Remember, for Q5, you'll need to:

1. **Sketch:** Draw the main geological units, structures (faults, folds, joints, bedding), and any hazards.
2. **Annotate:** Label everything clearly.
3. **Describe:** Briefly explain the geology and engineering implications.

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**General Themes to Remember from Your Notes:**

- **Rock Mass Rating (RMR):** You frequently assess this. Key parameters: Intact Rock Strength, RQD (Drill Core Quality), Spacing of Discontinuities, Condition of Discontinuities, Groundwater.
- **Discontinuities:** Joints, faults, bedding planes are critical for stability. Note their orientation, spacing, aperture, roughness, infill.
- **Weathering:** Affects rock strength and permeability.
- **Water:** Huge impact on pore pressure, weathering, slope stability, erosion.
- **Rock Types & Properties:** Limestone, sandstone, mudstone, conglomerate, granite, aplite, hornfels. Their characteristics (strength, permeability, how they weather) are important.
- **Geohazards:** Sliding, toppling, wedge failure, rockfall, soil erosion, flooding.
- **Human Impact:** Quarries, dams, road cuttings, sea defenses – how these interact with the geology.

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Here's a compiled summary based on your notebook pages:

**DAY 1 (Likely focus on Quarries & Rock Mechanics)**

**Site 1: Barrington Combe Quarry (Pages ~P1, P5-P8 in notebook)**

- **Location:** Barrington Combe Quarry (Landing of Wessex). Weather: Warm & Sunny.
- **Objective:** Walk-over survey, understand regional geology.
- **Geology:**
    - **Limestone Quarry:** Sedimentary rock. Carboniferous Limestone (oolitic, noted later).

- **Layers:** Consistent layers present, horizontally bedded (former ocean floor, 330-350 Ma).
- **Overlain by:** Mercia Mudstone (younger, red, seen in sketch on P6).
- **Other Rocks:** Dolomite Limestone, Chert & "Reds" (likely iron staining/mineralization) present as discontinuities or within layers.

- **Structures & Discontinuities:**
  - **Bedding Planes:** Generally horizontal, but can be warped. Key mechanical weakness.
  - **Joints:** "Spot cracks," e.g., ~8 joints noted in an RMR example. Spacing noted as 2-5cm in one area.
  - **Faults:** Present, related to relative motion of rock blocks.
  - **Aperture:** Often "closed aperture" but can vary.
  - **Fracture Surface:** "Rough."
- **Engineering Issues & Observations:**
  - **Slope Instability:**
    - **Wedge Failure:** High potential, especially due to intersecting discontinuities (man-made quarry faces expose these).
    - **Sliding:** Possible along unfavourably oriented discontinuities (e.g., if plane "goes into the ground" or "daylights").
    - **Toppling Failure:** Where beds dip steeply out of the slope or columns of rock are formed by joints. Noted as happening on the left side (P8).
  - **Rock Strength:** RMR assessments done. Limestone is a competent building material.
  - **Weathering:** Limestone can be "very weathered" in places.
  - **Water:** Weakens rock, reduces friction, increases pore pressure. Water seen coming out of joints.
  - **Man-made Impact:** Quarrying changes stress, creates new faces. "Force orientation has changed" (P8). "Bed is daylighting & overhanging" due to excavation.
- **RMR Example (from P1):**
  - Spacing: 2-5cm

    - **of discontinuities: 8 joints**
    - Aperture: Closed
    - Fracture: Rough
    - Permeability: Slightly permeable
    - Weathering: Very weathered
    - Water: Dark (implies damp/wet)
- **Sketch Focus for Q5:** Quarry face showing limestone layers, overlying Mercia Mudstone, key joints/faults, bedding planes, potential wedge/toppling failures.

**Site 2: Rock of Ages (RoA) (Pages P3-P4)**

- **Location:** Rock of Ages (RoA). Weather: Sunny. Date: 1/5/2023.
- **Objective:** Investigation of Gothianite and its mining adit formation.
- **Geology:**
    - **Rock Type:** Micrite Limestone (building material).
    - **Structure:** Forms a limb of an anticline (diagram on P3 suggests steep dip).
    - **Bedding:** Different bedding thicknesses. 1-65° dip angle.
    - **Tectonic Face:** Causes folds.
    - **Comparison:** At Cheddar Gorge, similar anticline with dip 32° (Asymmetric Anticline).
- **Processes & Features:**
    - **Limestone Weathering:**
        - Colour: Greyish-blue on-site, finish is because of infill materials (mostly calcite ($CaCO_3$), gypsum (soft), quartz (hard)).
        - Rain (acidic) erodes limestone; acidic water flows into gaps/joints.
        - Formation of humid acid from fallen trees/plants -> water flow -> decomposes rock & acid goes through joints.
    - **Scratch Lines:** All lines follow a certain pattern, indicating movement in a certain direction (tectonic?).
    - **Crystallized Calcium Carbonate**
    - **Joints:** Perpendicular to bedding.

- **Mechanism of Movement:** Tectonic movement (P5).
- **Sketch Focus for Q5:** Inclined limestone beds, joints perpendicular to bedding, evidence of weathering/solution (karstic features if visible), possibly related to an anticline limb.

**Site 3: Barrington Combe Quarry (Geohazard focus) (Pages P6-P8, revisiting Site 1)**

- This section of your notes (P6-P8) is a more detailed geohazard assessment of Barrington Quarry, already covered above. Key additions:
    - **Mercia Mudstone, Dolomite Limestone, Wedgel Geohazard** clearly labelled on sketch P6.
    - **Sliding:** "Into the ground, kinematically no potential" in one area, but water can reduce friction.
    - **Wedge Failure:** "Potential wedged failure" especially where different orientations of face exist. Water critical.
    - **Toppling:** "Slope is changing, some geology, changing orientation." "Bed is daylighting & overhanging."
    - "This area is far more active because of evidence (falling rock)."
    - Observations: "Corner of quarry, water coming out of joints between rocks."

**Site 4: Cheddar Gorge (Pages P9-P10)**

- **Location:** Cheddar Gorge. Weather: Sunny.
- **Objective:** Understand the history, nature & characteristics of limestone gorge.
- **Geology:**
    - **Rock Type:** Limestone (Carboniferous Limestone, same as Barrington, around 350 Ma). Layered, weathered rock.
    - **Structure:**
        - Bedding planes are horizontal (in general, but can be locally tilted).
        - Dip is shallow (20°), opposite limbs of anticline.
        - Anticline caused exposure of limestone; mudstone (Mercia) would then deposit on top, covering it.
    - **Joints:** Patterns are mostly perpendicular to bedding.
- **Processes & Features:**

- **Gorge Formation:**
    - Glacial movement & melting of ice (no river) -> periglacial processes.
    - Water seeps through underground (karstic caves) as limestone dissolved by water.
    - Mini ponds formed from water stored on surface, receded from glacial formed Cheddar Gorge (~1K years).
  - **Weathering:** Limestone filled with minerals.
  - **Rockfall:** Common on the more exposed face of rock mass.
- **Engineering Issues & Mitigations:**
  - **Geohazards:** Rockfall from cliffs.
  - **Prevention:**
    - **Catch net:** To catch >1$m^3$ of falling debris.
    - **Soft measure:** Barriers to prevent crowds too close to cliffs.
- **Sketch Focus for Q5:** Steep gorge walls in limestone, horizontal/sub-horizontal bedding, prominent joint sets (often perpendicular to bedding), evidence of rockfall or solution features. Mention anticline structure if context allows.

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**DAY 2 (Likely focus on Soils, Site Investigation, Coastal Processes)**

**Summary of Day 2 (Page P21)**

- **Desk Study:** Geological map tells you about the location.
- **Morte Slate:** Oldred rock.
- **Valley:** Visible from steep lines.
- **Dunes:** Dip angle is 25°-30°. Should look like: most common aeolian landform. Geometry & resulting sedimentary structures depend primarily on the rate of sediment supply & prevailing wind direction.
- **Ergs:** More than 85% of sand in active Sand Bodies is concentrated into sand seas (Ergs). Largest Ergs: Rub'al Khali, Saudi Arabia. Stabilized by vegetation cover, particularly in Sonora Desert.

- **Solifluction (Add on):** Head is the accumulation of unsorted solifluction debris. Very weak. Can flow by plastic deformation. BUTT, typically stored through basal, intermediate & circulatory slip surfaces.

**Site 5: Woolacombe, Croyde Park (Site Investigation) (Pages P12-P13, Borehole Log on P13 Add on)**

- **Location:** Woolacombe, Croyde Park. Weather: Sunny & Windy.
- **Objective:** Ground/Site Investigation important to identify suitability of site & risks.
- **Site Investigation Process:**
    - **Desk Study (3 phases usually):**
        1. **Map:** Look at history, previous building at site, identify topography (contour on survey map).
        2. **Geological map:** Tells you superficial topography & geology.
        3. **Focus on site specific ground conditions:** Check history, map conditions. (Cannot fully rely, but refer it. Not always updated).
    - **Walk-over survey (Contd on Pg 13):**
        - See if there is something different from the desk study.
        - Think of the logistics, e.g., equipment access, cables, ground.
        - Check ground conditions (might be soft).
        - Possible Landslide, Check topography.
        - Be careful with excavation (shear surface, 10°).
        - Freezing/thaw may weaken soil strength.
        - Residual strength <-> strain, slope 10° from 25-28°.
        - History: From periglacial times -> large rock debris slope -> long, sinuous shear surface. Repeated freezing & thawing slow down the slope. Due to glacial movement.
    - **Intrusive Ground Investigation (Methods on P13):**
        - **Probing:** To know about soil (outcrops, river/terraces exposure, river bank).
        - **Borehole:** Need casing to support, cannot dig through hard gravel.

        - **Trial Pit:** Dig a trench, 5m deep. To see the topography. To check everything (e.g. soil).
        - **Disturbed sample / Hand Auger (Juan):** ~10/15m, hard to go further. Measure length of spoil drilled. Soil type identification (water content, consistency, grain size).
        - **Rotary drilling rig:** Core barrel, hydraulic head drill, polymer mud (not environmentally friendly).
        - **Taking sample rock is not good:** Sample might be disturbed, damaged (build up), small size.
        - **Grabbing a sample out of tube:** Needs to trim it, might be broken.
        - **In-situ Testing (IMPORTANT):**
            - **Boring a Tube:** 40-50m.
            - **Standard Penetration Test (SPT).**
            - **Cone Penetration Test (CPT):** Get reading every few cm (good for analysis).
    - **Borehole Log (P13 add-on using Tube Sampler):**
        - Describe grain size soil (in-situ). Build profile, confirm it back in lab.
        - Extract sand (moist sand once it is underneath the ground, may dry up soon due to natural factors like wind & sunlight).
        - Can be used to calculate Gs, & Ms.
        - Thin shells can rust the soil efficiently.
- **Sketch Focus for Q5 (if this site was pictured):** Illustrate different site investigation techniques (trial pit, borehole). If a soil profile is shown, sketch that with layers.

**Site 6: Sand Dunes (Pages P14-P15)**

- **Location:** Sand Dunes. Weather: Sunny.
- **Objective:** Quaternary investigation of sand dune.
- **Sand Composition:**
    - Several colours of grey.
    - Transparent, black, translucent grains. No shells.

    - More than one mineral (impurities).
    - Wind from Morte Bay used to remove the excess sand.
- **Mixture Sand:** Everything apart from quartz has been broken down.
- **Dune Characteristics & Formation:**
    - Finely bedded, followed by a steep slip face (30-35°).
    - Blows the sand grain. Consider climate change.
    - Size of dune indicates they are wind-blown (Aeolian).
    - Originated by sea-borne process.
    - 500 thousand years; Glacial period is oldest.
    - 120 thousand years – 10/15 thousand years (Glacial movement).
    - Last Glacial period is called Devensian.
- **Edge of Sand Dune / Local Factors (P15):**
    - Grass – steadying growing (check of development).
    - Conservation for Flora & Fauna.
    - Cold-Arctic wind comes to this area.
    - Massive glacial movement, sea level is lower, much colder (7.5-8°C colder).
    - Prevailing wind blows the sediments here.
    - Sand comes from Gothia/swelling, suspension (Sand storm)?
    - Strong wind.
    - Grass holds the dunes in place, however they are eroding because of the sea.
    - Gorsebush dans acidic environment.
- **Sketch on P15:** Shows sand dune profile:
    - Wind direction.
    - Lee slope (steeper, slip face, ~31°), Stoss slope (gentler, ~21°).
    - Vegetation (Trees, Gorsebush, Grass) stabilizing parts of the dune.
    - "Transgressive dune system"
    - Height ~7.5m.

- **Sketch Focus for Q5:** Dune profile showing windward (stoss) and leeward (slip face) slopes, internal cross-bedding if inferable, stabilizing vegetation. Annotate angles.

**Site 7: Morte Bay (Sand Properties) (Page P16)**

- **Location:** Morte Bay. Weather: Sunny.
- **Objective:** To investigate the mechanical properties of sand.
- **Sand Content:**
  - Black: Mica
  - Orange: Quartz
  - Translucent: Feldspar
  - Well-rounded sands -> wind blown sand. Expected to be more round due to viscosity of air.
- **Important Sand Properties:**
  - **Compaction:** Stability & Strength.
  - **Angle of Internal Resistance (Friction Angle, ϕ'):** Angle between normal reaction force & the combined force of friction and normal reaction as object begins to move.
    - **Strength:** Angle of internal shearing resistance. Must be used for sand particles. Cohesion (c') = 0 for dry sand.
      - Higher ϕ' -> Higher strength.
      - Very little interlocking force.
      - Friction angle is invaluable. Loose sand has lower angle (~30°).
    - **Density:** Loose sand & dense sand has ~10° difference in friction angle. ϕ' of angular sand is higher. No change in volume when critical state is reached.
- **Angle of Repose (P21 top left, likely related general sand knowledge):**
  - Remains the same after several attempts. If you add more sand, $\theta 1 = \theta 2$. (Make sure sand is dry). Cohesion = 0.
  - Typical angles: 30°, 28°, 27°, 27°.

    - Difference between angular & rounded sand: Angular is stronger than rounded sand due to its interlocking properties.
- **Loose Sand vs Dense Sand Stress-Strain (P21 bottom left):**
    - Loose sand: Brittle response (volume decreases then constant).
    - Dense sand: Ductile response (volume decreases then increases - dilation).
- **Sketch Focus for Q5 (if showing sand):** Grain characteristics (rounded/angular), relate to angle of repose if a natural slope is shown.

**Site 8: Morte Bay (Close to rocks - Sand Castle Competition!) (Page P17)**

- **Location:** Morte Bay (Close to rocks). Weather: Sunny and Cloudy.
- **Objective:** To test soil angle with understanding of compaction & importance of water in cohesion of sand. To sketch topography of Morte Bay. To measure the C...(?) of Morte.
- **Sand Castle Competition Insights:**
    - Goal: To sustain as much load as possible.
    - **Key factors that cannot be changed:** Particle size, Shape of the particle.
    - **Factors that can be changed (controlled):** Water content, Degree of saturation, Compaction.
- **Outcomes/Observations from Sand Castles:**
    - Crack of the foundation is not always the support.
    - Suction of the cap would be a problem.
    - Cutting the top of the cap would be a good idea.
- **Calculations (P17 top left - for a model sand pile/castle):**
    - Relates to effective stress, pore water pressure, suction (matric suction).
    - $\sigma v = \gamma z$ (vertical stress)
    - $\sigma h = K0\ \sigma v$ (horizontal stress)
    - Example: Max height calculation based on shear strength parameters.
    - Equation for critical height $Hmax \sim 4Su / \gamma$ or similar for sands.
- **Sketch Focus for Q5:** If it's a sandy slope, consider factors affecting its stability: grain size/shape, water content (suction if damp), compaction.

**Site 9: Morte Bay Slate (Pages P18-P19)**

- **Location:** Morte Bay Slate. Weather: Sunny & Windy.
- **Objective:** Take measurement of discontinuity. To identify discontinuities of slate. To understand the history of slate.
- **Scan-line survey:**
  - Tells the spacing of discontinuity.
  - 2cm width & 2m length spacing.
- **Characteristics of slate:**
  - Rough, layered surface.
  - Dark-greyish colour.
  - Very tough.
- **Measurements (P18 top left):** Discontinuity measurements (spacing, dip, dip direction, aperture). E.g., 5m tape: 213cm, 40°, 019°, Close.
- **Location 9: Morte Bay (Sketching Area) (P19):**
  - **Sketch (P19 Left):** Shows cliff with different units:
    - Human for scale.
    - "Conglomerate: Mixture of slate, gravel and debris" at top.
    - "Solifluction - the effect of frost heave & sorting, act to move material down slope. Amplified by freeze-thaw."
    - "Thawed soil & Rocks, Shelly Sand/silt, Landfill" (Head deposit/colluvium).
    - "Bedrock: Slate, steeply dipping/cleaved."
    - "Sand" at beach level.
    - Compass (N,S,E,W).
  - **Solifluction Details:**
    - Affects slope as gentle as 1°-2° & in a permeable rate of 1m/yr(?).
- **Sketch Focus for Q5 (if similar to P19):** Cliff section with slate bedrock (showing cleavage/dip), overlying head/solifluction deposits (conglomerate mix), beach sand at base. Label processes.

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**DAY 3 (Likely focus on Dams, Intrusive Rocks, Mining)**

**Summary of Day 3 (Page P31)**

- **Meldon:** Hamlet in West Devon, on the edge of Dartmoor in Devon.
- **Main Features:** Meldon Quarry & Reservoir, Viaduct.
- **Limestone:** It is very important to make the dam (did not have to transport very far).
- **Variscan / Hercynian Orogeny:** A geologic mountain-building event caused by Late Paleozoic continental collision between Euramerica (Laurussia) and Gondwana to form supercontinent of Pangea.

**Site 10: Meldon Reservoir (Dam) (Pages P22-P25)**

- **Location:** Meldon Reservoir (On the edge of Dartmoor). Weather: Sunny & windy.
- **Objective:** Understand the history & construction of dam.
- **Geology & Dam Type:**
    - **Igneous Rock:** Intrusive (better crystal structure, e.g., Granite) vs. Extrusive.
    - **Dam:** 50 years old. Concrete gravity dam.
        - Meldon Dam is curved & is arched dam. Loads are transmitted from the arch to adjoining stone work (to the sides of the valley).
        - Abutment: Interface between the dam stands and the ground.
    - **Foundation:** Granite bedrock (local material).
    - **Aggregate for concrete:** Granite (local).
    - **Cement:** Limestone quarry nearby (is too costly) used for cement.
- **Dam Uses:** Water supply (drinking, industry, irrigation), Generation of hydropower.
- **Construction & Design Considerations (for dams in general, applied to Meldon):**
    - **Ideal Location (City of Plymouth example on P22):** No one lives there (or else need to locate them), steep slope/deep valley topography, environment (not destroying natural habitat), don't waste farmlands, reasonably impermeable ground (avoid erosion that causes stability issues), avoid vegetation on top (Gorsebushes indicate sandstone).

  - **Granite:** Pushes and metamorphoses the sandstone & it becomes quartzite (impermeable material).
  - **Meldon Reservoir specifics (P23):**
    - 200m long, 55m deep.
    - Large structure.
    - No clay around this location.
  - **Ground Investigation (P23):** 1960s: Rock types & ground conditions. Look at 3-4 potential locations (topography). Design the dam. Government permission (hearing). Discuss reasons for building. Potential environmental impacts.
- **Potential Failure / Weakness / Issues (P24-P25):**
  - **Overtopping:** Water going over the wall (energy dispersed to prevent eroding downstream bed).
  - **Sliding Failure:** In the splash face of the dam. (Large gravity structure supported by abutments).
  - **Interface between dam and valley:** Need a tight connection.
  - **Pore Water Pressure (PWP):** As dam fills, PWP increases, effective stress decreases -> potential for slope failure.
  - **Uniformly spaced trees:** To keep slope stability.
  - **Terracettes:** Also help with slope stability. Ridges that are formed when there's a thin layer of soil cover.
  - **Sedimentation:** Usually occurs upstream. Need to prevent building of sediment within the dam. Mitigation: Dredge, Sluice gates, Settlement bays upstream.
  - **Treat water:** Addition of pump.
  - **Demolish diversion channel:** If dam starts to fill and PWP increases.
  - **Potential Issues with water quality:** Build-up of sediments. Growth of algae (solution: cold water pumped from beneath to warmer portion, but not ideal place for algae growth).
- **Sketch Focus for Q5 (if a dam):** Cross-section of dam, foundation rock (e.g., granite), water level, key forces (water pressure, dam weight), potential failure modes (sliding, overtopping), abutments.

**Site 11: Meldon Quarry (Hornfels, Aplite) (Pages P26-P27)**

- **Location:** Meldon Quarry (Dartmoor National Park). Weather: Sunny windy, dry.
- **Objective:** Rock descriptions, Rock Mass Classification.
- **Geology:**
  - **Background History:** Dark-grey colour rock type -> Lighter dark-grey rock type.
  - **Grey Rock (Hornfels):**
    - Metamorphic rock (contact metamorphism). Used to be mudstone -> whole shale content.
    - Darker than granite.
  - **Granite:** Stacked yes, bars on top. Main minerals: Mica, Feldspar, Quartz.
    - When granite magma is cooled: Heat transferred to surrounding rock (contact metamorphism).
    - Heating -> Expansion -> Cracks & Joints.
  - **Aplite:**
    - Intrusive igneous rock. Fine-grained.
    - Fluid injected into cracks.
    - High conc. of Feldspar. In white colour.
    - After thousand of years, magma is cooled, mineral will be crystallized.
    - Water can't penetrate through the aplite, creates a bulgey area.
- **Rock Description Parameters (P26):** Colour, Grain size, Structure, Texture & Fabric, Strength, Stability, Carbonate content, Void content, Rock Name.
- **Rock Mass Parameters (P26):** State of Weathering, Discontinuities, Fracture states, Rock state permeabilities.
- **Task: Aplite Rock Description (P27 Left):**
  - Colour: Light Grey
  - Grain size: Fine grains
  - Texture & Fabric: Slightly rough

- Strength: Smith Hammer Test (values listed) -> Uniaxial Compressive Strength (UCS): 75 MPa
- Stability: Wedge failure (Pebbles at base of quarry)
- State of weathering: Slightly weathered (some difference in colour)
- Discontinuities: Closely spaced (~0.5cm on aperture)
- Fracture state: Angular (Non-round)
- Permeability: Completely dry, impermeable
- **Rock Mass Rating (Aplite):**

1. Strength of intact rock material: 12
2. Drill core quality - RQD: 8 joints/m? RQD = 115 - 3.3xJv = 88.6 (Rating 17)
3. Spacing of Discontinuity: 10
4. Condition of discontinuity: 25 (Slightly weathered)
5. Water: 15 (Completely dry)
   - Sum = 79 => Class 2: Good Rock

- **Task: Hornfels Rock Description (P27 Right):**
  - Colour: Greyish brown
  - Grain: Fine grains
  - Texture & Fabric: Slightly rough
  - Strength: Smith Hammer Test (values listed) -> UCS: 130 MPa
  - Stability: Possibly of sliding & toppling failure
  - State of Weathering: Slightly weathered
  - Discontinuities: Closely spaced (~0.5cm aperture)
  - Fracture state: Angular
  - Permeability: Completely dry, impermeable
- **Construction of Dam in Phases (P24, seems to be general dam info, not specific to Aplite/Hornfels):** Supply of concrete, spillway. Drill sure borehole to investigate. When water impels the reservoir, we don't want severe erosion in the dam. Measuring permeability is very challenging. Ensure the pores are not too large as "cracks" will be big. Using spillway to control water level.

- **Sketch Focus for Q5 (if quarry with these rocks):** Contact between granite and hornfels (metamorphic aureole), presence of aplite dykes/sills. Highlight differences in grain size, colour, jointing. RMR data implies jointing and weathering state.

**Site 12: Red 'A' Ven (Mine) (Pages P28, P30, Map P29)**

- **Location:** Red 'A' Ven. Weather: Sunny & Windy.
- **Objective:** Map-sketching of previous mining site.
- **Mine Human Activity/History:**
    - Site of former mining work from 1…(?)
    - Mining of tin, tin ores from river(?).
    - Molten rock cools down and carbonate.
    - Very hot water.
    - Underground under pressure with mineral, melted.
    - Granite is being pushed up (intrusive).
    - Cracks: Within perimeter.
    - Water heats up + under pressure.
    - Dissolve minerals that cools down to ores.
    - Follow the lode of the veins.
    - Fine mother lode & follow.
    - Sink shaft to find it.
    - Collect ore and disposed soil.
- **Tasks:** Draw map of area (Non-loge). Boundaries: Two streams & mountains. Add scale, contours, landmark/features (e.g. shaft).
- **Features of Red 'A' Ven (P30):**
    - Access ore through shafts.
    - Water weir -> to power the pulley system & water item.
    - Construct a shoot to & from the wheel.
    - Wheel power helps crushed ores and smelting are to minimise what to take out (Only pure ore extracted).

    - Ore: Greenish ore has sparkly surface (Interface between ore & parent rock).
    - Outside of boundaries: More shafts to maximise search. Follow the veins.
    - Shaft in map used to have a core to stabilise opening.
    - Collapsed in recent years.
    - Multiple collapse show tunnel path.
- **Contour Map Sketch (P29):**
    - Shows flow direction of a river/stream.
    - Weir.
    - Shaft.
    - Collapse of tunnel (x2).
    - North arrow.
    - Dip angle of the slope: 25°-30°. Dip direction of the slope.
    - "Golden Buddha" feature.
- **Sketch Focus for Q5 (if old mine site):** Location of shafts, adits, spoil heaps, processing areas (e.g., leats, wheel pits). Geological context (e.g., veins in granite). Evidence of collapse.

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**DAY 4/LATER SITES (Likely Coastal Defences, More Cliffs/Slopes)**

**Site 13: Minehead Beach (Sea Defences) (Pages P32-P33, P36-P39)**

- **Location:** Minehead Beach. Weather: Windy, slight gloom, some sun beating.
- **Objective:** Sketch some features.
- **Characteristics / Sea Defences:**
    - **Sea wall (curved).**
    - **Natural hazards.**
    - **Groynes.**
    - **Rip-rap walls (across the seashore).**
    - **Effectiveness:**
        - Sediment being trapped by groynes.

        - Shape of beach is constantly changing due to unpredictable wave.
        - Groynes slow down & reduce the impact of the tides. Reduce potential erosion.

- **Rip-Rap Wall Details (P33):**
    - Control Erosion.
    - Natural hazards which put coastline at risk.
    - Sediment is transported in a sinuous way due to the varying sea wave direction.
    - Coastal flooding will happen if there is potential thunderstorm.
- **Hazard Types (P35):** Flooding -> affects houses, shops by the seashore.
- **Minehead Harbour History / Context (P37):**
    - Sea Defence Scheme of Minehead Beach (Designed for >20 years).
    - **Main Industry:** Fishing (trying to catch herring). Tourism (Butlin's opened 1962).
    - **Tidal Range:** One of highest (2nd) in the world. Comes with its own risks (flooding, historically 300-320 years ago).
    - Combined with storm spring tides, there is flooding.
- **Stages of Sea Defence Scheme (P38-P39):**

1. **Planning stage:** 5 years by Michelle. Important in speaking to the stakeholders. Dealing with the boats. How to maintain & preserve the local archaeology.

2. **Feasibility Study:** UK is an island. Considered a range of options. Came out with preferred option (feasibility, cost, amenity).

3. **Environmental Impact:** Detailed design. Go through approval, planning (yes). Then only execution. Site investigation. Tides, waves, extreme storm floods.

4. **Construction:**
        - **Sea wall:** Curved, to deflect energy. ~2m. Pedestrian Wall ~3m.
        - **Concrete stop.**
        - Put in barges.
        - Stand spread.

        - **Rock Groynes:** About 1m, perpendicular to the beach. To hold on / maintain the sand that artificially brought in.
    - **Scheme is EFFECTIVE:** No major incidents happen. Transport of rocks are tough (300,000 tonnes). Create major challenges to get the lorries. Sourcing locally (Mendip). Using sea, railway (Sprivate). Communities are happy & it is environmentally friendly.
    - **Sheet piling (steel):** Being banged in during off-season because of the noise. Now they hydro press the sheet pile in hydraulically. Sheet pile to block the water flow, to stop the flooding.
    - Materials used tend to be higher quality because we want to use it as long as possible.
- **Sketch of Minehead Beach (P32 Left, P34 Left - close up):** Shows groynes, rip-rap, sea wall, beach, houses/hotel, harbour, vegetation.
- **Sketch Focus for Q5 (if coastal defences):** Sea wall (type), groynes, rip-rap, beach profile. Show how they interact with waves/sediment transport.

**Site 15: Allhallows Hill / Minehead North (Landslide/Slope) (Pages P40-P41)**

- **Location:** Allhallows Hill / Minehead North.
- **Think about:** Why hill is so high & steep? Think of the trees. Think of the ground conditions. Think about ground stability.
- **Stone:** Fine-grained rock.
- **Slope Characteristics:** Steep hill, High cliff. Well vegetated, very stable (currently).
- **Hill Details (P41):**
    - Localized area where you have failure.
    - Trees are branded on the top. Visible roots.
    - Behind the hill, it is primarily rock.
    - Soil will grow and extend into the ground.
    - Once there is crack in the rock, water will flow in & erosion occurs.
    - Some trees are very tall, strong wind will blow it down. It may bring down more trees.
    - Man-made brick wall.
    - Gabble-sized rock throughout the sea-shore.

  - **Ground:** Man-made. Steep angle from the hill suggests movement for the land.
  - **Vegetation:** Readily adapts to salt water. (Diagram: man-made ground, natural slope, cable).
  - **History:** Rubbish dump site. Now sealed for green vegetation.
  - **Seepage:** Long time to decompose. Release methane gas. Composted to decompose.
- **Sketch Focus for Q5 (if a coastal slope/landslide):** Profile of the hill, rock type, soil cover, vegetation, evidence of past instability (e.g., old dump site, cracks), man-made structures (walls, paths).

**Site (No Number, looks like Culver Cliff area): Red Cliff / Culver Cliff (Faults, Folds) (Pages P44-P47)**

- **Possibly Red Cliff Fault (P45):**
  - The material at the fault is soft & brittle, which is due to FAULT BRECCIA, where 2 surfaces rub together & breaks down the material.
  - FAULT DRAG: process of horizontal bed curving up.
  - **NORMAL Fault Diagram (P45):** Beddings are forced apart/together. During mountain-building, focus with granite as the material.
  - Can't trace bedding as it is a vertical offset.
- **Sketch of Culver Cliff (P44):** Shows a fault, some reddish rock, some yellowish (possibly weathered or different unit).
- **Sketch of Red Cliff (P46):** Shows complex geology:
  - Chimney.
  - S-shaped folds.
  - Anticline.
  - Faults.
  - Roughly horizontal red beds.
- **Old Red Sandstone (ORS) Details (P47):**
  - All through (West) England.
  - Goes back to Devonian era.
  - Red due to a lot of iron -> Terrestrial or shallow marine environment.

    - Stone forms rectangular & square blocks.
    - Chimney that all discontinuities meet up at. Dangerous, likely to collapse.
    - Fault suggests rock forced apart/together.
    - Anticline occurs when rock pushed together.
    - Rocks on the end of beach go to very steep limb of anticline (almost 90°).
    - M-Shaped folds at top of anticline.
    - Z-shaped & S-shaped folds on limbs of anticline.
    - Smaller parasitic folds all join up what we saw. (Diagram of anticline with parasitic folds).
- **Sketch Focus for Q5 (if complex cliff like Red Cliff):** Folded and faulted strata (e.g., ORS). Show anticlines, synclines, faults (normal/reverse if identifiable), fault breccia, drag folding. Label different rock units if distinct.

**Site (No Number, Soil Exposure) (Pages P48-P51)**

- **Location:** Western end of Culver Cliff. Weather: Windy & Strong.
- **Observation:** Soil Exposure.
- **Soil Characteristics (P48-P49):**
    - ~2-3m in length.
    - Not aeolian.
    - Behind the soil exposure, there is a big slope, and there is a landslide.
    - Natural flow down the hill side.
    - Colluvium, we saw illuviation.
    - Clayey content & mixture of many materials.
    - Very angular.
    - Fairly flat, tended to bed.
    - Orientation: Material is horizontally.
    - Predominant material: Sand, silt, gravel, clay, cobble?
    - **Particle Size Distribution Sketch (P49 top right):** Gravel > Sand > Silt & Clay. (Well-graded soil).
    - **Medium density.**

    - **Colour:** Reddish brown.
    - **Soil Type:** Angular predominantly, gravel & ... in a matrix of silty clay.
    - At the top, there are more rounded material.
    - Angular material: travel far & distance from the hill (fragments of old red sandstone, lower energy forces).
    - Categorization of clear (clear is not always useful).
    - **3 layers (P49 bottom right):** Top - Boundary Pale Brown (Elluviated, away), Mid - Darker Brown (Illuviated), Bottom - Dark Orange (Slightly more iron rich).
- **Water Table & Soil Properties (P50):**
    - No seepage. No erosion.
    - If water table is below the surface, pore pressure is negative (Usually, it is heavily dependent until rain). Uniform.
    - Gravel makes the soil strong.
    - In soil Mv, we talk about style of internal shearing resistance.
    - We can use diff. in-situ tests to predict $\phi'$.
    - **Compressibility:** The whole rock potentially incompressible. But local extracted sample can be moulded into a lump (Compressible). Local appears small part.
    - This soil exposure does not get destroyed over time.
- **Sketch of Soil Profile (P51 Right):** Shows distinct layers: Topsoil/Vegetation, Pale Brown, Dark Brown, Dark Orange. Compass N.
- **Rock Description: Old Red Sandstone (P52 Right):**
    - Colour: Dark Brown. Cross-bedding.
    - Grain: Very fine.
    - Structure: Bedded, sag.
    - Texture: Smooth, weathered.
    - Strength: ...
    - Stability: Rock slope, shear something, (Fissures).
    - State of: Very weathered.

    - Discontinuities: Closed aperture, spacing (~10cm-1.5m).
    - Fracture: Smooth, stone.
    - Rock Mass Permeability: Impermeable.
- **Sketch Focus for Q5 (if soil exposure):** Layered soil profile, describe material in each layer (grain size, angularity, colour), note parent material if known (e.g., weathered ORS).

**Site: Portishead (Bridge & RMR) (Pages P52-P53)**

- **Location:** Portishead. Weather: Sunny.
- **Objective:** Sketch the map of Britshg(?), Investigate of geology in Portishead.
- **West Hailing Point:** Understand the ground is crucial for the facilities.
- **Bridge History/Context:**
    - In 1950, the first bridge that provides shortcut from England to Wales is built.
    - Second bridge is built in late 1900s.
    - Effects of wind are considered too in the construction.
    - Jurassic tunnel, long tension being built and joist together.
    - Construction stopped because of ... -> Cost. -> Approval from the government.
    - **Bridge has 3 components:** 1km long Cable system for bridge. Channel at the centre of the bridge. Sign difference between high tide and low tide.
- **Map Measurements (4/5) (P52 Left):**
    - **RMR:** Range (R)
        1. Intact rock strength: UCS=100MPa -> Rating 12
        2. RQD = 115 - Jv*3.3 = 115 - x*3.3 = ... (0.22) -> Rating 17
        3. Spacing of discontinuities: ~60cm -> Rating 10
        4. Conditions of joints: Slightly rough, High weathering -> Rating 20
        5. Groundwater: Completely dry -> Rating 15
        - **RMR = 70 => Class II: Good rock.**
    - **Map Data (Bedding/Joint orientations):** Locality, Bedding (dip/dip dir), Joint (dip/dip dir).

        - Fault located at 016N 447E.

- **RMR (General, P54):**

1. Strength
2. Joints: num of discontinuities: 4 joints
3. Degree of weathering: Very weathered

- **Conglomerate Description (P55):**
    - Colour: Black
    - Grain size: Pebble sized, Grounded cobble, Gravel, small
    - Sandy, silty clay
    - Structure: Interlocking structure
    - Texture: Rough
    - Stability: Sliding failure, unstable
    - State of Weathering: Slight, very weathered
    - Rock name: Conglomerate
- **Sketch Focus for Q5 (if bridge foundation):** Rock type at abutments, key discontinuities, RMR assessment if relevant data is provided in the image.