tailings. A secondary floatation step was devised to strip pyrite from the first generation tailings. However, according to experts, this process proved to be highly inefficient because of complex textural features and oxidation of the sulphide ore. After the two floatation steps, the fine grained tailings slurry (d80 <180 μm) that was discharged into the sea still contained significant amounts (>10%) of pyrite, small amounts of galena and sphalerite, silicates, oxides, carbonates and other sulphides. This waste component usually represented more than 95% of the initial milled ore material.

Previous estimates indicate that the total amount of processed ore was 60 million tonnes, yielding 57 million tonnes of tailings. Of these, about 14 million tonnes (roughly equivalent to 5.6 million cubic meters) remain in the bay, while all the rest (i.e. about 43 million tonnes) is under the sea, off the bay and along the adjacent continental shelf.

Figure 1 (left): Group photos of the participants in the MIDAS-Portman research cruise. Top: the trawlers' team aboard R/V Ramon Margalef. Bottom: the surveyors' team aboard R/V Angeles Alvarino

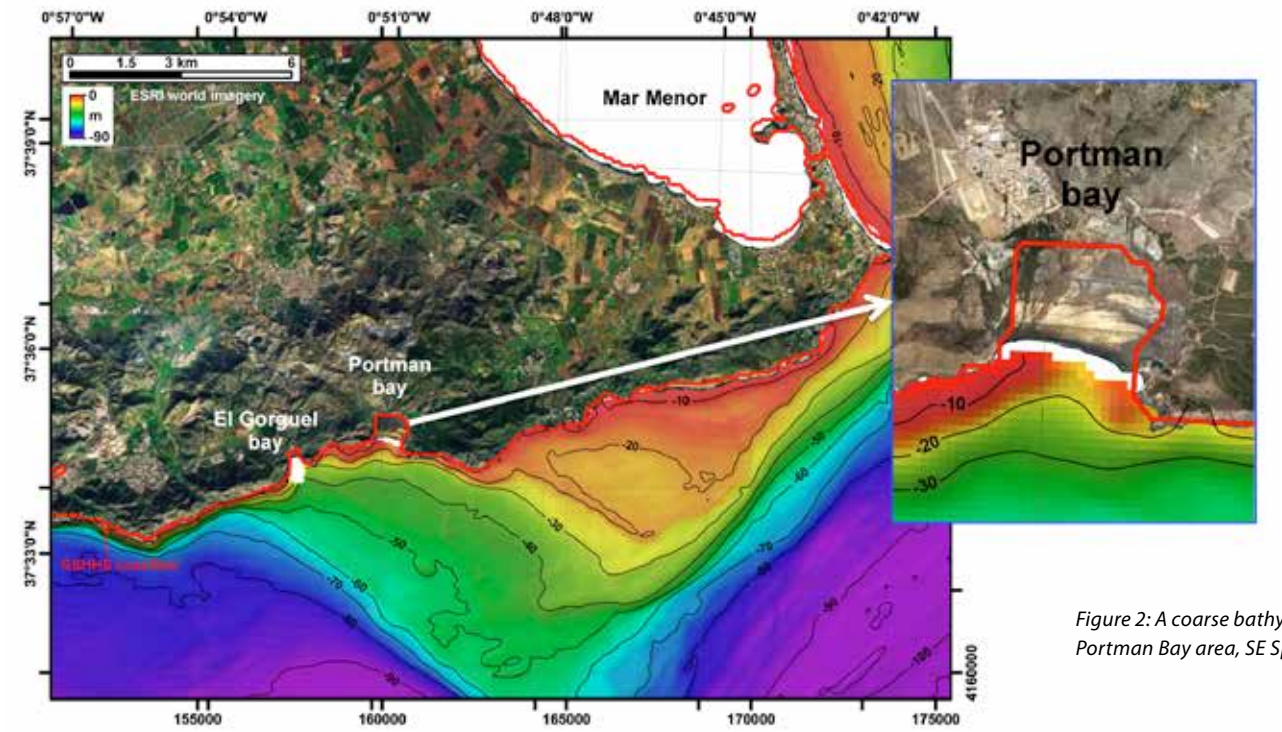


Figure 2: A coarse bathymetric map of the Portman Bay area, SE Spain.

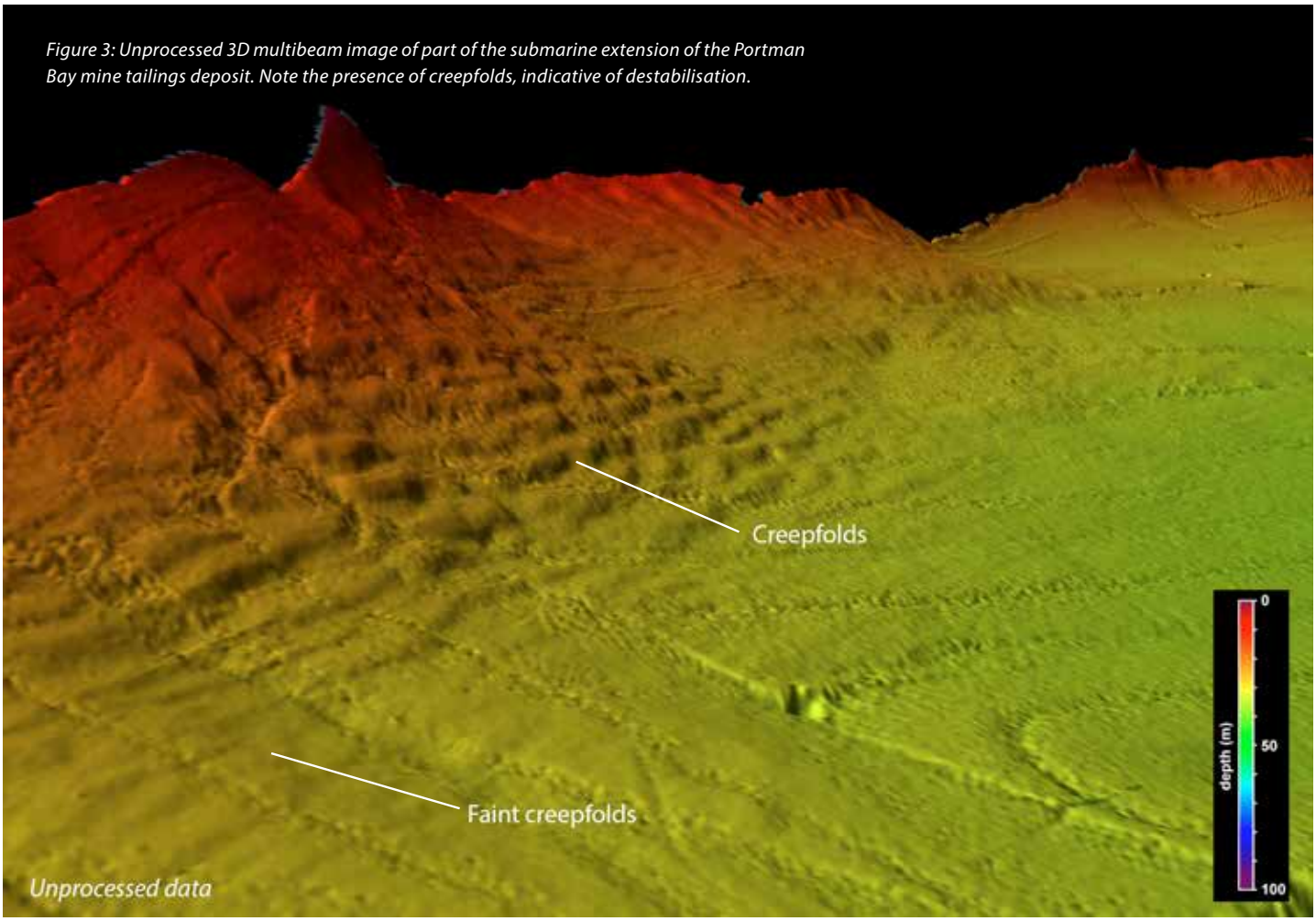


Figure 3: Unprocessed 3D multibeam image of part of the submarine extension of the Portman Bay mine tailings deposit. Note the presence of creepfolds, indicative of destabilisation.

One of the first and most obvious impacts of such disposal was the entire disappearance of Portman Bay - originally measuring 1.3 x 0.8km - through infilling, despite some pre-dumping studies indicating that this would not happen. The slurry pipe outfall was located over a low coastal cliff enclosing the bay to the west. Tailings were progressively shifted into the bay by coastal currents, which resulted in the advance of the 1957 shoreline by some 500-600 m (locally up to 700 m) to its present position, in parallel with the bay infill and burial of the continental shelf. An old dock facility into the bay was completely blocked by the induced siltation.

In addition to the clearly visible effects of the disposal of tailings in the emergent part of the bay, much remains unknown about the submarine extent of the deposit. Though limited in scope, previous studies on the impacts of the tailings deposit on marine habitats have demonstrated the disappearance of extensive *P. oceanica* meadows and the presence of the highest concentrations of Hg, Pb, As and Cd in marine organisms found along the entire Spanish Mediterranean coastline.

Therefore, in view of the situation and the unique opportunity it represented, researchers from the University of Barcelona, jointly with their collaborators, conceived and implemented a complex transdisciplinary experiment in Portman Bay in order to obtain a comprehensive dataset on a massive seafloor mine tailings deposit for the benefit of MIDAS.

The MIDAS-Portman research cruise in Portman Bay and the adjacent marine area took place during 6-17 August 2014. Two modern vessels owned by the Spanish Institute of Oceanography were used: R/V Angeles Alvarino and R/V Ramon Margalef (http://www.ieo.es/web/ieo/flota). The Spanish Ministry for Economy and Competitiveness supported the cruise, the main objectives of which were:

i) To map the marine extension, geometry and distribution of the Portman Bay mine tailings deposit by means of very high resolution multibeam bathymetry and seismic reflection techniques, which also allowed the identification of signs of destabilisation in the deposit (Fig. 3).

ii) To obtain multicorer samples to characterise the physical properties and composition of the deposit's upper layers and to groundtruth geophysical data (Fig. 4).

iii) To trigger resuspension plumes via bottom trawling and monitor their behaviour through time by using a range of acoustic and optical tools (multibeam, hull mounted and HR near-bottom towed ADCPs, LISST particle sizer and holographic camera), jointly with CTD and associated fluorescence and turbidity sensors, moored arrays with automated particle traps and current meters, and rosette water sampling (Figs. 5, 6 and 7).

iv) To investigate the long-term effects of the deposit on organisms, and the short term effects of the resuspension plumes on indicator organisms moored in plume-influenced and off-plume reference sites.

Activities related to objectives i), ii) and iv) were carried out from R/V Angeles Alvarino, while activities related to iii) were carried out using the two vessels, R/V Ramon Margalef as trawling vessel and R/V Angeles Alvarino as monitoring vessel (Figs. 5 and 6).

The cruise was organised in three legs:

a) Pre-trawling leg (6-9 August 2014, R/V Angeles Alvariño) when high-resolution EM-710 swath mapping and TOPAS PS18 profiling were performed, multicore samples obtained, and moorings deployed.

a) Trawling leg (10-14 August 2014, R/V Angeles Alvariño and R/V Ramon Margalef) when resuspension plumes were triggered and intensively monitored through time.

a) Post-trawling leg (15-17 August 2014, R/V Angeles Alvariño) when moorings were recovered, and further high-resolution swath mapping and TOPAS profiles and multicore samples obtained.

At the time of writing, results are still very preliminary and a huge amount of data and samples are being processed, analysed and interpreted. However, some of the main outcomes of the cruise can be provided.

The area and thickness of the submarine extension of the Portman Bay coastal deposit is perfectly imaged from the multibeam and TOPAS data, yielding a total surface of 3.8 km^2 from its outer limit to the coastline, with a maximum thickness of about 12 metres within the surveyed zone. These values do not take into account the emergent part of the bay infill (with an extension estimated at 0.7 km^2), the outermost extension of the deposit where its thickness is below the detection limits of the TOPAS profiles, nor mixtures with natural sediment and losses due to current transport. The deposit forms a prism attached to the coast, with a steeper foreset at depths less than 30 m showing creepfolds and other destabilisation and erosional signs (Fig. 3). In section, the deposit displays a crenulated pattern with a distinct, laterally continuous basal reflector.

In total, 78 six-tube multicores up to 50 cm in length were taken during the cruise. At the time of writing some of the multicores have been XRF-scanned, which has confirmed exceptionally high background metal contents with even higher spikes at specific depths (Fig. 4). A systematic non-destructive analytical protocol will be applied to the cores in the coming months, including XRF (for elemental composition) and multisensor (for physical properties) core logging, and scanning with the new Multitom X-ray CT for ultra-high resolution 3D imaging (for textural and densitometric properties) at the University of Barcelona. A set of standards will be prepared for calibration purposes so that the XRF data can be converted into concentrations.

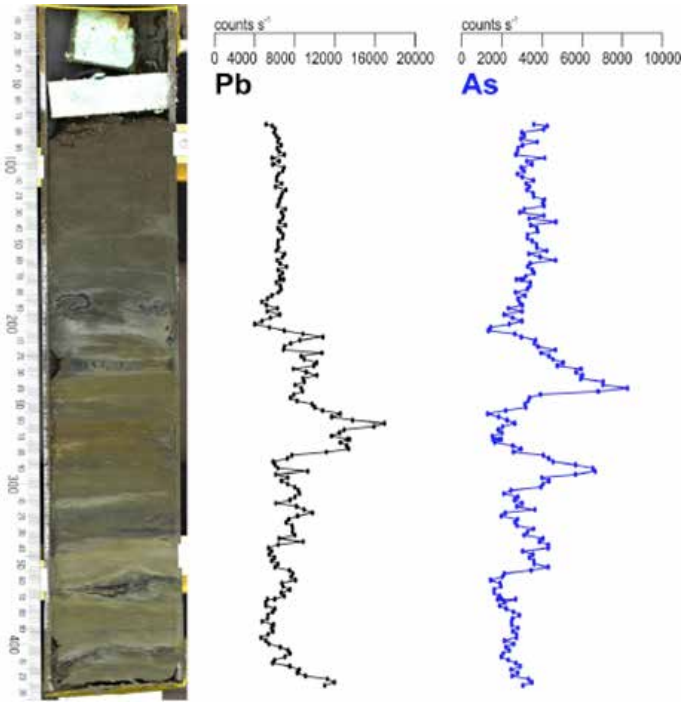


Figure 4: XRF Pb and As profiles of one of the multicores collected in the mine tailings deposit of Portman Bay. Note the extremely high background values (in counts s^{-1}) and some prominent spikes.

Four moorings were also deployed: one equipped with a currentmeter and automated particle trap was placed at some distance from the trawling area (see below) to keep a record of the ambient conditions during the cruise and the eventual export of particles from the resuspension plumes. Three moorings with mussel ropes were located in the inner and outer part of the deposit trawling area and outside it to investigate the effects of the short-term suspension plumes on these organisms.

Figure 5 (above): The two vessels used for the research work in Portman Bay sailing in parallel over calm seas.

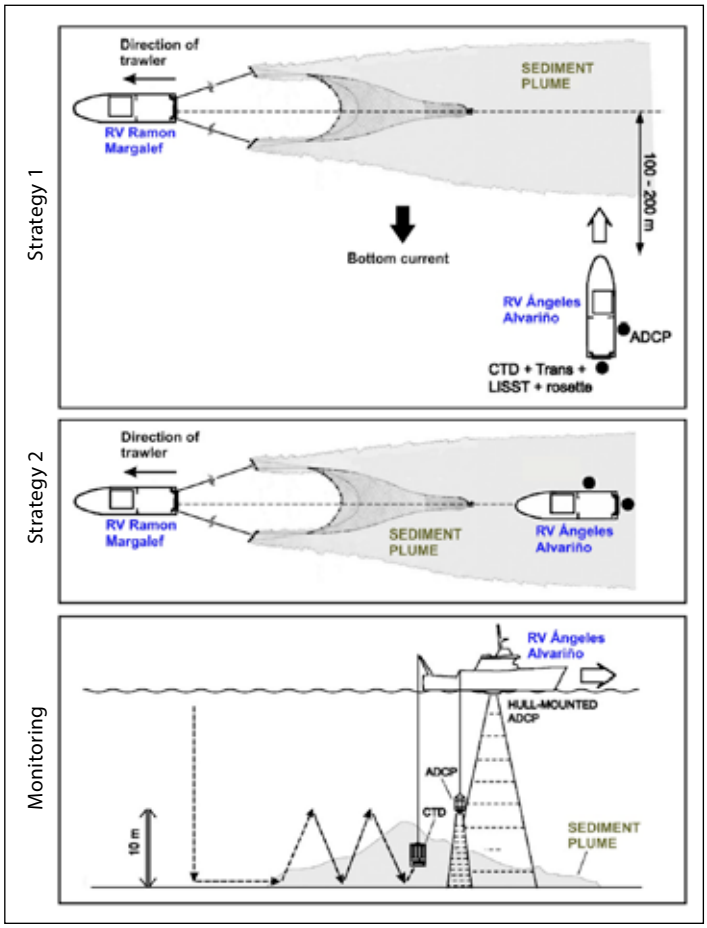


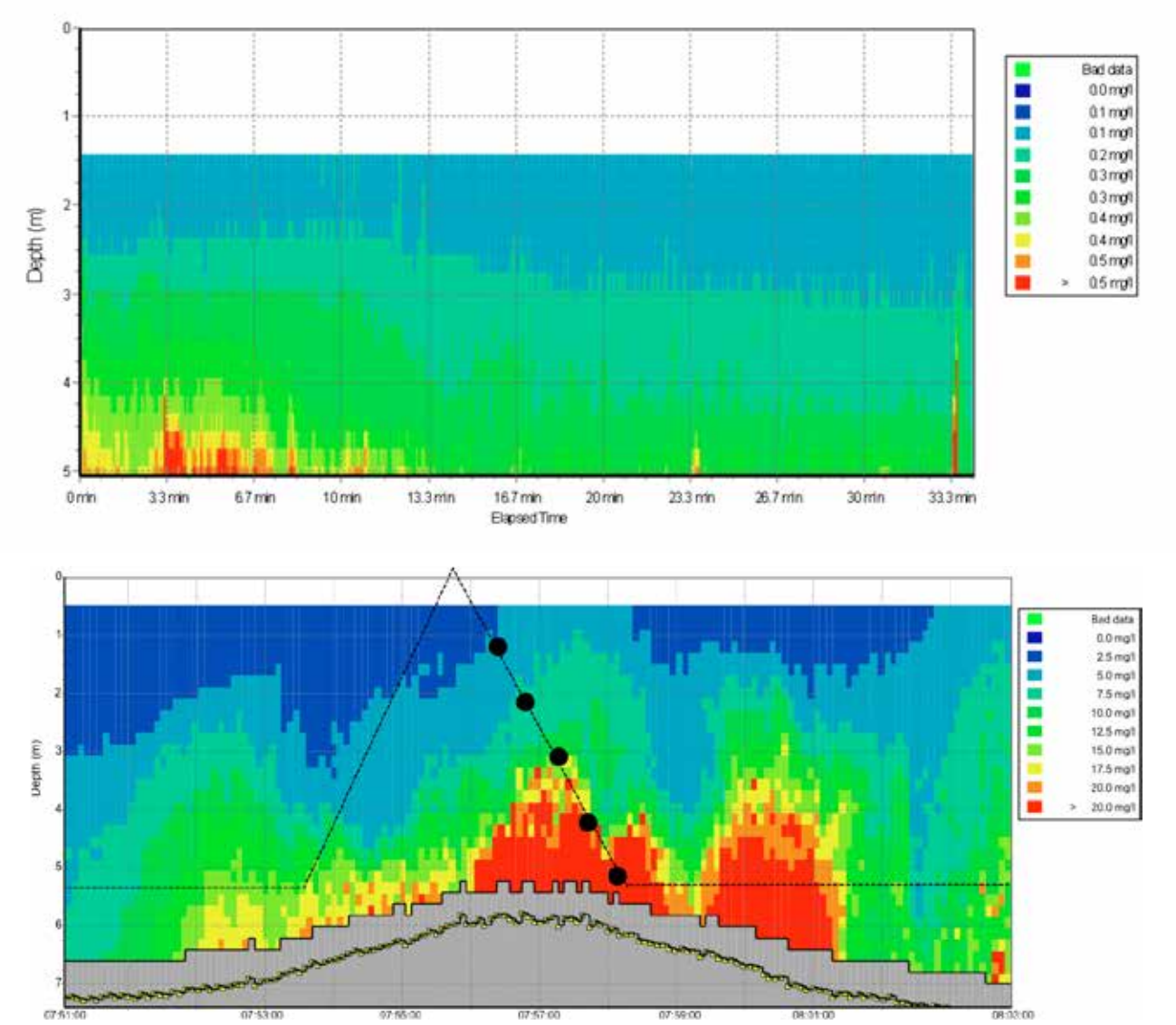
Figure 6 (right): Sketches of the design and instruments deployed during the two-vessel resuspension experiment in Portman Bay.

During the trawling leg 14 trawls were performed along six short corridors, both on the deposit and outside, as control runs. In all cases, both the resulting, metal-loaded plumes and those triggered outside the tailings deposit were monitored successfully. The two vessels performed very professionally despite the risk due to the proximity of the coast, and the difficulties imposed by the presence of obstacles both afloat (fish culture cages) and on the seabed (scattered and aligned rock outcrops around the deposit), and also by the shallowness of the trawled area – all involving the need for fast and efficient display and recovery of the fishing gear while watching the maintenance of the minimum safety distance amongst the two vessels (Figs. 5 and 6). Trawling parameters were strictly controlled in every haul. During this leg, 22 CTD casts in yo-yo mode (i.e. entering and exiting the trawl-generated plumes) were also performed, combined with water sampling and subsequent filtering to analyse the grain size and composition of plume particles (Fig. 7). Overall, we found that the metal-loaded plumes were attached to the bottom (i.e. usually less than 2 m in height, rarely up to 4 m or more) and had a variable though relatively quick decline (the maximum tracking time for a given plume was about 4 hours) and limited dispersal, though export of the finest fraction to other places cannot be ruled out. We also verified that the resuspension experiment was performed under low current speeds (less than 0.2 m s^{-1} most of the time).

Benthic biodiversity patterns and attributes of ecosystem functioning in relation to putative gradients of contamination and their responses to the disturbance events induced by trawling are currently underway, led by the MIDAS team at CONISMA. So far, preliminary results on the distribution of meiofaunal abundances and biodiversity, including dominant and rare meiofaunal taxa, the degradation rates of organic matter and microbial biomass production have been obtained, which will provide new insights on the impacts of mining residues on faunal assemblages, the cycling of organic matter and the dynamics of the benthic food webs.

But, please, keep in mind that all of what is described above is just the start. Much more work remains to be done, which will undoubtedly bring novel and interesting results. There are certainly some valuable lessons to be learnt from the Portman Bay study case.

Figure 7 (overleaf): 300 kHz near-bottom ADCP profiles before (top) and immediately after a trawling run (bottom) in Portman Bay. Values correspond to acoustic backscattering converted into suspended sediment concentration (mg L-1) using the Sediview method (note that scales are different in the two plots). Zero depth corresponds to the immersion depth of the ADCP, not to actual water depth. The track of the CTD cast and water sampling depths are also depicted in the lower plot. The seabed is represented either by the bottom line of the plot (upper image) or the grey area under the red to green coloured resuspension plume (lower image). SSC = Suspended sediment concentration.



LC/LP Correspondence Group on Mine Tailings

The London Convention and Protocol (LC/LP) has given consideration to disposal of mine tailings since 2008. An independent report (Vogt, 2012) provided detailed background information on the current management of mine tailings, which can contain pollutants such as heavy metals, cyanide and chemical reagents, sulfide compounds and suspended solids. For deep-sea tailings placement (also known as submarine tailings disposal), via pipeline, plumes of finer material can form at various depths subject to stratification. Various factors, such as earthquake prone regions, high rainfall or coastal topography, can influence technical decisions in favour of marine disposal.

It has been acknowledged that international guidance is needed on this topic but it is not clear which international body should lead. An LC/LP Correspondence Group reported in November 2014 (LC 36/9/2) noting parallel GESAMP and UNIDO processes. The Group identified an inventory of 15 existing marine discharges and identified 8 more under consideration. GESAMP will produce a scoping paper considering information gaps such as the behavior of slurries underwater and a future GESAMP-led international conference and/or GESAMP Working Group has been suggested. LC/LP will continue to examine best management practices, some of which may be worthy of consideration in the context of deep-sea mining.

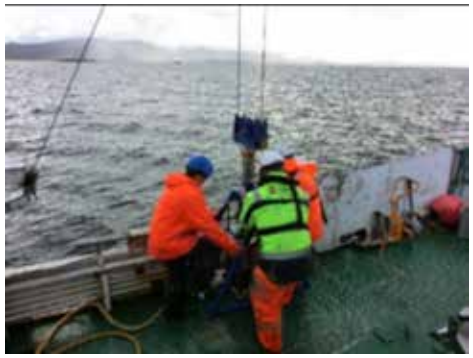
Reference: Vogt, C. (2012) International Assessment of Marine and Riverine Disposal of Mine Tailings. A report prepared for LC/LP, IMO and UNEP GPA

Norwegian mine tailings exposure experiments: The MIDAS experiments at IRIS

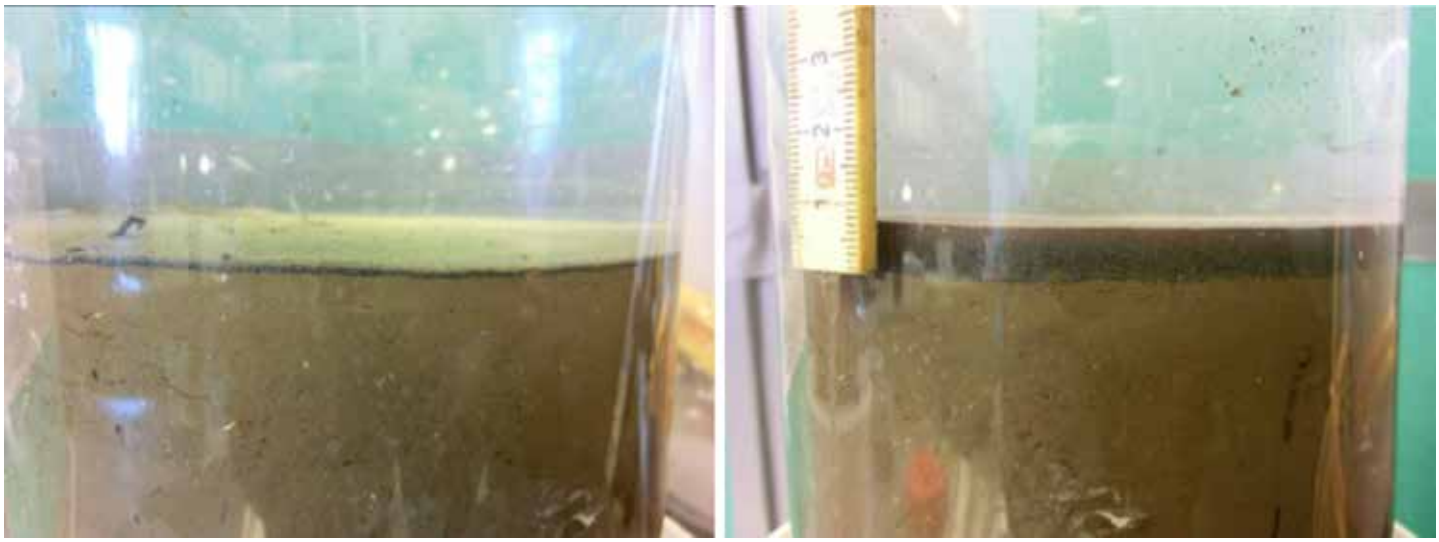
The first set of experiments to determine the impact of mine waste (tailings) on seafloor life are underway at the International Research Institute in Stavanger, Norway. Deep-sea mining activities will indisputably affect the status of the marine environment. In addition to the direct disturbance of the seafloor substrate, mining operations will create extensive sediment plumes. Resettlement of particles from these plumes away from the mining site will smother the sediment and benthic fauna with unforeseen consequences. The impacted area may therefore be a multifold of the area that is actually mined and novel scientific data are critically needed to establish how significant the impacts of mine tailing deposition actually are.

These exposure experiments - a collaborative effort between MIDAS teams at IRIS, NIOZ and University of Gent - are designed to determine the effects that the settling of resuspended particles might have on the seafloor fauna. We investigated the response of soft-sediment biota to the deposition of ground-up rock (mine tailings) on deep-sea sediments collected from a Norwegian fjord. Sediment was supplied from cores collected in late October aboard RV MS *Solvik* from a site at 200 m water depth in the Hardangerfjord in south west Norway. After a short, early morning steam through the beautiful fjords, we reached the site named 'MIDAS 2014' where we collected 42 sediment cores for our laboratory experiments.

Above: Map showing location of sediment core site in Hardangerfjord, Norway.



Right: the team working aboard MS Solvik in the fjord.



Above: A layer of tailings material was added to the top of the sediment in the core to measure the impact on biota. The amount of tailings reqiured to obtain the desired deposit thickness was based on deposit density measurements verified with trials in extra cores taken for this purpose.

As a consequence of deposition of mine tailings, a large part of the seafloor benthos will be buried, cutting them off from the supply of organic matter and oxygen and causing mortality or reduced biotic activity. We examined the impact of tailing deposits of three thicknesses (1, 5 and 30 mm; see image above) compared to a control without tailing deposits. As response variables, we chose to determine i) the oxygen conditions in the sediment; ii) the structure of the main components of seafloor biota, namely bacteria, meiofauna and macrofauna; iii) the total sediment community oxygen consumption (SCOC) as a measure of total activity, and iv) the capacity of the seafloor community to process organic matter (^{13}C-labelled diatoms). These response variables will allow us to establish the impact of aberrant tailing deposits on the structure and consequently the functioning of seafloor communities. The images below show some of the core processing at the end of the incubations. Analyses are currently underway and some initial findings are expected to be available to share at the ASLO meeting in February 2015.

For more images and video from the cruise, please visit www.eu-midas/science/norwegian_tailings_experiment

Top: Annelien Rigaux (UGent, Belgium) proceesing cores. Above: Lisa Mevenkamp (UGent) processing meiofauna samples. In order to better differentiate the dead from living nematodes, Lisa used the time consuming method of Trypan Blue, which only attaches to dead specimens. This is of crucial importance as treatment-related mortality may be masked if dead specimens have not degraded within the experiment period.

Left: Tanja Stratmann (NIOZ), carrying out sediment microprofiling under in situ bottom water temperature of 8°C in the absence of light, using Unisense micro-electrodes.

MIDAS scientists gather in the Azores to discuss first year results

Completion of the first year of MIDAS research was marked by a gathering of project scientists in the Azores to share their results and progress so far. Despite the appalling weather conditions brought by the tail-end of Hurricane Gonzalo, over 70 MIDAS scientists and social scientists gathered in Furnas on the Azorean island of San Miguel at the end of October.

Above: Hurricane Gonzalo, photographed from the International Space Station as it tracked across the Atlantic towards the Azores. Image courtesy NASA.

The 5-day meeting allowed plenty of time to discuss data, analyse results and undertake detailed planning of the next steps in the MIDAS research programme. The meeting was structured around a series of plenary sessions interspersed with WP-specific planning workshops and side meetings to discuss specific aspects of work or project deliverables. The conference also hosted the first meeting of the MIDAS Advisory Board, welcoming experts from the International Seabed Authority, Duke University (USA) and the FP7 Blue Mining project.

During the course of the week, over 50 presentations were made in plenary sessions, covering a wide range of topics from across the MIDAS work programme, including aspects of geochemistry, geophysics, imaging and mapping techniques, ecotoxicology, oceanographic modelling, genetics, biogeography and ecosystem science - all in the context of understanding the impacts of deep-sea minnig. A full morning was dedicated to the more management-focused aspects of MIDAS, with presentations on environmental impact assessment development, the legislative framework for deep-sea mining, and the role of the precautionary principle in the development of regulations.

Opportunities for more informal knowledge exchange and networking were provided during the conference fieldtrip to some of the local landmarks on the island, and at the conference dinner at a former hunting lodge on the shores of Lake Furnas, where the traditional *cozido* stew was served. Participants were also able to take advantage of the island's more therapeutic hydrothermal features - notably the large swimming pond in the hotel gardens fed by the local hot springs, which provided a welcome spot to soothe mind and body at the end of a busy day!

Above. from top: MIDAS fieldtrip participants gather at a local vantage point (but low cloud denies them a view!); local hot springs and fumaroles at Furnas; the subtropical gardens at the conference hotel; relaxing in the hot springs after a long day discussing MIDAS results!

MIDAS convenes the first meeting of its Science-Policy Panel

The purpose of the MIDAS Science-Policy Panel is to establish an ongoing dialogue between the MIDAS community and stakeholders in order to link research and policy, and to provide policymakers and stakeholders with sound and relevant scientific knowledge in support of policy developments.

MIDAS intends to convene a Science-Policy Panel annually from 2014-2016. The attendees at each panel meeting will include senior policymakers, stakeholders from industry and NGOs, representatives of international organisations, and leading scientists. The objective is to ensure that MIDAS results are brought promptly to the attention of policy makers in a forum where they can be discussed with all interested parties. Ultimately, the aim is to facilitate open discussions on the development of policy to accommodate deep-sea exploitation whilst maintaining good environmental status.

The first MIDAS Science-Policy Panel meeting was held in the European Parliament on 28 November 2014. A total of thirty people attended the meeting including representatives from the European Commission (DG Research, DG MARE and DG Environment); NGOs WWF International, Seas at Risk and Oceana; ISA contractors BGR, Global Sea Mineral Resources and UK Seabed Resources; the OSPAR Commission; mining company MTI Holland; the International Marine Minerals Society, and a small number of MIDAS scientists.

Following a welcome by Prof. Philip Weaver, MIDAS project coordinator, a series of short presentations were given by the MIDAS team to introduce the scope and objectives of the project. This was followed by a series of Q&A and discussion sessions, and then a series of presentations from the different stakeholder sectors who outlined different perspectives on deep-sea mining topics.

The issues raised during discussions were predictably wide-ranging but key recurring themes included the need for scientific input into the development of environmental management plans and regulatory frameworks, how the precautionary principle might be applied in deep-sea mining, the size of the gap in our understanding of the environmental impacts of deep-sea mining, and what timeframes are likely to be necessary in addressing this gap.

The SPP meeting participants agreed that the meeting had been highly successful in establishing an open and frank discussion platform, and was a very productive and effective means for exchanging information and debating issues relating to the environmental aspects of deep-sea mining.

A summary report of the meeting will be available on the MIDAS website in due course, along with slides from the speakers' presentations. MIDAS would like to thank all meeting participants, and in particular MEP Ricardo Serrao Santos and his team for their support and assistance in organising this meeting at the European Parliament.

Industry and non-science stakeholders see the need for more fundamental deep-sea research: Preliminary recommendations from the European Marine Board Working Group Deep Seas

In January 2014 the European Marine Board launched an expert Working Group on *Deep Sea Research for Societal Challenges and Policy Needs*[1]. Chaired by Prof. Alex Rogers from Oxford University, the Working Group includes 14 European experts spanning deep-sea natural sciences, socio-economics and marine law and governance. This interdisciplinary group is reviewing the actual scientific, socio-economic, and governance issues relating to the deep-sea. It is also taking a fresh look at what the European Commission's Blue Growth agenda[2] with a view to delivering recommendations for future, policy-relevant deep-sea research.

In 2014 the Working Group met three times in Brussels, Oxford and Lisbon, engaging with industry and other stakeholders through dedicated consultative workshops. The stakeholders represented industry (deep sea mining, oil and gas, marine biotechnology and deep sea fisheries), civil society (NGO sector) and policy. A clear and consistent message from these non-science stakeholders was the need for fundamental scientific knowledge on deep-sea systems, notably to provide the evidence base for establishing baselines, informing Environmental Impact Assessments and monitoring impact of human activities on deep-sea ecosystems. In November 2014 the EMB WG Deep Seas communicated this message in a letter to Horizon 2020 National Contact Points and Programme Committee members for Societal Challenges 2[3] and Societal Challenge 5[4]. This message, together with 7 other draft recommendations, were presented by the WG Chair, Prof. Alex Rogers, at a number of events in Autumn 2014, including EurOCEAN 2014[5], SeaTechWeek[6] and the World Research and Innovation Congress[7].

Right: EMB WG Deep Sea Research, 3rd meeting 13-14 November 2014, Lisbon, Portugal.

Picture features (top row, left to right): Marina Cunha (University of Aveiro), Pierre-Marie Sarradin (Ifremer), Henry Ruhl (NOC, Southampton), Bruno Sommer Ferreira (Biotrend), Fernando Barriga (University of Lisbon), Alf Håkon Hoel (IMR), Ralph Spickerman (UK Seabed Resources), Sybille van den Hove (MEDIAN SCP), Gui Menezes (University of the Azores), Niall McDonough (EMB), (bottom row left to right): Helena Vieira (University of Lisbon), Colin Devey (GEOMAR), Alex Rogers (University of Oxford), Kate Larkin (EMB), Monica Verbeek (Seas at Risk), Mário Ruivo (FCT).

The EMB invite the MIDAS community to take part in a wider stakeholder consultation on European and national investment in deep-sea research. This is targeted at Research Performing Organizations, Research Funding Organizations and Industry and responses will help determine trends and gaps in deep-sea research investment in the context of EU and National policies and strategies. Surveys can be downloaded from the EMB website . Please submit completed responses to Kate Larkin (klarkin@esf.org) by 16 January 2015.

The EMB WG Deep Sea Research Position Paper will be launched at the international deep-sea symposium 2015 in Aveiro, Portugal, 31 August – 4 September. EMB look forward to exchanges with the MIDAS project throughout 2015 and hope you will join us in Aveiro for the launch of the EMB Position Paper.

For the latest information, please visit the EMB website: http://www.marineboard.eu/deep-sea-research or contact EMB Senior Science Officer Kate Larkin klarkin@esf.org

[1] www.marineboard.eu/deep-sea-research
[2] ec.europa.eu/maritimeaffairs/policy/blue_growth/
[3] Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy
[4] Climate action, environment, resource efficiency and raw materials
[5] www.eurocean.eu
[6] www.seatechweek.com
[7] wric-oceans.com/agenda/

Tonga – a world leader in Seabed Minerals Law

In August 2014, the Kingdom of Tonga became the first country in the world to put in place a law that manages seabed mineral activities within its national marine space and under its sponsorship in international waters. Tonga's Seabed Minerals Act 2014 was prepared with the assistance of the Secretariat of the Pacific Community - European Union (SPC-EU) Deep Sea Minerals (DSM) Project. The Act received Royal Assent from the King in August 2014.

Now, the requirements of the Seabed Minerals Act must be followed before any seabed mining can commerce. These include a stringent vetting process by the government on any new project proposals, and public consultation if mining is proposed. Environmental Impact Assessment and ongoing monitoring are legal requirements under the Act, and the government is given enforcement powers in order to maintain compliance with required performance standards.

The Act also highlights the importance placed by Tonga on the protection and preservation of the marine environment, recognising the need to balance economic development for the people of Tonga against conservation of the biodiversity of the oceans.

Tonga is currently undergoing development of Seabed Minerals Regulations which, combined with the Act, will equip Tonga with a set of tools that will allow it to manage its deep sea resources to maximise the benefits of deep sea mining for its population, while being clear about environment commitments.

Dr Suka Mangisi (Counselor and DPR at the Permanent Mission of the Kingdom of Tonga to the U.N.) announced this achievement at the United Nations Small Island Developing States Conference in Samoa, acknowledging the assistance the SPC-EU DSM Project provides to Pacific states.

For more information on the SPC-EU Deep Sea Minerals Project and the assistance we provide to our member countries in the Pacific, visit: www.sopac.org/dsm

Above: Ms Alison Swaddling (DSM Project Environment Advisor) and Dr Suka Mangisi at the UN SIDS Conference.

Upcoming meetings, workshops and conferences

3rd Annual Deep-Sea Mining Summit: 9-10 February 2015, Aberdeen, UK. http://deepsea-mining-summit.com

2015 ASLO Aquatic Sciences Meeting: 22-27 February 2015, Granada, Spain. Special MIDAS-relevant session on "Natural and anthropogenic disturbances in deep-sea ecosystems" on 24 Feb. www.sgmeet.com/aslo/granada2015/

Workshop to initiate an Environmental Management Planning process for the Mid-Atlantic Ridge, 1-3 June 2015, Azores. Further details to be released in due course.

21st Annual Assembly of the International Seabed Authority: 13-25 July 2015, Kingston, Jamaica. www.isa.org.jm

14th International Deep Sea Biology Symposium: 31 August – 4 September 2015, Aveiro, Portugal. http://14dsbs.web.ua.pt/14dsbs

The MIDAS newsletter is published quarterly. The deadline for articles for the spring 2015 issue is Friday 20 March - please email vikki.gunn@seascapeconsultants.co.uk