Attachment A

[DRAFT] SCAR Code of Conduct for Geosciences Field Research Activities in Antarctica

Background

- This Scientific Committee on Antarctic Research (SCAR) Code of Conduct (CoC) for Geosciences Field Research Activities in Antarctica provides guidance when planning or undertaking geological or geophysical field research activities in the Antarctic Treaty area, in order to minimize human impact on the Antarctic environment and to preserve the region's geological heritage. The CoC was prepared by the SCAR Action Group on Geological Heritage and Geoconservation, building on the SCAR Geological Sampling Code of Conduct (GeoReach Newsletter, SCAR GSSG Vol. 7 May, 2008), and with input from the SCAR geological community before and during the SCAR/IASC Open Science Conference in Davos, 15-26 June 2018. The guidelines have been finalised through broad consultation, including with the Council of Managers of National Antarctic Programs (COMNAP). [TO BE UNDERTAKEN]

- The SCAR Environmental Code of Conduct for Terrestrial Scientific Research in Antarctica (2018) (https://www.scar.org/scar-library/search/policy/codes-of-conduct/3407-code-of-conduct-terrestrial-scientific-field-research-in-antarctica/) continues to provide guidance on practical measures to minimize impacts by scientists undertaking fieldwork in terrestrial environments, generally applicable to different scientific disciplines and across all of Antarctica. The Code of Conduct for Activity within Terrestrial Geothermal Environments in Antarctica (2016) (https://www.scar.org/scar-library/search/policy/codes-of-conduct/3406-code-of-conduct-geothermal-environments-in-antarctica/) provides guidance for scientists, including geologists working in geothermal areas.

- This SCAR Code of Conduct for Geosciences Field Research Activities in Antarctica was developed in recognition of a specific need for guidelines for scientific activities beyond those generally applicable guidelines above, since geological field researchers may operate under unique conditions and circumstances where more specific and customized guidance may be needed to safeguard the values of geological sites. The CoC will be updated and refined as new scientific results and environmental impact reports become available.

Introduction

- Antarctica contains many unique geological (i.e. petrological, mineralogical, stratigraphical, tectonic, geochronological, geomorphological, palaeontological and meteoritic) features. Many of these features may be vulnerable to disturbance and easily and irreversibly damaged. In Antarctica, geological specimens may be vulnerable to unauthorized collection. Furthermore, some geological fieldwork employs destructive methods and techniques, resulting in environmental impacts and impact on the scientific value of an area. Cumulative impacts resulted from repetitive scientific and logistic activities can also result in a reduction in the scientific value of some geological sites. Geological specimens such as rocks, minerals, fossils and meteorites, are finite scientific resources. Thus it is important to safeguard the scientific value of geological sites and ensure adequate material is available in the field and repositories to allow future geological research to be undertaken.

- This CoC provides recommendations on how scientists and associated personnel can undertake geological field activities while protecting Antarctic geological heritage for future generations. All countries that undertake terrestrial geological field research in Antarctica are encouraged to include this CoC within their operational procedures and to ensure that personnel undertaking or

supporting scientific research in the field follow this CoC. It is recommended that this CoC be followed by all personnel undertaking or supporting scientific research to the maximum extent possible, so long as it does not affect the safety of the expedition.

1.

- The Protocol on Environmental Protection to the Antarctic Treaty (also known as the Madrid Protocol or Environmental Protocol) provides a basis for environmental protection alongside other associated regulations adopted by the Committee on Environmental Protection and the Antarctic Treaty Consultative Meeting. This CoC complements the relevant sections of the Protocol and provides guidance for researchers conducting land-based geological field research in the area of land and permanent ice south of latitude 60 degrees south.

2.

- Antarctica's geological heritage has not been systematically identified, and its values, and risk from anthropogenic impact, have yet to be assessed. Through this CoC the community is encouraged to identify and evaluate of sites of special geological interest, including those at risk of damage.

General guidelines

- Field activities of any kind, but including geological work in Antarctica, should be designed to have as little environmental impact as possible.
- Careful planning is required before undertaking research within ice-free environments, and appropriate measures need to be considered to help maintain the integrity of sites. If possible, coordination with other researchers is suggested in order to maximize the potential use of samples.
- The locations of sites visited and nature of activities undertaken should be documented and maintained in a national data centre, which may also link to the Antarctic Master Directory (AMD) and include accurate location positions, so that visited and unvisited sites may be more easily distinguished by future researchers.

Before going into the field

- In accordance with the provisions of Annex I to the Protocol on Environmental Protection to the Antarctic Treaty, and as part of the planning process, the researchers should provide, in advance, adequate information for carrying out an environmental impact assessment (EIA) to the national authority responsible for undertaking these evaluations. This information should include details such as the type and approximate quantity of samples to be taken, location of sample sites, sampling methods, type of transportation (e.g. use of vehicles), if any scientific equipment or structure will be left and for how long, and any planned restoration of the site. For further information, consult the "Guidelines for Environmental Impact Assessment in Antarctica" (Annex to Resolution 1 (2016)), available at: http://www.ats.aq/documents/recatt/Att605_e.pdf.
- When planning any field activity, it is necessary to inquire whether the work site is within an Antarctic Specially Protected Area (ASPA). If this is the case, consult the ASPA Management Plan in order to ensure that the planned activity is permitted within the area. Then, ask for a permit for entry to the ASPA issued by an appropriate national authority, providing the following information: type and approximate quantity of samples to be collected, location of sample sites, sampling method, type of transportation (e.g. use of vehicles), if any scientific equipment or structure will be left and for how long, and any planned restoration of the site. After the fieldwork is completed, ensure a report of the ASPA visit is provided to the permitting authority, including any evidence of damage to geological and any other specified values in the area.

- A permit is not required to enter an Antarctic Specially Managed Area (ASMA). However, a copy of the ASMA Management Plan should be obtained and the guidelines understood. In particular, agreement should be obtained from the relevant national authority to access and undertake geological research, including sampling, within any Scientific or Restricted Zones, as described within the associated ASMA Management Plan.

- At locations where geologists from different nations are operating, consideration should be given to coordinating activities to minimise environmental impacts and potential oversampling. Information on proposed activities should be recorded by the permitting authority on the Electronic Information Exchange System (EIES; https://www.ats.aq/e/ie.htm), which is managed by the Antarctic Treaty Secretariat.

- In order to minimize substrate erosion and vegetation trampling, routes should be planned for vehicle and pedestrian transit before going to the field. Researchers are encouraged to request advice and information from the national authority regarding any existing GPS tracks. Where these do not exist or cannot be provided, available aerial or satellite imagery or maps should be used to determine the route likely to cause the least environmental damage. If helicopters are to be used, landing sites should be selected where the site's values will not be impacted.

- If geological samples are transported through another country *en route* to the home nation, please ensure that any legal requirements of that country are understood in order to avoid legal problems (i.e. at the customs).

Once in the field

- In ice-free areas, the presence of terrestrial biological habitats and species may not be obvious to non-experts (e.g. soil crust, endolithic communities, crustose lichen and sparse moss communities, freshwater bodies, ground nesting birds, etc.). To the maximum extent practical, care should be taken not to inadvertently trample vegetation, soils, or terrestrial or freshwater biological habitats.

- In accordance with the SCAR Environmental Code of Conduct for Terrestrial Scientific Research in Antarctica, ensure adequate biosecurity procedures are implemented to reduce the risk of the introduction of non-native species (for instance seeds, invertebrates, etc.) and the inter-regional transfer of native biota. For further information about biosecurity procedures, consult the CEP Non Native Species Manual (edition 2017), available at: http://www.ats.aq/documents/ATCM39/ww/atcm39_ww009_e.pdf

- In accordance with an EIA, assessed by an appropriate national authority, researchers may remove geological samples for further scientific study. To maintain the scientific integrity of a location, however, fossil, mineral or rock materials should not be moved out of their original stratigraphic context into another stratigraphic context.

- If geological or palaeontological samples are to be taken for the purpose of research, sampling should be minimized, particularly with regard to the extraction of large amounts of fossils or rare minerals. Only the minimum amount of material required for the scientific project should be collected, in accordance with the quantities specified in the Environmental Impact Assessment for the project. Enough material/specimens should be left to allow future researchers to understand the context of the material.

- Under exceptional circumstances, it is recognised that it may be necessary to collect a rare or fragile specimen, thus leaving no further material. Once the study is finished, this material should be deposited in an appropriate repository of geological samples.

- If sites are at imminent risk of being destroyed by natural processes (such as landslides, lake water level changes or erosion processes) try to gather as much information as possible (e.g. photographs, samples, etc.).

- Minimise the use of explosives, rock saws, rock drills and other mechanical equipment for sample collection.

- During work performed in rock and unconsolidated sediment profiles (e.g. where sedimentary sequences are cleaned to permit more accurate description/sampling), after sampling leave the surface as worked on, without trying to restore the original appearance of the site. The 'clean' surface has more scientific, educational and visual value than the restored one. However, if the researcher considers that leaving the surface as worked on is likely to increase erosion, steps to minimised erosion, such as infilling, should be undertaken.
- When digging a pit in soils, follow these procedures depending on the type of soil:

    - In areas where rich plants communities are present (e.g. the Antarctic Peninsula region, or coastal areas of East Antarctica), as far as possible restore vegetation after the work is finished. To achieve this, separate the plant material and upper organic horizon and, if possible, any further sediments of different texture. Then, after the field work is complete, refill the pit in the original order of the sediments and vegetation.

    - When sampling soil in desert areas, use groundsheets to contain excavated material to minimise the extent of damage to the desert pavement. Backfill soil pits and, as far as feasible, replace the desert pavement materials at the soil surface to restore the site appearance.

- Do not build new cairns in the field, but take GPS coordinates to indicate positions. Do not destroy existing cairns as they may mark earlier field locations.

- Avoid activities that could result in the dispersal of foreign materials into the environment. Ensure steps are taken to prevent wind-blown dispersal if using packaging material to wrap specimens, such as plastic sheeting (including for example, lacustrine sediment cores). Avoid the use of spray paint, solvents or acids. If use of paint cannot be avoided (e.g. for marking rocks to study their movement in geomorphological studies) use should be kept to an absolute minimum, and limited to a biodegradable paint.

- Take steps to minimise the potential for any spills of fuel, water for cooling drills or slurry generated from drill or saw operations. To prevent spill contamination in the field when using jack hammers or drilling equipment, use drip trays when handling fuels or other liquids and take particular care when handling fuels in high winds. Appropriate absorbent materials to contain fuel spills should be made available and, if used, necessary arrangements should be made for fuel contaminated absorbent material to be evacuated from the site and treated in accordance with Annex III to the Protocol.

- Some geological locations have intrinsic value, for example, those that contain rare minerals, fossils, particular lithofacies or special geomorphological features. If, during field research, a geological site of particular interest or outstanding scientific value is discovered, please inform the relevant bodies at the national and international level (e.g. the geosciences representative of the national SCAR Committee (https://www.scar.org/members-and-officers/national-committees/) and the SCAR Geoscience Group (https://www.scar.org/science/gsg/about/)). Please provide information, including the location, the spatial scale of the site, a simple description that includes details on the importance of the site, pictures and a reference bibliography. If the scientific value

of a location is in jeopardy due to anthropogenic impact, report this information, as detailed above.

Fossils

- When studying fossils in the field, minimise any disturbance caused by activities (e.g., drilling, digging, sieving). In the case of the extraction of large vertebrate skeletons (e.g., marine reptiles or whales), keep the working area tidy during use and ensure adequate labelling and packing materials are available.

- When taking plaster casts of fossils, do not leave evidence of plaster in the field after the plaster jacket is removed.

- If sieving for tiny fossils, do it on site and take care to avoid deposit mixing, which sometimes is unrecognizable in sediments that are originally poorly sorted.

Geomorphological features

- Some features, such as boulder belts and drop moraines, overturned clasts, scuffs and scrapes, perched cobbles and compressed ground, may not be obvious to non-experts and may be easily disturbed. Care should be taken to minimise disturbance to fragile geomorphological features, including, for example, patterned ground (i.e. frost-sorted polygons, stone stripes), dunes, glaciofluvial terraces, and raised beaches. Minimize vehicle and pedestrian movement over these areas as much as possible.

- Avoid disturbing ventifacts or changing their orientation.

- When digging into marine, lacustrine or glacio-fluvial terraces, take care to minimize the size of the cut section, especially if the remaining landform is very small.

Meteorites

- Meteorites can be found in Antarctica mainly on the ice surface or sub-surface, particularly in areas of upwelling blue ice. It is essential that candidate meteorites are not contaminated by handling, as this could compromise their use in future science, i.e. organic studies, astrobiology, halogen studies and light isotope studies.

- Should a candidate meteorite be found, it should not be touched or removed until adequate precautions have been taken to avoid physical disturbance and chemical and biological contamination and to preserve its scientific value. Take photographs, note the GPS position, mark the location with a temporary maker (such as a flag), and contact meteorite experts for further guidance on meteorite collection.

- Meteorites should be collected and curated according to accepted scientific standards, and should be made available for scientific purposes (see Resolution 3 (2001) ATCM XXIV - CEP IV, St. Petersburg).

Cosmogenic analysis

- Erratic boulders and polished surfaces may be of scientific use in dating glacial advance and retreat using cosmogenic analysis. This methodology requires the erratic boulders and surfaces to remain undisturbed. In order to preserve their scientific value, researchers and other visitors should be careful not to move or overturn erratic boulders or perched clasts.

- Researchers should not collect all the erratic boulders in a given area to ensure that future research using different techniques may be possible. If complete boulder samples or smaller sized samples

are taken, where possible, archive a portion of the sample for future research using potentially more sophisticated methodologies.

- Consideration should be given to recording human movement within areas using GPS and making this information available, so that future researchers may more easily identify boulders likely be undisturbed by human activity in the area.

- Cosmogenic analysis is destructive, but sometimes not all the collected samples are processed. Therefore, if available, deposit remaining samples and remains in repositories with public access and/or share the sample metadata through publically-accessible websites in order to optimize material-sharing within the framework of scientific cooperation.

Geophysics

- The relevant national authority must be informed of plans to install autonomous instruments in the field. When establishing autonomous instrumentation on rock, snow or ice, ensure that the site is visited and, if necessary, the equipment raised frequently enough to prevent damage or irretrievable burial. Retrieval of elements of the equipment may not be practical or feasible (e.g. deeply buried cabling). Take steps to keep this to a minimum, particularly during the planning phase of the project. The location of such equipment, and any disturbance related to its use, should be recorded and reported with a high degree of accuracy.

- When carrying out geophysical procedures, as permitted by the appropriate national authority, including seismic surveys, electrical resistivity tomography or radar surveys, consider proximity to local wildlife and minimise disturbance as much as possible.

- If constructing a concrete base or plinth on which to mount geophysical research equipment, take appropriate steps to minimise environmental impact from wind-blown cement dust.

- When establishing geophysical reference stations, take steps to ensure that they are well marked and obvious so that they are not inadvertently damaged or destroyed. Remove all markers and equipment when the work is complete. Under some circumstances, it may be important to maintain constructed reference stations plinths, bases or platforms (such as used in geodetical markers or gravimetric base stations) for future reference after the initial research is complete. In such cases, the station bases or structures should be clearly marked, details of their position and purpose submitted to an appropriate national database, and the need for their on-going presence reviewed periodically (e.g., every five years). Once deemed no longer necessary, they should be removed.

Post field work

- Geological sites may require subsequent monitoring to ensure adequate geoconservation management, which includes cumulative impact assessment (under the provisions of the Protocol for Environmental Protection to the Antarctic Treaty). For this purpose, the following information, as appropriate to the study, should be provided to the National Data Centre, which may also link to the Antarctic Master Directory (AMD) after the trip: quantity of samples collected, location of general sample area (including GPS position (necessary metadata: latitude, longitude, geodetic datum specified (e.g.WGS84)), sampling method, type of transportation (e.g. use of vehicles), evidence of previous impacts in the area, whether any artificial structure has been left and for how long it is expected to remain, whether site restoration was performed, etc.

- If during your field work you recognized that sites of geological value are in danger of being degraded by natural or anthropogenic processes, send details to the national Antarctic programme and SCAR Geosciences Group.

- In order to maximize scientific benefit and cooperation, ensure samples are made available to other researchers by placing them in an appropriate publicly-accessible geological collection, according to international agreements and national laws and repository regulations.

- Ensure adequate information on samples is recorded (e.g. sample numbering, sample location, orientation, etc.) and made available to other researchers once the sample is placed in a geological or palaeontological collection.

- Where possible, 3D scans of fossils should be made available through an appropriate repository such as phenome10k: http://phenome10k.org/.

- Repositories should retain sample metadata and link to the Antarctic Master Directory so future workers can find the material and so that samples can be made available to future workers.

- All publications resulting from geological fieldwork should acknowledge where the field samples and data are stored.