OS51C-0884 0830h POSTER

Methane Hydrate Detection Using Dense Velocity Analysis

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As one of approach to evaluating the total amount of methane hydrate, a method utilizing the results of velocity analysis on reflection seismic exploration data is studied. Well log sonic data reveals that the velocity of the methane hydrate bearing zone is greater than that of surrounding sediments. Thus, the velocity information can be used for detection of the methane hydrate zone.
In order to delineate detailed velocity variations, a dense velocity analysis is performed using an automatic velocity picking tool. Because the target depth of this analysis is fairly shallow (less than 400m below sea bottom), a simple algorithm can be used for the picking.
Dense velocity analysis is applied to 2D marine seismic data acquired over the Nankai Trough, Offshore Japan. Comparison between automatic and manual picking results showed a similar trend at the shallower zone above BSR. The processing time, however, is considerably different; it takes several days for manual picking against a few minutes for automatic picking.
In the automatic picking process, the velocity trend is also estimated. The difference between actual velocity and velocity trend provides another viewpoint for the delineation of velocity anomaly zone.
On going work includes an analysis of 3D marine seismic data in the Nankai Trough. Provisional results will be shown in this meeting.

OS51C-0885 0830h POSTER

A trial of the delineation of gas hydrate-bearing sediments using multi seismic attributes analysis offshore Tokai Japan

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MITI Research well Nankai Trough was drilled at the offshore Tokai Japan in 1999/2000 and the occurrence of gas hydrate was confirmed by borehole measurments or core. It gave us so big impact to the view of Japanese future energy resources and other scientific interests. METI, Ministry of Economy, Trade and Industry of JAPAN, started "The Research for Methane Hydrate Resources in Japan" from fall of 2001. Bottom Simulating Reflectors (BSRs) were widely found on the marine seismic data acquired offshore Japan, especially in the shelf-slope near the Nankai Trough. If we will explore and exploit the gas hydrate, we have to get the information of hydrate-bearing sediments, such as their saturation, porosity or thickness. BSRs indicate the existance of gas hydrates accurately, they, however, do not estimate reservoir parameters. In order to estimate the amount of gas hydrates accurately, we have to get the more detailed reservoir parameters. We computed the multi-seismic attributes and after that, we tried to delineate hydrate-bearing sediments. Firstly, we get some seismic attibutes sections which show such as the P-reflectivity(P), Gradient(G), Products(P*G), Poisson's ratio change sections from pre-stack(AVO) analysis and the P-wave interval velocity section and P-wave impedance sction.

OS51D MCC: 3000 Friday 1020h

Sedimentation on European Margins II *(joint with C)*

Presiding: **J P Syvitski,** Institute of Arctic and Alpine Research**; C A Nittrouer,** University of Washington**; P Weaver,** Southampton Oceanography Centre**; F Trincardi,** CNR-Istituto di Geologia Marina

OS51D-01 1020h

Sediment Accumulation Along the Italian Adriatic Coast

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Sediment supply to the Adriatic Sea is dominated by the Po and Apennine Rivers in the northern and southern regions, respectively. Recent investigations have revealed that processes impacting sedimentation in this area are active on a variety of time-scales, ranging from events (e.g., floods) to seasonal and decadal variations. In the northern region, flooding of the Po River is common, and a 100-year flood event occurred in October 2000. Using ^{7}Be (half-life 53.3 days) as a tracer of flood sediment, the deposit was found to be up to 15-cm thick. However, the depth of ^{234}Th (half-life 24.1 days) exceeds ^{7}Be in cores of the flood deposit, indicating that thicknesses derived from ^{7}Be are minimum estimates and that the first sediment deposited during the flood event likely originated from the river channel. The location of the flood deposit immediately adjacent to the distributary channels at the river mouth can be predicted considering the relatively low-energy physical oceanographic conditions during the time of emplacement. Near the Po River Delta, sediment from flood events contributes significantly to longer-term (100-year) sediment accumulation. The signature of flood layers is observed in radiochemical (low ^{210}Pb activities; half-life 22.3 years) and textural (fine grain size) profiles, which lead to accumulation rates >2 cm/y. Southward, the character of sediment accumulation transitions to steady state, reflecting the decreased impact of event sedimentation, and accumulation rates decrease to levels near and below 1 cm/y in the southern portion of the Po River dispersal system. Sedimentation near the Apennine Rivers is even more strongly impacted by anthropogenic activities (dam construction), which increased after the second World War. These activities have resulted in a reduction of sediment accumulation in the area, evidenced by changes in ^{210}Pb profiles. Across-shelf accumulation rates reach a maximum on the foreset of a shelf clinoform and are ~ 1 cm/y.

OS51D-02 1035h INVITED

Sediment transport processes across crenulated clinoforms on the western Adriatic prograding mud wedge

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Sea-floor crenulations of complex and uncertain origin characterize large portions of the late Holocene prograding mud wedge in several sectors of the Apennine shelf. Sediment failure has been postulated as the most plausible mechanism for their formation, although their maintenance through time seems to be related to different sediment accumulation rates in the flat and steep flanks. In order to establish relationships between active sediment dynamics, cross-shelf transport and sediment accumulation in these crenulated fields, as part of the EuroSTRATAFORM program, and in combination with the Po and Apennine Sediment Transport and Accumulation (PASTA) study, a tripod and a mooring were deployed off the Pescara River during autumn and winter 2002-2003, in a region characterized by a crenulated clinoform. The tripod was placed at 20 m water depth, close to the clinoform roll-over point, and the mooring was located at 50 m depth, in the foreset region. Several sediment-resuspension events were recorded at the tripod site, mainly related to Bora and Sirocco storms, during which current and wave shear stresses reached similar values. Sediment transport around the roll-over point was predominantly towards the SE, following direction of the coastal current and the bathymetry, but showing a significant offshore component that was intensified during storm events. Currents at the mooring site were also directed to the SE. In mid-waters they were clearly aligned with the local bathymetry, whereas near the bottom they had an important and continuous offshore component. This predominant offshore current behavior near the bottom seems to be associated with an intense bottom Ekman transport, which will enhance the suspended sediment transport from the topset down the foreset region and contribute to the development of the clinoform feature. In addition, activity of near-inertial waves was also recorded by the moored current meters and temperature sensors. During periods characterized by a strong near-inertial signal (17 h), increases of the water turbidity clearly coincided with the offshore direction of the cross-shelf velocity component and with strong temperature fluctuations through the water column. During these events, velocities in the cross-shelf and along-shelf components were similar, which suggest that near-inertial internal waves also contribute to the offshore transport of suspended sediment across the crenulated clinoforms. Further analysis about the role of near-inertial internal waves in the sediment dynamics of the study area will provide insights for understanding if this mechanism could have created and/or maintained the crenulated clinoforms that that extends along the Apennine shelf.

OS51D-03 1050h INVITED

Organic Carbon and its Isotopic Composition in Surficial Sediments From the Western Adriatic Continental Shelf

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Continental shelves play an important role in the global carbon cycle because they represent the largest modern repository of particulate organic carbon. However, recent studies indicate that the role of shelves as sinks for C_{org} is still poorly known in details, suggesting that more understanding of sedimentary processes affecting the distribution and preservation of organic matter on the continental shelves is required. The western Adriatic continental shelf receives inputs of allochthonous, terrestrial organic carbon via rivers and autochthonous, marine organic carbon from coastal biological productivity. In the northern region, the Po river dominates the supply of organic carbon. The central coast is characterized by a series of small, distributed fluvial sources draining the Apennine mountains. In this region, modern sedimentation occurs on a clayey-silt shelf clinoform oriented parallel to the coastline. The organic carbon content of surface sediments collected during 2 cruises (April 2002 and October 2002) follows the same pattern of fine sediment dispersal. The highest values (from 0.60 to 1.71 wt%) were recorded close to the Po river delta, while in the central Adriatic the contents range from 0.11 to 0.91 wt%, with slightly higher values toward the bottomset region and negligible along-shelf variability. Riverine contributions measured on sediment collected along the axis of some rivers (Po, Uso, Marecchia and Aso), are characterized by intermediate C_{org} contents (from 0.56 to 0.82 wt%), and very negative $\delta^{13}C_{org}$ values ranging from -25.39 to -26.47$^{o}/_{oo}$. The $\delta^{13}C_{org}$ distribution of surface sediments near the Po delta shows a clear increasing trend with distance from the river mouth, as a consequence of the decrease in the contribution of terrestrial organic carbon and the increase of marine carbon. The signature of terrestrial C_{org} is almost lost at about 9 km offshore the Po river's mouths. The sedimentary $\delta^{13}C_{org}$ values in the central Adriatic Sea suggest an overall dominance of the organic matter of terrestrial origin and a stronger influence of terrigenous organics close to the mouths of

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the Chienti, Pescara and Sangro rivers. Small seasonal variations of the carbon stable isotopes were observed and tentatively related to hydrodynamical conditions. Across-shelf variability of organic carbon accumulation rates, based on ^{210}Pb chronologies, is fairly small in front of the Chienti River, and well apparent offshore the Tronto River, with maximum values of 45 and 84 g C m^{-2}y^{-1}, respectively, occurring in the foreset of the modern clinoform. The isotopic composition of organic matter in marine sediments is often used to identify its source and transport pathways. Many workers have determined the relative proportions of marine and terrestrial organic carbon in sediments from the study of its isotopic composition. On the basis of suspended matter and sediment collected both in fluvial and marine environments, we have determined $\delta^{13}C_{org}$ values of -18.5$^{o}/_{oo}$ as end member for marine organic matter and -26.5$^{o}/_{oo}$ for terrigenous.

OS51D-04 1105h INVITED

Shaping of the Southern Adriatic Continental Margin Through Widespread Mass Wasting and Bottom Currents

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New TOBI seafloor images and VHR Chirp sonar profiles reveal widespread collapsing of the South Adriatic continental slope including: multiple overlapping slide scars affecting more than 100 km of Pleistocene regressive shelf-margin deposits below the shelf edge, extensive blocky slides on the lower slope (block sizes up to 200 x 500 m), and a basin wide acoustically-transparent deposit up to 40 m thick, buried under a late-Pleistocene-Holocene mud section, in water depths greater than 1000 m. Lateral variations in internal geometry and seafloor morphology likely reflects along margin differences in sediment composition and thickness of the mass-transport deposits and variable run outs (up to 40 km). Preliminary correlation to published cores in the area indicates that the main mass transport deposit reached the basin floor during the Last Glacial Maximum, but younger failures of smaller size may have affected the slope in more recent times. The new data show that the entire slope area is swept by bottom currents generating furrowed areas up to several tens of km^2 in extent, moats on the downdrift side of seafloor irregularities (slide blocks) and preferential sediment deposition on the inferred updrift side, and growth of upslope-migrating sediment waves. In particular, two fields of sediment waves can be mapped in water depths of 400-600 and 1000 m. The former may reflect the activity of the Levantine Intermediate Waters, while the latter may be linked to the downslope flow of the Northern Adriatic Dense Waters. Future work will focus on the definition of intervals of growth vs quiescence of the sediment waves, their possible relation to paleoceanographic reconfigurations, and their interplay with seafloor irregularities dictated by slope instability. A smaller-scale possibly comparable interaction of seafloor morphology generated by sediment deformation and differential deposition of muddy deposits on the shelf emphasizes the importance of bottom-hugging currents in the semi-enclosed Adriatic basin in a wide range of water depths.

OS51D-05 1120h

Critical Shear Stress and Erosion Rates on the Western Adriatic Shelf

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One of the fundamental limitations on our ability to predict sediment transport rates in fine-grained marine settings is our poor understanding of spatial and temporal changes in critical shear stress and erosion rates. Temporal variations in these quantities can be the result of consolidation as well as seasonal and storm-related changes in deposition (e.g., degree of flocculation of settling particles) and bed surface properties (e.g., roughness, biogenic coatings, organic content). Spatial variations may be related to changes in sediment composition, grain size, water depth, distance from sediment sources and changes in hydrodynamic conditions. The western Adriatic shelf provides a low-to-moderate energy, fine-grained shelf setting with a large sediment source (the Po River) and a number of smaller sources along the Apennine coast. Critical shear stress and erosion rates were measured along the 20-m isobath between the Po River mouth and the Gargano Promontory during the winter (February) and spring/summer (June) of 2003 to investigate spatial and temporal effects on their values. Measurements were made using a Gust erosion chamber fitted onto the top of 10-cm-diameter core collected using a hydraulically damped short (1 m) piston corer, which minimized disturbance to the bed surface. The erosion chamber applied a range of known stresses (0.01 - 0.4 Pa) to the sediment surface of the core, each of which was maintained for 20-30 min. Water in the chamber was replaced by pumping seawater into the chamber; water leaving the chambers passed through a turbidity sensor that recorded turbidity levels every 0.5s. The water was then collected in bottles, filtered, dried and weighed to obtain the mass of eroded sediment. The results were used to calibrate the turbidity measurements. Filtered material was combusted to obtain organic fraction. Two to four replicates were made at each site. The measurements show a clear seasonal signal with higher erosion rates during winter when organic content was lower. Erosion rates vary spatially, but not with any consistent alongshelf trend. Erosion rates are higher near several river mouths and toward the southern end of the sampling line. Parameterizations of erosion rates based on the measurements are being used in a shelf-sediment transport model and compared to near-bed tripod measurements of suspended-sediment concentration.

OS51D-06 1135h

Representing Holocene and Recent Sediment Source-to-Sink Processes of the Central Italian Adriatic Sea

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The Coastal System Tract concept (Cowell et al., in press) expresses the importance of sediment-sharing processes between a variety of individual system elements in a given coastal region. The surf zone/beach system, the shoreface/shelf system and the inlet/estuary system are all examples of the individual system elements. There are many others examples dictated by the scale and nature of the specific problem undergoing analyses. The CST-Model has been developed to provide a quantitative tool that represents the complex interactions between arbituary combinations of the sediment-sharing elements. This is a large-scale behavior-oriented 2-DH model, based on representations of the physics of the macroscopic morphodynamic processes. The model operates on an inter-annual time scale so that it can resolve trends in system-wide morphology over periods of decades to millennia. It is capable of resolving various combinations of river sources, estuaries and lagoons, flood- and ebb-tide shoal complexes, and inlets in concert with a littoral surf zone, shoreface, continental shelf and upper continental slope. The shoreline translates according to the dictates of sediment transport gradients. Although the individual components are portrayed in different numerical schemes they are linked by a common time-step so that the non-linear aspects of system integration are preserved. The CST-Model has been used to examine several different examples of coastal system tracts. In one case, the effects of millennial-scale Dansgaar-Oeschger late Quartenary climate and sea level cycles with amplitudes on the order of 0.5 m were examined using a system that contains a river, estuary, inlet, barrier island, shoreface and shelf complex. The system of clinoform development and coastal progradation predicted in the model are similar to those observed on the central Florida Panhandle coast. In another case, the development of a Holocene subaqueous shelf clinoform along the central Italian Adriatic coast was modeled. A number of different source and forcing parameter patterns were varied to demonstrate features that can be identified in the internal stratigraphy of the deposits. These compared favorably with patterns identified in the sub-bottom records. The CST-Model examples illustrate how large-scale processes can either be diagnosed with modeling techniques or simulated in order to make predictions. This model is publicly available to the research community.

OS51D-07 1150h

Fluvial Incision in the Adriatic Shelf (Italy) During the Last 120 kyr: the Role of the Apennine Rivers.

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We used the Detachment Limited Model (DeLiM) of Howard (1994) to simulate the development of rivers in the Adriatic shelf during sea-level cycles. The computer model couples a drainage basin evolution component with sea level oscillations and deltaic deposition in the ocean. The drainage basin component of the model incorporates the chief geomorphological processes responsible for the routing of sediments to the ocean: weathering, mass wasting, detached limited fluvial erosion, and transport limited fluvial erosion. Low sea levels during past glacial epochs exposed large areas of the Adriatic shelf, with the southernmost coastline located near the Puglie region during the Last Glaciation Maximum. As a consequence the Po River (the major river flowing in the Adriatic Sea) was dissecting the entire Adriatic shelf, flowing into the Mediterranean Sea 500 km away from the actual delta. Simulations show that the peculiar characteristics of the Adriatic Sea dictate the evolution and degree of incision of fluvial channels in the shelf. Its narrow epicontinental basin prevents the distribution of fluvial sediments over large areas. Moreover the Apennine Rivers flowing into the Adriatic Sea along the west coast of Italy are easily captured by the ancient Po River during sea level low stands. The capture of these rivers is proved to be critical for channel incision and sediment deposition in the shelf. Particular emphasis is devoted to the role of the Apennine Rivers in sculpting the morphology of the Adriatic shelf. Different scenarios, with river discharges and sediment loads varying as a function of climatic fluctuations are also explored in the simulations.

OS51D-08 1205h

Modeling the Stratigraphy and Tectonics Around the Gargano Peninsula on the Adriatic Coast of Italy

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The E-W trending Gargano Peninsula interrupts the Adriatic foreland of the Apennines. This uplifted block and additional faults and structural highs represent a tear structure that separates the Adriatic foredeep to the north from the Apulia foredeep to the south. In the region surrounding the Gargano Peninsula a succession of four depositional sequences mainly composed of regressive deposits have been mapped. The four stratigraphic packages and their associated prominent erosion surfaces correspond to the last four 100ky sea level cycles. The sediments that comprise these sequences have primarily been transported along the Adriatic margin from the Po and other Apennine Rivers by the strong the along-strike current system. The geometry of these four sequences exhibits significant changes in thickness and morphology along strike of the Adriatic margin due to the local tectonics. We have used Sequence4, an interactive stratigraphic modeling program to duplicate the changes in geometry of the deposits along a series of 2D sections. The code was modified to allow for out-of-plane sediment supply rather than just landward supply. The variation in the sequences was obtained by varying the tectonics uplift associated with the Gargano Peninsula structures and sediment supply due to the interaction of the sediments and the tectonics along the dispersal pathway. The results and their implications for the understanding both the local tectonics and sequence architecture will be presented.