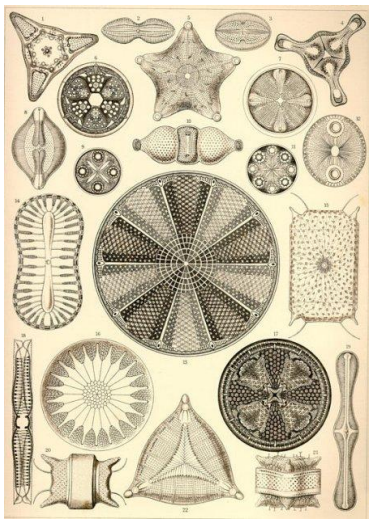
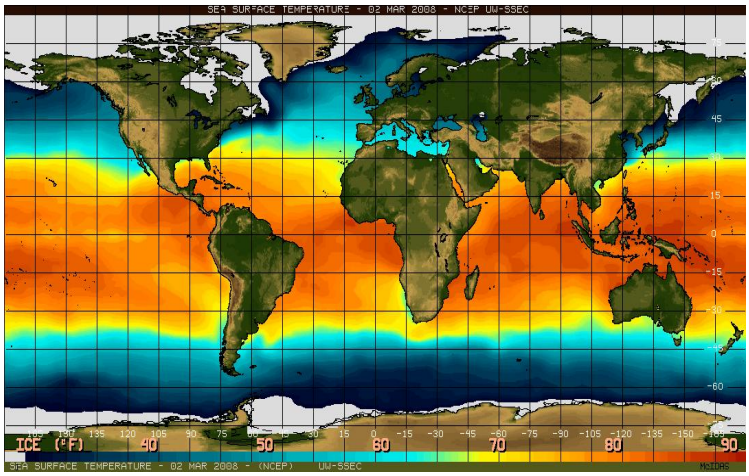
SOUTHEASTERN PA REGIONAL SCIENCE OLYMPIAD 2008

OCEANOGRAPHY C DIVISION

MARCH 4, 2008

CABRINI COLLEGE





SCHOOL NAME_____ **SCHOOL CODE**_____

INSTRUCTIONS

1. Turn in all exam materials at the end of this event. *Missing exam materials will result in immediate disqualification of the team in question*. There is an exam packet and a blank answer sheet.

2. You may separate the exam pages. Re-staple them as you submit your materials to the supervisor. Keep the answer sheet separate.

3. *Only* the answers provided on the answer page will be considered. Do not write outside the designated spaces for each answer. Write LEGIBLY.

4. Write your school name and school code in the appropriate locations on the answer sheet as well as on the title page. Indicate the names of the participants at the bottom of the answer sheet. Write LEGIBLY.

5. Point values for each question are in parentheses. Tiebreaker questions are identified with a (T#) indicating the first, second, third, etc. There are 10, and they do not appear in numerical order. *Tiebreaker questions count toward the overall grade, and are only used as tiebreakers in the event of a tie.*

6. When the time is up, *the time is up*. Continuing to write after the time is up risks immediate disqualification.

7. Mocking, inappropriate, and/or nonsensical answers WILL result in disqualification.

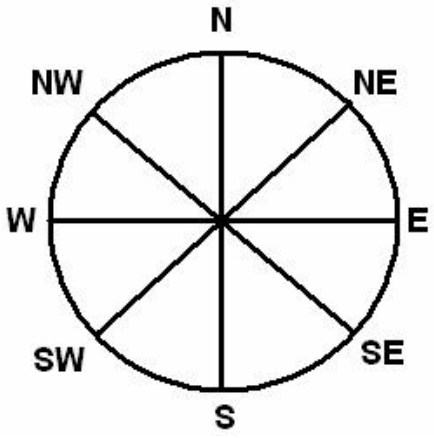
8. Resource is as per the Science Olympiad Student Manual. "Participants may bring only one 8.5^{II} x 11^{II} sheet of paper of computer-generated or handwritten notes per team." Any type of calculator is permitted. No other resources are permitted.

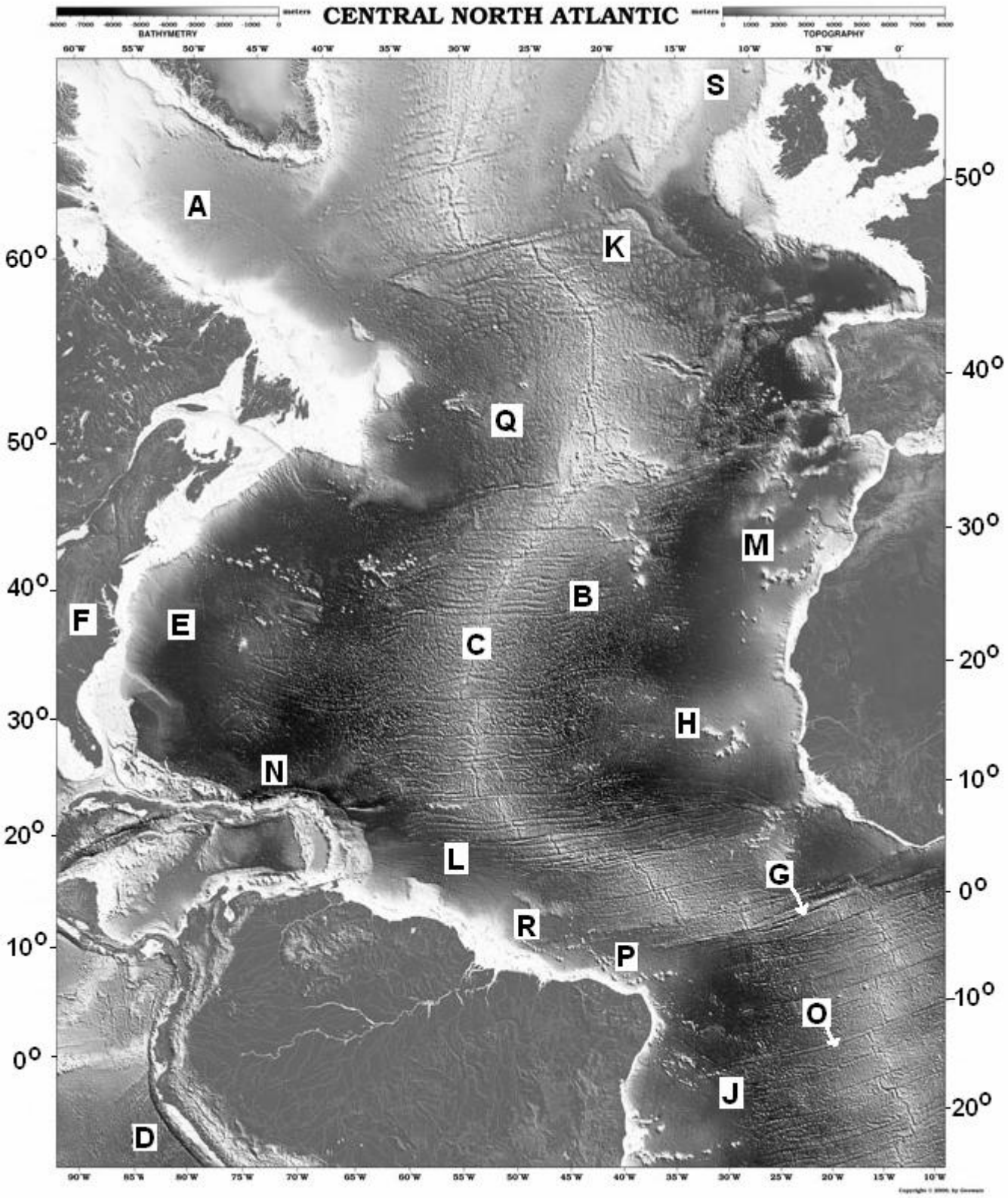
For numbers 1-20, consult map 1 on the next page. Answers are by letter, indicated by particular processes, structures, and/or locations on the map. The number of correct responses is indicated by the point value for each question.

1. (1) Where is the Mid-Atlantic ridge?
2. (2) Where is the Gulf Stream?
3. (2) Where is subduction taking place?
4. (1) Where is there an active transform fault?
5. (1) Where is the thickest crust indicated?
6. (3) Where would there most likely be descending, cool, dry air and high atmospheric pressure?
7. (2) Where would there most likely by ascending, warm, moist air and low atmospheric pressure?
8. (1) Where is the Canaries Current?
9. (1) Where is the Labrador Current?
10. (2) Where is the oldest oceanic crust on this map?
11. (2) Where is there a seismically inactive fracture zone?
12. (1) (T9) Where is the major amphidromic point for the North Atlantic?
13. (1) Where is the North Atlantic Drift?
14. (1) Where is there significant upwelling due to the Humboldt current?
15. (1) Where is the accumulation of lithogenous sediment occurring at the greatest rate?
16. (1) Where is the most likely location to find a hydrothermal vent?
17. (2) There are several hotspots indicated on the map; list any two of them.
18. (1) Where is the western boundary current for the North Atlantic?
19. (1) Where is the Coriolis Effect the strongest?
20. (1) Where is there an active continental margin?

For numbers 21-25, refer to map 1 *and* the diagram below right. For each question, select one direction from the options on the diagram. Directions are *in the direction of flow*.

21. (1) In what direction do the prevailing winds blow at location Q?
22. (1) In what direction is the surface current at location J?
23. (1) (T10) In what direction is the deep-water current at location B?
24. (1) In what direction is the surface current at location A?
25. (1) In what direction do the prevailing winds blow at location J?





Map 1: Note that the latitude scales on the sides of the map are *not* horizontal.

For numbers 26-35, select one of the three options listed below:

A) greater than B) less than C) the same as

26. (1) The speed and depth of western boundary currents is _____ eastern boundary currents.

27. (1) The surface water temperature in the equatorial Pacific during an El Niño year is _____normal.

28. (1) Geostrophic flow results when the Coriolis force is _____ the horizontal pressure gradient.

29. (1) The Coriolis Effect at the equator is _____ that at 30° of latitude.

30. (1) The width of the continental shelf of a passive continental margin is _____ that of an active margin.

31. (1) (T8) The productivity of regions of coastal upwelling is _____ that of other regions of the ocean.

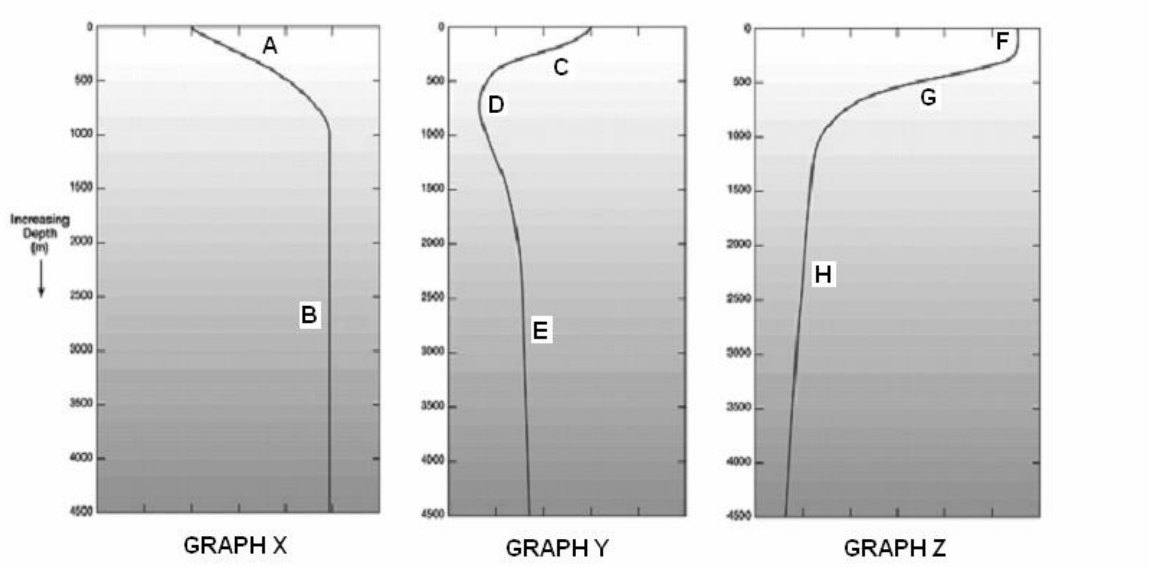
32. (1) The amplitude of a neap tide is _____ the amplitude of a spring tide.

33. (1) The density of cold water is _____ the density of warm water.

34. (1) Atmospheric pressure at the equator is _____ atmospheric pressure at the horse latitudes.

35. (1) The amount of lithogenous sediments on the ocean floor is _____ the amount of hydrogenous sediments.

For numbers 36 – 40, use the three graphs shown below. All three graphs are associated with mid-latitudes in the South Atlantic.



36. (1) Which graph indicates temperature versus depth?

37. (1) Which graph indicates salinity versus depth?

38. (1) Which graph indicates density versus depth?

39. (1) Which letter on the graphs indicates the pycnocline?

40. (1) (T7) Which letter on the graphs indicates the thermocline?

For numbers 41-50, use the three tidal charts shown below right.

41. (1) Which of the three graphs was generated on the East coast of the U.S. at Cape Hatteras?

42. (1) Which of the three graphs was generated in the Pacific Northwest of the U.S.?

43. (1) Which of the three graphs was generated on the gulf coast of Texas?

44. (1) Which graph shows a diurnal tide?

45. (1) Which graph shows a semidiurnal tide?

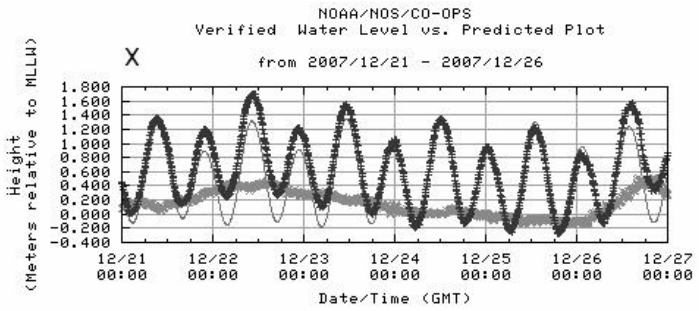
46. (1) Which graph shows a mixed semidiurnal tide?

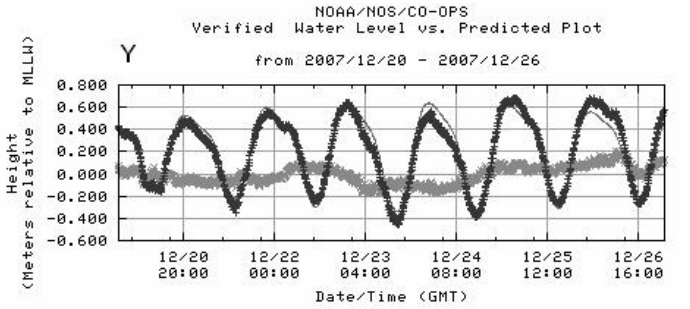
47. (1) What is the tidal range of graph Y on December 24th?

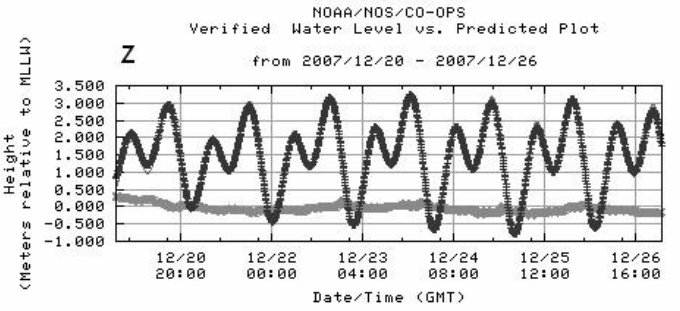
48. (1) What is the tidal period of graph X?

49. (1) (T1) According to graph Z, what is the MHHW (relative to the MLLW)?

50. (1) On graph Z, when was the lower high water on December 22nd?







For numbers 51-60, use the diagram shown below. Answer with a letter from the diagram indicating where each particular feature is located or where that process is taking place.

51. (1) Mid-ocean ridge

52. (1) Active transform fault

53. (1) Volcanic island arc

54. (1) Continental crust

55. (1) Abyssal plain

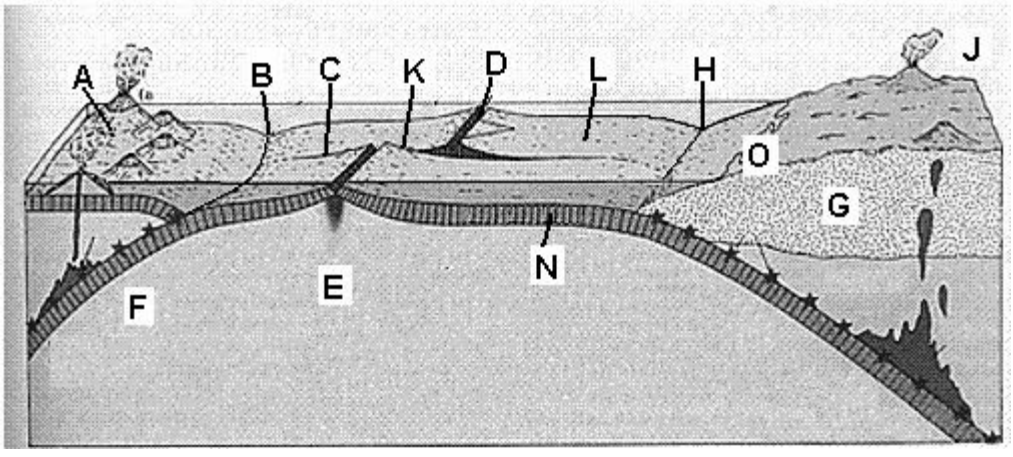
56. (1) Fracture zone

57. (1) (T6) Slab pull

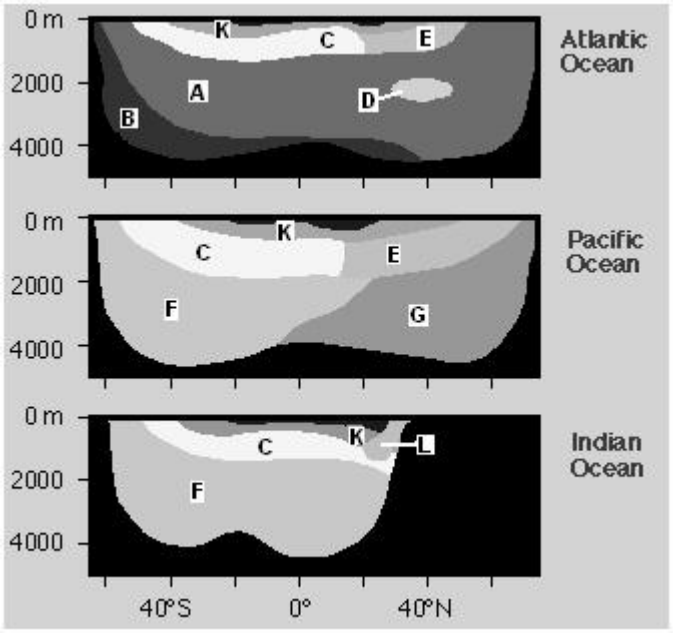
58. (1) Oceanic crust

59. (1) Active continental margin

60. (2) Trench



For numbers 61- 71, refer to the vertical cross-sectional diagrams of the major world oceans.



61. (1) (T5) Where on the diagrams is *exclusively* Antarctic Bottom Water?

62. (1) Where on the diagrams is Mediterranean Water?

63. (1) Where would there be Circumpolar Water mixed with Antarctic Bottom Water?

64. (1) Where is Pacific Deep Water?

65. (1) Where is North Atlantic Deep Water?

66. (1) Where is Antarctic Intermediate Water?

67. (1) Where is Arctic Intermediate Water?

68. (1) Where is Red Sea Water?

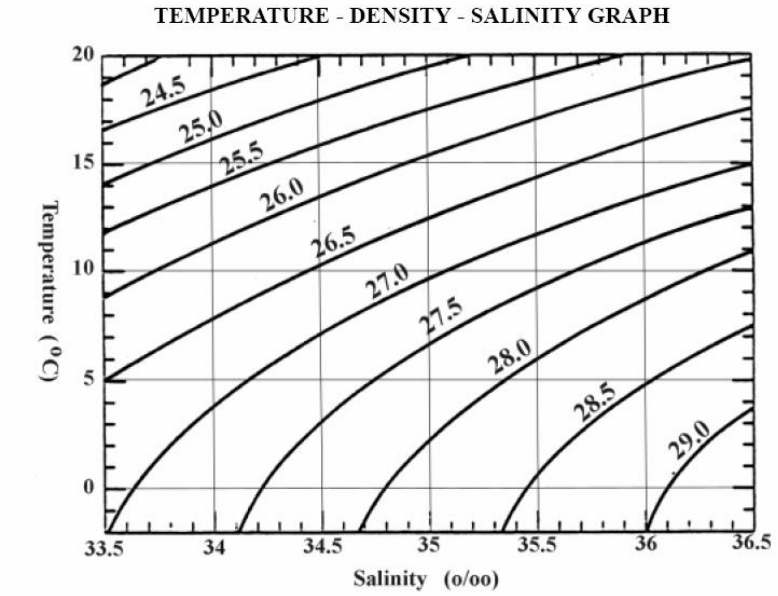
69. (2) Mediterranean Water is (warm W or cold C) and relatively (salty S or fresh F).

70. (2) Antarctic Bottom Water is (warm W or cold C) and relatively (salty S or fresh F).

71. (1) (T2) According to the graph shown below, what is the density in g/cm^3 of a sample of salinity 34.5(o/oo) and temperature 7^{o}C?

72. (1) According to the graph shown below, what is the salinity of a water sample with a density of 1.028 g/cm^3 at a temperature 8^{o}C?

73. (1) What are the units of the salinity scale across the horizontal axis of the temperature-density-salinity graph?



74. (1) True (T) or False (F): The Earth's magnetic polarity reverses periodically.

75. (1) True (T) or False (F): Siliceous sediments are most common at temperate latitudes.

For numbers 76 – 100, provide the term or phrase that best fits the statement provided.

76. (1) Rapidly moves large volumes of sediment from the continental shelf to the sea floor

77. (1) General term for sediment eroded from a continent or volcanic island

78. (1) Name for a coral structure separated from the mainland (or island) by a lagoon

79. (1) Zone of asthenospheric rock below a hot spot

80. (1) Muddy, soft sediment composed of foraminifera, coccolithophore, or pteropod hard parts

81. (1) (T4) The density-driven, deep-water circulation of the oceans

82. (1) Cooler, nutrient-rich water is brought to just below the surface layer by Ekman flow offshore

83. (1) A fissure in the earth's surface from which geothermally heated water issues

84. (1) The underwater equivalent of topography

85. (1) Wave action that causes the littoral drift of sand parallel to the coast

86. (1) The depth at which calcium carbonate is dissolved as fast as it accumulates

87. (1) Unobstructed distance of sea over which wind blows

88. (1) An area of land adjacent to water on three sides

89. (1) A coast that has experienced a rise in sea level due to subsidence

90. (1) A deposition landform which forms between an offshore island and the mainland

91. (1) A narrow, flat area at the base of a sea cliff

92. (1) Causes waves to change speed and direction as depth changes

93. (1) (T3) The seaward sloping portion of a beach between high and low tide water levels

94. (1) When the sun and moon are at right angles, causing minimal tidal ranges

95. (1) Apparent deflection caused by the Earth's rotation

96. (1) Biogenous, pelagic sediments composed of diatoms and radiolaria

97. (1) The region between the continental rise and the continental shelf

98. (1) The deepest part of the seafloor

99. (1) A U-shaped, flooded glacial valley

100. (1) Name for the feature indicated by the white arrow in the image