Below are underwater photos of three major sediment types. Not pictured is a sample of muddy bottom, which is similar in appearance to silt. Muddy bottom is most common at or beyond the shelf edge and grades into muddy sand (Figure 2), and the boundary between the two sediment types may be indistinguishable.

The inside foldout chart shows a continental shelf off Oregon that is irregular in outline. The sediment chart shows approximate boundary lines of the areas.

The economic potential of the continental shelf lies in the exploitation of its fisheries and of its mineral wealth. The purpose of this publication is to provide information concerning the surface of the continental shelf—its shape and what the bottom is made of. The information presented here is the result of the efforts of a number of the staff and students of the School of Oceanography at Oregon State University. The original scientific research was carried out under contract with the Office of Naval Research.

The continental shelf is the shallow platform or terrace which surrounds the continent. It extends from the low tide line to a position offshore where the slope of the bottom increases markedly downward. The position at which the slope changes is commonly called the shelf edge or the shelf break. Off Oregon, the continental shelf varies in width from approximately 9 to 40 miles, and the shelf edge lies in water 70 to 100 fathoms deep. It is a smooth surface interrupted in only a few places by small hills. The contour chart reveals that the shelf is extremely irregular in outline. It narrows off Cape Blanco and widen off the central coast in the vicinity of Florence. The average slope at the continental shelf varies from about 10 feet per mile to about 50 feet per mile. In general, the slope of the shelf is steeper at the inner and outer edges and flatter in the central area. The depth at the shelf edge is about 55 feet. The continental shelf is covered by sand, muddy sand, or mud. In the offshore area, rock is comparatively present. The map of bottom sediments is based on more than 900 samples collected from the continental shelf at three-mile intervals north of Coos Bay and at two-mile intervals south of Coos Bay. The boundary lines between sediment types should be considered approximate, as samples on either side of the boundary may be two or three miles apart. It should also be kept in mind that borrowing currents may shift the sediment from time to time.

The types of sediments indicated on the chart are based on the size of the sedimentary particles. The diameters of these particles are measured by passing the sediment through a sieve having 250 mesh openings. Coarser sediments appear on the chart as dark circles, whereas finer sediments appear as lighter areas. The upper part of the photo is a combination compass and current vane.

### SHELF SEDIMENT TYPES

**BATHYMETRIC CHARTS**

Detailed water-depth information can be extremely valuable. Standard nautical charts present a considerable amount of information about the chart area (water depths). However, other charts are available that present other complete bathymetric data. These are advantageous and disadvantageous to each of the charts.

All of the bathymetric information used for any of these charts is based on government hydrographic surveys. The last full survey of the continental shelf of Oregon was made in 1929. Since then, the areas have been surveyed more frequently. All charts, regardless of their source, use the same base information.

The best and the standard nautical chart (Figure 6). These charts show about 20 percent of the soundings that have been collected. They show depth in feet or fathoms and have been published. The contour chart reveals the extent and general configuration of the topography. The bathymetric maps for Oregon are: 10981-1, Umpqua River to Cape Arago, and 13082-11, Yaquina Head to Necos Head. No bathymetric maps showing coverage further north than 49°10 latitude (approximately Seattle) have been published. The second kind of chart is the standard nautical chart (Figure 5). These charts show about 80 percent of the bathymetric information that has been collected. Bathymetric maps present a considerable amount of information concerning the surface of the continental shelf. They show depth in meters and have not been published. The third kind of chart is the special hydrographic survey at three-mile intervals. The map shows the type of sediment exposed at the bottom. Samples were collected from these areas. The economic potential of the continental shelf lies in the exploitation of its fisheries and of its mineral wealth. The purpose of this publication is to provide information concerning the surface of the continental shelf—its shape and what the bottom is made of. The information presented here is the result of the efforts of a number of the staff and students of the School of Oceanography at Oregon State University. The original scientific research was carried out under contract with the Office of Naval Research.

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The types of sediments indicated on the chart are based on the size of the sedimentary particles. The diameters of these particles are measured by passing the sediment through a sieve having 250 mesh openings. Coarser sediments appear on the chart as dark circles, whereas finer sediments appear as lighter areas. The upper part of the photo is a combination compass and current vane.
These animals generally feed on minute plant material. Dollars (flat sea urchins) are found close to the coast. Activity on the bottom is regular and fairly strong (not as strong as in rocky areas, however). The bottom will generally be smooth and relatively hard. Where current activity at the bottom, and burrowing organisms such as clams. Sand sediments include rapidly moving animals such as the commercially important Dungeness crab and English sole, slow creeping animals such as the Nassarius snail, and stationary buried organisms such as clams. Sand may be somewhat coarser than the nearshore sand. It extends from the shore to light gray. Mud is slick or slippery to the feel, and ordinarily is a greenish or olive-gray color. The characteristics of muddy sand fall between those of sand and mud. Muddy sand feels slick, although the grittiness of the contained sand is apparent. The color varies from gray to olive-gray.

Shelf-edge: close to shore and at the shelf edge. The nearshore sand is usually gray. It extends from the shoreline out to a depth of about 60 fathoms off the northern and central coast. In the vicinity of the Umpqua River, sand is limited to shallower water, generally 30 fathoms or less, and forms a narrow belt along the coast at least as far south as the Rogue River. Sand which occurs on the continental shelf off Oregon is termed mud. For those sediments that are 50 to 75% sand, the term muddy sand is used. Most of the sand which occurs on the continental shelf off Oregon is gray to olive-gray. It is usually moderately fine in texture, although it feels gritty when rubbed between the fingers. The color is usually a little darker than the nearshore sand, but in general most of the sand is medium to light gray. Mud is slick or shiny to the feel, and ordinarily is a greenish or olive-gray color. The characteristics of muddy sand fall between those of sand and mud. Muddy sand feels slick, although the grittiness of the contained sand is apparent. The color varies from gray to olive-gray.

Muddy sand
Gray to olive-gray sand generally grades into the sandy areas. It occurs between 50 to 90 fathoms in the northern portion of the shelf and ranges from about 50 fathoms in the southern portion. These sediments are formed on the upper continental slope beyond the shelf edge. In areas where this sediment is present, the bottom is usually smooth but somewhat softer than the sandy type. There is little current activity at the bottom, but it is possible that in some places a rippled surface will have developed. It is not uncommon to find flex and Petrel sole living on this type of sediment. Sea cucumbers, sea urchins, starfish, and other invertebrates are also commonly associated with these sediments.

Mud
Muddy bottom is most common at or beyond the shelf edge. Mud is a finer grained sediment usually found in quiet water. It grades into muddy sand; the boundary between the two sediment types may be indistinguishable. Mud also occurs on the continental shelf southwest of the mouth of the Columbia River and off the Umpqua River. The muddy bottom is generally smooth and very soft. There is little or no current activity at the bottom, and burrowing organisms such as polychaete worms are very abundant. In addition, numerous sea urchins, sea cucumbers, starfish, and brittle stars are found on the sediment. Dover sole and sand dollars are among the commercially important animals common to this type of bottom.

Rock
Rock is most common along the coastline and in banks some distance offshore. Rock is also exposed in patches at the shelf edge. Rocky areas are generally higher than the rest of the shelf and are extremely rough and irregular. They are areas of strong current activity and are commonly inhabited by attached animals such as sponges, sea stars, sea anemones, corals, tube worms, and hydroids. Starfish and brittle stars are also present. Mantis is one fish generally living around rocky areas.

Subsurface sediments
Operations such as dredging may disturb the surfac e sediment enough to smoother different sediments beneath the surface. Recent studies have indicated that sand probably underlies mud and muddy sand in most areas. It is possible that dredging or other operations near the boundaries of the mud and muddy sand may disturb the mud or muddy sand so that it is replaced by clean sand. This would make it possible for muddy sand to be eroded from the boundaries, while the sandy sediments will remain intact. Operations near the boundaries of the muddy sand may result in the removal of fine sediments and will result in the sand and muddy sand grading into the sandy areas. It is also possible that dredging or other operations in the vicinity of the rocky areas will post- pulate the thin sediment cover and ENCOUNTER bottom beneath the surface of the sediment.
These animals generally feed on minute plant material. dollies (flat sea urchins) are found close to the coast. Activity on the bottom is regular and fairly strong (not as decayed plant and animal remains. Sand, and stationary buried organisms such as clams. Sand sole, slow creeping animals such as the Nassarius snail, sediments include rapidly moving animals such as the or wave activity is persistent, it is not uncommon for ridges or ripples of sand to be produced.

Sand

In many areas, it contains appreciable amounts of broken shells. Sand which occurs as nearshore sand is usually gray. It extends from the shore line out to a depth of about 50 fathoms off the northern shelf southwest of the mouth of the Columbia River and to light gray. Mud is slick or slimy to the feel, and ordinarily is a greenish or olive-gray color. The characteristics of muddy sand fall between those of sand and characteristics of muddy sand. Sand is defined as consisting of particles finer in texture, although it feels gritty when rubbed between the fingers. The color varies from a light yellow to dark gray, but in general most of the sand is medium gray to olive-green.

Muddy sand

Muddy bottom is most common at or beyond the shelf edge. Mud is a finer grained sediment usually similar to the sand on the beach. It is usually relatively fine in texture, although it feels gritty when rubbed between the fingers. The color varies from a light yellow to dark gray, but in general most of the sand is medium gray to olive-green.

Rock

Rock is most common along the coastline and in rock banks some distance offshore. Rock is also exposed in rock areas where rocks are commonly inhabited by attached animals such as sponges, sea fans, sea anemones, corals, tube worms, and hydroids. Starfish and brittle stars are also commonly associated with these sediments and will reach the sand a short distance beneath the surface. Recent studies have indicated that sand probably underlies mud and muddy sand in most areas. It is conceivable that dredging or coring operations near the boundaries of the mud and muddy sand areas will penetrate the softer, finer grained sediments. Operations such as dredging may disturb the surface sediment enough to encounter different sediments beneath the surface of the sediment.

Subsurface sediments

Subsurface sediments consist of more than 75% particles of this size are termed sand. Where less than 50% of the sediment by weight consists of sand-sized particles, the sediment is termed mud. For those sediments that are 50 to 75%

Bottom sediments

Wherever sand occurs, it is likely that current activity will erode the thin sediment cover and encounter rocks beneath the surface. It is also possible that dredging or coring operations in the vicinity of the rocky areas will penetrate the softer, finer grained sediments. In areas where this sediment is present, the bottom is usually smooth but somewhat softer than the sandy bottom. There is less current activity at the bottom, and burrowing organisms such as polychaete worms are very abundant. In addition, numerous sea urchins, sea cucumbers, starfish, and brittle stars are found on the sediment. Dover sole and pandalid shrimp are among the commercially important animals common to this type of bottom.
SHELF SEDIMENT TYPES

Below are underwater photos of three major sediment types. Not pictured is a sample of muddy bottom, which is similar in appearance to shelf edge and grades into muddy sand (Figure 2), and the boundary between the two sediment types may be indistinguishable.

The inside foldout chart shows a continental shelf off Oregon that is irregular in outline. The sediment chart shows approximate boundaries of lines of the shelf.

BATHYMETRIC CHARTS

Dissolved water-depth information can be extremely valuable. Standard nautical charts present a considerable amount of water-depth information (under depths). However, after charts are available that present these complete bathymetric data. There are advantages and disadvantages to each of the charts.

All of the bathymetric information used for any of these charts is based on government hydrographic surveys. The last full survey of the continental shelf off Oregon was made in 1940, but since then many surveys have been made more recently. All charts, regardless of their source, use this basic information.

The best end is the standard Hark- cik chart (Figure 6). These charts show about 20 percent of the soundings that have been collected. They show depth in feet or fathoms and have been published for the continental shelf.

These charts sell for $2.50 and are available through chart dealers or by mail order.

The second kind of chart is the bathymetric map chart. A chart specifically intended for presentation of depth information. Through more complete use of available soundings, these charts show about 90 percent of the bathymetric information, and have been collected by shallow-water coring methods of exploration. These charts sell for $3.75 and are available through chart dealers or by mail order.

The third kind of chart is the benthic map chart. A chart specifically intended for presentation of depth information. Through more complete use of available soundings, these charts show about 90 percent of the bathymetric information, and have been collected by shallow-water coring methods of exploration. These charts sell for $3.75 and are available through chart dealers or by mail order.

These varieties of charts are available that present even more complete information concerning the surface of the continental shelf—shape and what the bottom is made of. The information gathered there is the result of the efforts of a number of the staff and students of the School of Oceanography at Oregon State University. The original scientific research was car- ried out under contract with the Office of Naval Research.

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The map of bottom sediments is based on more than 500 samples collected from the continental shelf at three-mile intervals north of Coos Bay and at two-mile intervals south of Coos Bay. The boundary lines between sediment types should be considered approximate, as samples on either side of the boundary line may be found in one of the two adjacent types. The sediments of the continental shelf are: (1) sand, (2) muddy sand, (3) silt, (4) clay, and (5) green mud.

The cathead grab is a device used to obtain samples of the bottom and spread out on the continental shelf.

The clamshell grab is one device used to obtain samples of the continental shelf.

The continental shelf sediments off Oregon

by John V. Byrne, Professor of Oceanography, Oregon State University and Daniel A. Panshin, Extension-Oceanographer, Oregon State University

The economic potential of the continental shelf lies in the exploitation of its mineral wealth. The purpose of this publication is to pro- vide information concerning the surface of the conti- nental shelf—shape and what the bottom is made of. The information gathered there is the result of the efforts of a number of the staff and students of the School of Oceanography at Oregon State University. The original scientific research was car- ried out under contract with the Office of Naval Research.

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