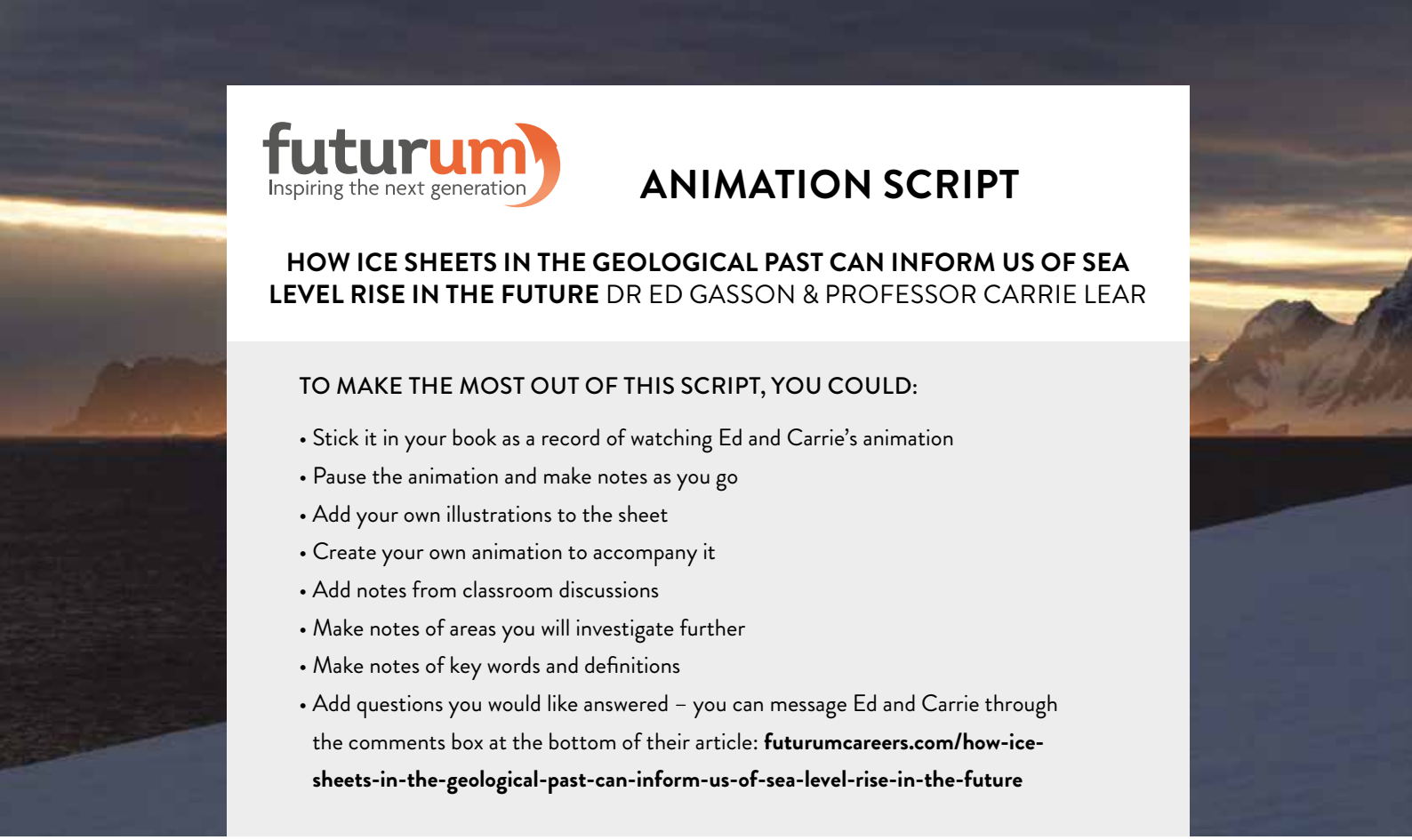

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ANIMATION SCRIPT

HOW ICE SHEETS IN THE GEOLOGICAL PAST CAN INFORM US OF SEA LEVEL RISE IN THE FUTURE DR ED GASSON & PROFESSOR CARRIE LEAR

TO MAKE THE MOST OUT OF THIS SCRIPT, YOU COULD:

- Stick it in your book as a record of watching Ed and Carrie's animation
- Pause the animation and make notes as you go
- Add your own illustrations to the sheet
- Create your own animation to accompany it
- Add notes from classroom discussions
- Make notes of areas you will investigate further
- Make notes of key words and definitions
- Add questions you would like answered – you can message Ed and Carrie through the comments box at the bottom of their article: **futurumcareers.com/how-ice-sheets-in-the-geological-past-can-inform-us-of-sea-level-rise-in-the-future**

SCRIPT:

The melting of the Antarctic Ice Sheet and subsequent changes to sea levels could have profound impacts on communities all around the world.

Current projections of how sea levels will change by 2100 and beyond vary significantly. Sea levels could fall slightly due to ice sheet growth from increased snowfall as the Antarctic warms. They could also rise as the ice sheet melts.

To improve current projections, Dr Ed Gasson, at the University of Exeter, and Professor Carrie Lear, of Cardiff University in the UK, are simulating glacial and interglacial conditions in the Earth's past with the aim of understanding the extent of sea level change in the future.

Precise predictions of future climates are hard to achieve. However, Earth scientists can look into the geological past to find out what climates were like, and how the ice sheets changed during these periods.

The last time the atmospheric CO_2 conditions were as high as today was around 3 million years ago in the mid-Pliocene.

To reconstruct past climates, scientists can measure atmospheric CO_2 from gas bubbles trapped in ice cores. These only provide measurements for the past 800,000 years; to go further into the past, a range of indirect techniques,

called proxies, are used. If these match the changes measured in the ice cores, scientists can be confident that the proxies are reproducing atmospheric CO_2 levels further back in time.

The rate of CO_2 increase is much faster now than in the past, and we will even exceed the CO_2 concentrations in the mid-Pliocene by 2025.

Ed and Carrie can calculate ice sheet volume by analysing trace metals and the isotopic composition of microfossils within sediments. This tells them how warm the oceans were in the past and how much CO_2 was dissolved in them. They also use oxygen isotope ratios of fossil plankton which tell them how salty the oceans were.

The team simulates how big the ice sheet was during the cooler 'glacial' stages of the mid-Pliocene, and how small it was during the warmer 'interglacial' stages.

Simulating Antarctic Ice Sheet melt during past warm intervals is challenging because ice sheet changes inferred from palaeoclimate data are larger than Ed and Carrie can simulate using their models. This means that a model could underestimate sea level changes, making predictions for the future misleading. If the team can reduce the palaeoclimate data ranges, future sea level predictions will be more accurate.

Team member Amy Thomas-Sparkes has prepared hundreds of fossils for analysis and knows the exact ages of these fossils. This will help the team to calculate how fast the Antarctic Ice Sheet grew and decayed in the past.

The new sea level records from these fossils will help Ed and Carrie test and calibrate their own ice sheet models. Currently, these models predict faster rates of sea level rise in the future, but there are still modelling issues that need to be addressed.

Models must pass the test of matching previous Pliocene sea level estimates. However, because the range of Pliocene sea level estimates are so large, many different models pass this test. The team hopes to narrow the number of models that pass the test, so they can narrow the range in future projections.

Ed, Carrie and Amy are working hard to help us prepare for changing sea levels.

How could you contribute to the field of Earth and environmental science?