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Guest Editorial

Seymour (Marambio) Island: an outstanding example of Antarctic geological heritage

Antarctica has many sites containing geological features of global scientific importance. Such sites allow us to understand the geological history of the Earth, the processes which have formed it, past and present climates and landscapes, and the origin and evolution of life. But how are these Antarctic sites to be given the international recognition that they so clearly merit?

The SCAR Action Group on Geological Heritage and Geoconservation has developed a methodology to systematically identify scientifically important Antarctic geological sites that contribute to global geological heritage. The methodology follows that of the *Global Geosites Project* (originally adopted by UNESCO and the International Union of Geological Sciences) but adapted for the unique circumstances found in Antarctica. Geosites are identified as outstanding representations of a limited number of geological themes, or Geological Frameworks, that cover the most significant events in Antarctica's geological past. The identification of Geosites can also assist Antarctic Treaty Consultative Parties (ATCPs) when conducting Environmental Impact Assessments for activities in Antarctica, and in the identification of vulnerable geological locations requiring greater management or protection.

After broad consultation within the SCAR geoscience community, nine Geological Frameworks were identified. One of these was the Cretaceous-Paleogene (K-Pg) transition, which concerns the period sixty-six million years ago when an asteroid hit Earth wiping out approximately three quarters of plant and animal species globally, including the non-avian dinosaurs. The event is used as a chronostratigraphic marker for the end of the Cretaceous Period (K) and the start of the Paleogene (Pg), marking the transition from the Mesozoic to the Cenozoic Era.

The Action Group met in Cambridge in March 2020 to identify Geosites for the K-Pg transition Geological Framework. The result was the selection of one specific sector of Seymour (Marambio) Island, north-eastern Antarctic Peninsula. Here, uninterrupted deposition across the K-Pg boundary reveals major declines in species diversity following the asteroid impact. Crucially, the location contains fossil evidence that the extinction at high latitudes was just as extensive as in lower latitude sites closer to the impact site, and that the effects of the event were truly global. The general lack of surface cover and permanent ice/snow mean little of the sequence is obscured across the 7 km-long exposure of the K-Pg boundary, making it an exceptional site for research. Over 200 publications have been produced on the geology of the area by researchers from many nations, including Argentina, Brazil, Chile, the Czech Republic, Poland, Spain, Sweden, the United Kingdom and the United States. However, the globally important geology of Seymour (Marambio) Island is under increasing threat from human activities. Intensive research programmes are reducing the area's scientific value through oversampling and 'mining out' of some finite fossil locations. Changing sea ice conditions mean easier access by cruise vessels, which in turn facilitates higher levels of tourist visitation. This may increase the opportunity for casual souveniring, or movement of fossils out of their stratigraphic context, despite the best efforts of tourist guides. What can be done? Oversampling of the remaining fossils could be reduced by encouraging geologists from different nations to make maximum use of the existing significant fossil collections located in repositories worldwide. Furthermore, the ATCPs could be encouraged to consider the use of existing management tools to protect the island's extraordinary geological values, including further coordination of research activities and controlling tourist access.

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