IESO 2026 — TURIN

PRACTICAL TEST 3 — 3D OUTCROP

Time: 75 minutes • Questions: 16 • Score: 20 points (1 or 2 points per question as indicated) • Read all the data before answering. Only one correct answer for all multiple-choice questions.

Instructions

DDE-Outcrop3D platform (outcrop3D.deep-time.org) is an open-access Web platform that allows to visualize and examine geological 3D outcrops. This test focuses on the examination of a coastal geological formation in Telheiro (Portugal), rendered in a 3D model at the link below the introduction.

After examining this geological formation, answer the multiple-choice questions. For each question there is one correct answer. There is no penalty for a wrong answer.

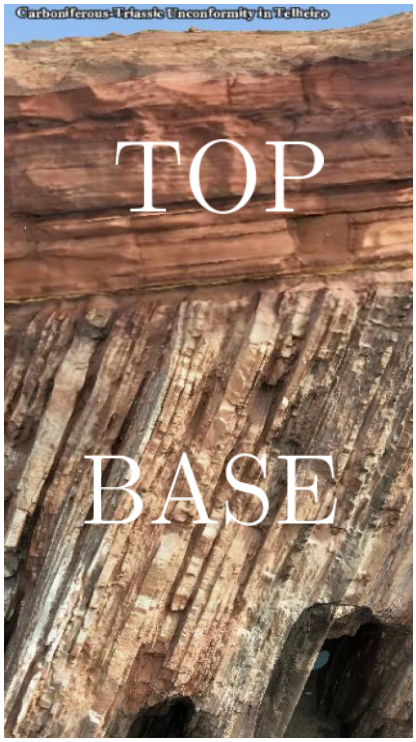
Navigation and controls:

- Click and drag with the left mouse button to move around the 3D outcrop model.
- Zoom by scrolling the mouse wheel, or by using the "+" and "-" buttons in the bottom-right corner.
- Reset the view by clicking on the "Original view" icon in the top-right corner.
- Use the "Measure" icon on the bottom-left to make measurings: select the options appearing in the top-right corner, then click two or more points on the outcrop face to calculate spatial distances, bed thicknesses, or elevation profiles.
- To measure bed orientations, click on the "Geological analysis" icon in the left panel, then select "Attitude measuring". Then, select three non-aligned points on a bed surface to obtain measurements.

Record all answers on the separate answer sheet.

Model: https://outcrop3d.deep-time.org/?model=af3b75ee-c59a-44b3-f6ac-3869fbf69a48

To provide your answers, **refer to the middle part of the outcrop**, which approximately corresponds to the one in the figure below.



MEASURE **1.** Measure the dip angle of the beds at the **base** of the cliff. Give the answer in degrees in the answer sheet. *(2 pt)*

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MEASURE **2.** Measure the dip angle of the beds at the **top** of the cliff. Give the answer in degrees in the answer sheet. *(2 pt)*

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MEASURE **3.** Measure the dip direction of the beds at the **base** of the cliff. Give the answer in degrees in the answer sheet. *(2 pt)*

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MEASURE **4.** Consider the **top** part of the formation. Given a hypothetical average depositional rate of 0.01 mm/year, what is the age difference between the uppermost visible beds and the lower ones directly above the discontinuity? Give the answer in years in the answer sheet. *(2 pt)*

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5. The outcrop records two main units. To which geological periods do they belong? *(1 pt)*

A) Triassic (base) and Carboniferous (top)
B) Paleogene (base) and Permian (top)
C) Cretaceous (base) and Devonian (top)
D) Carboniferous (base) and Triassic (top)

6. The rocks at the base of the cliff originated as… *(1 pt)*

A) deep-marine sediments
B) evaporitic deposits in a closed basin
C) lava flows followed by pyroclastic fall
D) magmatic intrusions and contact metamorphism

7. The reddish, gently-dipping rocks at the top originated as… *(1 pt)*

A) deep-marine organic muds
B) volcanic ash
C) glacial till
D) continental sediments

8. Which kind of unconformity best describes the contact between the two units? *(1 pt)*

A) Angular unconformity, meaning an unconformity where horizontally parallel strata of sedimentary rock are deposited on tilted and eroded layers

B) Nonconformity, meaning an unconformity between sedimentary rocks and metamorphic or igneous rocks when the sedimentary rock lies above

C) Disconformity, meaning an unconformity between parallel layers of sedimentary rocks

D) Paraconformity, meaning an unconformity in which the sedimentary layers above and below the unconformity are parallel and there is no obvious erosional break between them

9. The base unit shows mainly… *(1 pt)*

A) horizontal, undisturbed beds
B) folds
C) cross-bedding
D) columnar jointing

10. Which unit is older? *(1 pt)*

A) The top unit
B) The base unit
C) They are the same age
D) It cannot be determined from field relations

11. Which one of these events led to the formation of the unconformity? *(1 pt)*

A) Thrust plane, eroding mainly the base unit
B) Tilting and erosion of the top unit
C) Tilting and erosion of the base unit
D) Thrust plane, eroding mainly the top unit

12. Within the base unit, the alternation of more-protruding and less-protruding beds is best explained by… *(1 pt)*

A) erosion caused by biological agents
B) strike-slip faults between the beds
C) random variability in how the same lithology is affected by erosion
D) alternation of lithologies with different susceptibility to erosion

13. The gently-dipping beds at the top of the cliff act as a… *(1 pt)*

A) resistant cap-rock that limits erosion of the softer rocks beneath
B) rapidly-eroding cover that accelerates cliff retreat
C) soluble layer that dissolves in seawater
D) layer with no effect on the cliff morphology

14. Which is the orientation of the fold axis (hinge) for the fold shown in the image and found in the base unit? *(1 pt)*

A) NNE–SSW
B) ENE–WSW
C) NNW–SSE
D) the axis cannot be defined from given data

15. Which structure do you see in the left part of the image? *(1 pt)*

A) normal fault
B) inverse fault
C) antiform
D) synform

16. The steep attitude of the base unit is regionally linked to… *(1 pt)*

A) orogenesis
B) rifting
C) a meteorite impact
D) glacial loading and rebound