	Part 12.1	Part 12.2	Part 12.3
Title (of each part)	What Sediment Facies are common on the Antarctic Margin?	ANDRILL 1B – The Big Picture	Pliocene Sedimentary Patterns in the ANDRILL 1-B Core
How much class time will I need? (per part)	40 to 60 mins + (depends on amount of discussion, extra material used, student experience, or 'mini-lectures' given)	30 to 120 mins (depends on amount of discussion and extra material used, or 'mini-lectures' given, and student experience)	40 to 80 mins (depends on student level, amount of discussion and student comfort with math and rate calculations)
Can this be done independently (i.e., as homework)?	Yes. Would need follow-up discussion in class	Yes. Would need follow-up discussion in class	Yes. Would need follow-up discussion in class. Might need preparatory review of rate calculations.
What content will students be introduced to in this exercise?			
Science as human endeavor			
Judgement, decision-making, problem-solving	x	x	x
Science as an evolving process / Nature of Science			
New Research builds on previous research	x	x	x
Unexpected discoveries	x	x	x
Exploratory research vs. focused questions			x
Research enabled by technology (technology change through time)		x	x

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Earth History Archives (nature of the sedimentary record)			
How do you know about earth history? Types of archives outcrops vs. cores	x	x	x
Where do you go to learn about earth history? Land vs. sea vs. ice	x	x	x
Geographic awareness	x	x	x
Awareness of deep time		x	x
Marine sediments (distribution & controls on distribution)	x	x	x
Stratigraphic Principles			
Relative dating	x	x	x
Subdivisions of geologic time			x
Unconformities, hiatuses, missing records	x	x	x
Climate Change			
Glacial-interglacial cycles	x	x	x
Climate change can be gradual	x		x
Greenhouse - Icehouse			x
Climate change can be abrupt			x
Regional to global scales of change		x	x
Ocean-atmosphere-biosphere-cryosphere system interactions/feedbacks	x	x	x
High latitude climate change sensitivity	x	x	x
What types of transportable skills will students practice in this exercise?			
Make observations (describe what you see)	x	x	x
Recognize trends (abrupt vs. gradual vs. patterns)	x	x	x
Plot data – map, graph, pictoral form		x	
Form Questions		x	
Interpret graphs, diagrams, photos, tables	x	x	x
Make hypotheses or predictions	x	x	x
Test a hypothesis	x	x	x
Critical reading & analysis		x	
Synthesize/integrate & draw broad conclusions	x	x	x

Math Integration			
Perform calculations (rates, averages, unit conversions) & develop quantitative skills		x	x
Communication			
Written communication	x	x	
Making persuasive, well supported arguments	x	x	x
Uncertainty in Science			
Identifying assumptions & ambiguity	x	x	x
Levels & types of uncertainty (quantitative vs. qualitative)		x	x
Significance/evaluation of uncertainties & ambiguity	x	x	x
What general prerequisite knowledge & skills are required?	None required, but prior exposure to the following topics would be helpful: 1. Antarctic Geography 2. Nature of the Cryosphere 3. Nature of sediment cores 4. General stratigraphic principles 5.General geologic time scale	1.Ability to summarize / write in clear written english 2. Ability to read stratigraphic columns 3. Basic understanding of the concept of different depositional environments 4. Ability to make simple estimates and determine approximate percentages	1. Ability to follow instructions 2. Basic knowledge of what a sed core is 3. Ability to read stratigraphic columns 4. Basic math skills (rate calculations) 5. Knowledge of long-term orbital variations of eccentricity, obliquity, and precession (see Climate Rhythms module)
What Anchor Exercises (or Parts of Exercises) should be done prior to this to guide student interpretation & reasoning?	1.Intro to Cores exercises 2.Cenozoic Overview exercises 3.Seafloor Sediments exercises 4. Past Antarctic Climates exercises	Part 1 of this exercise 2.Intro to Cores exercises 3.Cenozoic Overview exercises 4.Seafloor Sediments exercises 5. Past Antarctic Climates exercises	1. Parts 1 and 2 of this exercise; 2.Intro to Cores exercises 3.Cenozoic Overview exercises 4.Seafloor Sediments exercises 5. Past Antarctic Climates exercises 6. Climate Rhythms exercises

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What other resources or materials do I need? (e.g., internet access to show on-line video; access to maps, colored pencils)	1.World map or globe; Map of Antarctica or the Arctic 2.Internet connection and data projector for viewing videos, and access to supplementary materials 3.Document camera or over head projector for discussion of figures 4. You may want to print out/laminate images in Figure 3 for use in class	1.World map or globe; Map of Antarctica or the Arctic 2.Internet connection and data projector for viewing videos, and access to supplementary materials 3.Document camera or over head projector for discussion of figures 4. Calculators 5. Highlighters help students select abundant facies in Table 2 (Question 5) 6. Hand-lens or magnifying glass to help read fine print in Figure 1 – or print out of enlarged versions	1.World map or globe; Map of Antarctica or the Arctic 2. Document camera or over head projector for discussion of figures 3. Calculators 4. Maps / figures from 'Past Antarctic Climates' exercises for use in discussions 5. Earth-Sun-Moon model if students need assistance with seasons and obliquity, eccentricity and precession. 6. Symbols used for sediment portrayal in sediment core logs
What student misconception does this exercise address?	1.All sediment is the same 2. Nothing can live in 'cold' water (diatoms) 3.Diatoms are plants (they are not plants) 4. The depositional environment at one fixed locality cannot change over time (they DO change over time) 5. There is no order or reason for the sedimentary sequences that we see. 6. It is all in Antarctica, so it won't tell us anything useful about climate change because it has always been cold there	1.There really isn't much one can do with a a sediment core from the seafloor 2. Only igneous rocks provide paleomagnetic data 3. The information is too complex to make any interpretations 4. Microscopes are used only for biology	1.Thre is no real reason for changes in seafloor sediment 2. All cores of a fixed length represent an equal amount of time (i.e. rate of sedimentation does not matter) 3. Repeated patterns in sedimentation are just chance

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What forms of data are used in this? (e.g., graphs, tables, photos, maps)	3-D sketch, cross section, written descriptions, core images, core logs	Videos, core logs, tables	Core logs, thicknesses, age data
What geographic locations are these datasets from?	Antarctica	Antarctica (Ross Sea region)	Antarctica (Ross Sea region)
How can I use this exercise to identify my students' prior knowledge (i.e., student misconceptions, commonly held beliefs)?	Instructor 'grading' of exercises checks on student understanding of: Sedimentary environments, order of depositional events (& Walthers Law); sedimentological terminology and reasoning; ability to predict and develop hypotheses – and test them; how to apply knowledge of depositional environments in core interpretation	Instructor 'grading' of exercises checks on student understanding of: Data that can be 'collected' from a sediment core; estimate percentages; develop simple reasoned interpretations	Instructor 'grading' of exercises checks on student understanding of: Reading core logs; complete guided rate calculations; make connections (orbital cycles)
How can I encourage students to reflect on what they have learned in this exercise? [Formative Assessment]	1.Ask students: what they found interesting/useful? 2.Ask students: what was new? 3.Ask students: what questions it makes them want to ask?		
How can I assess student learning after they complete all or part of the exercise? [Summative Assessment]	See suggestions in Summative Assessment section at end of Instructor Guide		
Where can I go to for more information on the science in this exercise?	See the supplemental materials and reference sections at end of Instructor Guide		