NAME: _____ STUDENT I.D.# _____

EARTH SC 3E03/ENVIRO SC 3E03 CLASTIC SEDIMENTARY ENVIRONMENTS

DURATION OF EXAMINATION: 2 HOURS December 12, 2011
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THIS EXAMINATION PAPER INCLUDES **4 PAGES AND 23 QUESTIONS**. YOU ARE RESPONSIBLE FOR ENSURING THAT YOUR COPY OF THE PAPER IS COMPLETE. BRING ANY DISCREPANCY TO THE ATTENTION OF YOUR INVIGILATOR.

Instructions:
This is a closed book examination. Answer **all** questions in Parts A and B. Answer Part A on the exam and Part B in the examination booklets provided. No calculator required.

PART A - Multiple choice. Circle one answer only. (1 mark each – 20 marks total)

1. The sedimentary characteristics typical of debris flow deposits include:
a) clast-supported gravel beds with normal grading
b) matrix supported gravels with weak b-axis fabrics
c) matrix-supported diamicts with weak inverse grading and a-axis clast fabrics
d) well-sorted gravels with well developed inverse grading
e) none of the above

2. An olistostrome is best defined as:
a) a calcium carbonate mound built by reef organisms
b) a type of watery debris flow
c) a chaotic mass of large sediment clasts deposited by slumping and sliding
d) a sandy deposit generated on the continental slope by geostrophic flows
e) none of the above

3. The Fly River delta (Papua, New Guinea) is a classic example of:
a) a river-dominated delta
b) a wave-dominated delta
c) a tide-dominated delta
d) a Gilbert-type delta
e) a fan-delta

4. A deltaic sequence consisting of prodelta muds overlain by a coarsening upwards sequence of HCS/SCS sands capped by planar-bedded and rippled sands is typical of:
a) a river-dominated delta
b) a wave-dominated delta
c) a tide-dominated delta
d) an ebb tidal delta
e) a flood tidal delta

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5. The upper to lower flow regime transition occurs at the boundary between turbidite units:
a) d and e
b) c and d
c) a and b
d) b and c
e) none of the above

6. Deposition in gravelly braided rivers is characterized by:
a) the lateral accretion of point bars
b) deposition of overbank organic silt and formation of levees
c) the downstream accretion of longitudinal gravel bars
d) development of crevasse splays
e) all of the above

7. Debris flow fans are characterized by:
a) debris flow channels and levees
b) steep fan gradients
c) areally restricted fan lobes
d) matrix-supported diamict facies
e) all of the above

8. When a river inflow is denser than the receiving water body the flow is termed:
a) homopycnal
b) hyperpycnal
c) superfluous
d) thermally buoyant
e) hypopycnal

9. A clear water lake with low nutrient levels and abundant macrophytes is termed:
a) an eutrophic lake
b) a mesotrophic lake
c) a clastic-dominated lake
d) an oligotrophic lake
e) a carbonate-dominated lake

10. Dimictic lakes undergo convective overturn:
a) once per year
b) twice per year
c) three times per year
d) four times per year
e) whenever the lake freezes over

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11. The primary sources of $CaCO_3$ in carbonate-dominated lakes do not include:
a) gastropods and freshwater bivalves
b) charophytes
c) groundwater
d) diatoms
e) cyanobacteria

12. The term 'gyttja' refers to a lake mud with:
a) > 50% organic matter
b) > 10% organic matter
c) > 50% calcium carbonate
d) < 50% organic matter
e) little or no organic matter

13. The 'foreshore' refers to the area on the coast:
a) between the beach berm and dune ridges
b) between fair-weather and storm wave base
c) between the low tide mark and fair-weather wave base
d) between the storm wave base and the shelf edge
e) none of the above

14. A sedimentary facies defined by a characteristic assemblage of trace fossils is best termed:
a) a fossiliferous zone
b) a biofacies
c) a bioturbated facies
d) an ichnofacies
e) none of the above

15. *Skolithos* are:
a) vertical burrows formed in sand in the high-energy littoral zone
b) surface tracks and trails formed in sand in the moderate energy sub-littoral zone
c) surface traces formed in muds in the low energy bathyl zone
d) regular surface patterns found in the deep water abyssal zone
e) none of the above

16. Tidal current velocity is at a minimum:
a) during maximum high tide
b) during the slack water phase between tides
c) during the midpoint between low and high tide
d) when the moon is at right angles to the sun (quadrature)
e) none of the above

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17. Sediment gravity flows in order of *increasing water content* include:
a) debris flows, grain flows, turbidity currents, fluidized flows
b) slumps, debris flows, turbidity currents, sheet flows
c) turbidity currents, fluidized flows, grain flows, debris flows
d) debris flows, fluidized flows, grain flows, turbidity currents
e) none of the above

18. Fluidized flows are recognized by the following sedimentary facies:
a) poorly sorted sands with inverse grading
b) moderately well-sorted sands with water escape and soft sediment deformation structures
c) massive structureless sands and gravels with little or no grading
d) fining upwards sequences of sand, silt and mud with an erosive base
e) massive, matrix-supported diamicts with weak inverse grading

19. River competence is defined by the:
a) largest particle transported by the flow
b) volume of sediment discharged
c) volume of wash load
d) rate of sediment erosion
e) all of the above

20. The turbidity current created by the Grand Banks earthquake of 1929 travelled an estimated distance of
a) > 700 km
b) < 70 km
c) > 320 km
d) > 3200 m
e) none of the above

PART B - Answer all 3 questions in the examination booklet. (30 marks total)

1. Using two annotated cross-sections discuss the depositional environments and the sequence of sedimentary deposits typical of: a) a regressive barrier island and b) a transgressive barrier island. Your diagrams must be neat and legible with the depositional sub-environments and deposits clearly labelled (10 marks).

2. a) Draw an annotated diagram showing a typical *Bouma sequence* (turbidity current deposit).
   b) Briefly describe (in a few sentences each) the sedimentary facies, bedforms and bedding types that are characteristic of each unit in the Bouma sequence (10 marks).

3. Using annotated diagrams describe the sedimentary processes and deposits typical of the continental slope. Your answer should include an idealized vertical profile (sediment log) summarizing the sedimentary facies types.

THE END