

**GEOTRACES INTERNATIONAL SSC MEETING
SALVADOR, BRAZIL
18– 20 SEPTEMBER 2017**

List of attendees

SSC Members:

Phoebe Lam (co-chair)
Reiner Schlitzer (co-chair)

Eric Achterberg
Adrian Burd
Zanna Chase
Jay Cullen
Vanessa Hatje
Tung-Yuan Ho
Marina Kravchishina
Maite Maldonado
Rob Middag
Hajime Obata
Alakendra N. Roychoudhury
Geraldine Sarthou
Yeala Shaked
Antonio Tovar Sanchez
Tina van de Flierdt
Liping Zhou

Other participants:

Graham Allen (BODC)
Bob Anderson (Past SSC co-chair)
Laurent Bopp (DMC)
Andy Bowie (DMC co-chair)
Ed Boyle (Past SSC co-chair)
Walter Geibert (Standards and Intercalibration Committee co-chair)
Gideon Henderson (Past SSC co-chair)
Catherine Jeandel (IPO science director)
Bill Landing (Data Management Committee member)
Maeve Lohan (Standards and Intercalibration Committee co-chair)
Elena Masferrer (IPO Executive officer)
Alessandro Tagliabue (Data Management Committee co-chair)
Ed Urban (SCOR)
Jing Zhang (Data Management Committee member)

MONDAY 18 SEPTEMBER 2017

Introduction

Vanessa Hatje welcomed SCC members to Salvador. Reiner Schlitzer introduced Phoebe as the new co-chair and welcomed the SSC. Reiner introduced Prof. Olival Freire, Pro rector Universidade Federal da Bahia, who welcomed all participants on behalf of the University president. He reviewed the history of Salvador as the first capital of Brazil and the 70-year history of the university. Reiner thanked Vanessa for hosting the workshop and for success in securing local funds to support the workshop.

Reiner introduced the new SSC members: Jay Cullen, Marina Kravchishina, Yeala Shaked, Rob Middag, Antonio Tovar Sanchez and Tina van de Fliertdt.

Reiner reviewed the agenda and then asked for additional items. Adrian Burd said that there is interest in coordinating or intercalibrating EXPORTS with GEOTRACES.

Reiner asked for approval of the minutes of the last SSC meeting, which are archived in the secure area of the GEOTRACES web site.

Review action items from 2016 SSC meeting

Reiner reviewed action items from the last meeting that have not yet been completed.

Action item 2: Alakendra Roychoudhury (Roy) to send to S&I the intercalibration report from data of their recent cruises.

Status: Roy will send it in 2 months.

Action item 19: Elena and Ed Urban to prepare a “Survey Monkey” questionnaire asking for feedback from IDP2017 and including a question to ask community’s opinion regarding the registration step.

Status: This will be a continuing action item from this meeting. Discussion: When should we solicit feedback? Reiner suggested doing it soon to get feedback in time to influence the content and form of Version 2. The DMC will review the questions before the survey is distributed.

Action: Elena Masferrer and Ed Urban to prepare a “Survey Monkey” questionnaire asking for feedback from IDP2017. (Note: This was done by the end of the SSC meeting).

Action item 38: S&I and Ludmila to work together to see if the aerosol data from Russian cruises could qualify as compliant data.

Action: Bill Landing to communicate with Marina Kravichishina about possible inclusion of Russian aerosol data.

Action item 39: Sunil Kumar Singh to submit a request for the SK/2016/05 to be endorsed by the second International Indian Ocean Expedition (IIOE).

Status: Roy saw that it has already been endorsed.

Action item 68: Bob to contact deVries and Primeau saying that there is interest in a model workshop

Status: Phoebe Lam discussed with Tim DeVries and established an ongoing interest. Bob lost track of this item and did not follow through. Adrian noted that DeVries is exploring other options.

Action: Adrian Burd to contact Tim DeVries about planning a modelling workshop.

National Reports

Australia– Zanna Chase

Zanna Chase reported about Australian activities. Four GEOTRACES related cruises occurred in the last year, including 2 coastal cruises off Antarctica and one subantarctic cruise. The subantarctic grant had the first deployment of the respiration sediment trap to examine TEI regeneration from particles.

Two new projects were funded and new cruises are forthcoming. The SR3 repeat transect, repeated from the IPY, will be in January 2018, but now proposed as a full Section. Andy Bowie has a cruise around Australia looking at aerosols.

Science highlights: Source of Fe around Heard and McDonald Islands. Volcanic sources of Fe were studied. High Fe concentrations were found in shallow coastal waters. McDonald Island has high Fe (II) concentrations, likely associated with sea floor gas emanations. Fe near Heard Island is likely glaciogenic.

The K-axis cruise did a tracer release to study natural Fe fertilization near Kerguelan. Late-season blooms were likely fertilized with Fe supplied by upwelling.

Australia will get a new ice-breaker in 2020.

New Zealand– Zanna Chase (on behalf of Claudine Sterling)

Zanna mentioned that the information she will provide is mostly from Claudine Sterling. She is working especially in the Black Sea, involving U, Fe, Cd isotopes. Claudine is also studying Cd isotopes in the SW Pacific subantarctic in a study of nutrient utilization. The report also described work in the Phantastic process study near Antarctica.

Brazil – Vanessa Hatje

Vanessa Hatje explained that the Brazilian Congress on Oceanography was held in Salvador with a GEOTRACES session. Most GEOTRACES talks were on SGD. Brazil is seeking time on the new Brazilian ship to run the coastal section along Brazil to Argentina. Not clear if they can cover all TEIs to make it a section cruise.

Brazil hosted the IUPAC 46th World Chemistry Congress this year that included a day on GEOTRACES topics, with 4 GEOTRACES speakers. A summary is being written for the Journal of the Brazilian Chemical Society.

Catherine Jeandel led a capacity building school on trace elements and isotopes (June 2017) in Salvador. Rodrigo Aguiar spent time in the lab of Katharina Pahnke.

The PIRATA cruise sailed in August but the new Brazilian ship had problems after the 2nd station and the cruise was terminated. The cruise will be rescheduled. Several TEIs will be sampled. Another cruise from Monaco to Rio de Janeiro (May 2017) undertook limited TEI sampling.

A new project will study TEIs introduced to coastal Bahia from submarine sewage outflows.

Canada – Jay Cullen

Jay Cullen reported that synthesis of Baffin Bay and Labrador Sea data is underway. There is an on-going process study along Line P. Canadian Arctic GEOTRACES (GN02 and GN03) focused on modification of Pacific water chemistry as it moves through the Arctic, the Canadian Archipelago and into the Atlantic. Many biogeochemical rate measurements were made alongside the GEOTRACES TEI measurements to establish sensitivity of primary productivity to environmental conditions. Canadian researchers are collecting TEI data along Line P in February, June and August. The main focus is on Fe.

Canadian Arctic GEOTRACES has had 2 synthesis/data workshops, one in December 2016 and one in May 2017. Joint Arctic synthesis efforts are being planned with US PIs. Line P samples are being collected for international partners.

China – Liping Zhou

Liping Zhou reviewed capacity building activities. Modellers are starting to show interest in GEOTRACES. Six universities in total are involved.

The Qingdao group is starting to measure dissolved metals in the Yellow Sea and Bohai Sea. The Xiamen group is measuring Fe flux from sediments. A cruise in the Bohai sea in July 2016 sampled for metals. This is an institute cruise, not a GEOTRACES cruise. The PI is still getting her lab up to speed. This is the first Institute of Oceanography in Qingdao, so they may become part of GEOTRACES. Qingdao has 2 institutes. Dr. Ren at OUC was the chief scientist of the Chinese leg that partnered with Japan last year.

New initiatives are looking at Ba isotopes and Al in the South China Sea.

January 2017 there was a planning cruise for the first China-GEOTRACES cruise in 2019.

The launch of the new vessel (Tan Kah Kee) was used to publicise GEOTRACES. The test cruise occurred 2-14 August 2017. The next test cruise will be in March 2018.

Intercalibration samples will be shared with other labs. The goal is to do GP09 in 2019. The main challenge is to get Chinese labs fully intercalibrated. China may become more involved in paleo proxy calibration.

France – Geraldine Sarthou

Geraldine Sarthou started her presentation reviewing three scientific highlights: 1) Bonus Good-Hope Fe isotope results are now published (Abadie et al., 2017, PNAS). Minimum $d^{56}\text{Fe}$ at intermediate depths is related to organic Fe regeneration. An increase in $d^{56}\text{Fe}$ with depth toward the bottom reflects non-reductive Fe release from sediments. 2) GEOVIDE aerosol fluxes were published (Shelley et al., 2017). Fluxes (and concentrations) are much lower than on GA03. Fluxes were estimated using 2 approaches: a) standard aerosol settling rate and b) ^7Be normalization. Good agreement between the 2 methods was found for about half of the TEIs. For the others, the disagreement ranged from factors of 2 to 40. 3) Tachikawa et al., 2017 published a new Nd isotope database. They developed a statistical correlation with hydrographic parameters to predict epsilon Nd.

France led the HERMINE cruise to the TAG site in the North Atlantic to study hydrothermal TEIs.

GEOTRACES-France published 21 peer-reviewed articles; 2 PhDs defended; 5 new PhDs started.

Germany – Eric Achterberg

Eric Achterberg reported because Katharina Pahnke could not attend. Two intercalibration studies were undertaken: Si isotopes (Grasse et al.) and a REE intercalibration (Behrens et al.)

Eric reviewed the publications from Germany. In total 23 publications were published or are in press.

Four PhDs were completed. A GEOTRACES process study was completed (UltraPac; Tim Ferdelman chief scientist). Michael Rutgers van der Loeff led the Fram Strait cruise as his last cruise before retirement.

Upcoming cruises: Kochinsky Amazon plume cruise in April 2018. Eric has GI06 funded along 23°S but the ship has not been scheduled. It will probably occur in 2019. Eric is writing a proposal for a South Pacific cruise along 32.5°S along WOCE P6.

Intercalibration samples from GA08 are being distributed. New surface-water reference samples will be collected in the South Atlantic next year.

Discussion:

Andy Bowie – He recommended that Eric schedule crossover stations with Australia and Japan.

India – Phoebe Lam

Phoebe Lam reported on behalf of Sunil Kumar Singh because Sunil could not attend. SK338 was completed in the Bay of Bengal. McLane pumps were used for the first time on India GEOTRACES cruise. Zinc data look good. Hafnium isotopes have also been published.

Israel – Yeala Shaked

Adi Torfstein and Yeala Shaked are the two GEOTRACES contacts in Israel. Work is mainly in the Mediterranean and Red Sea. Recently, investment in open water research followed discovery of offshore gas deposits. Yeala is interested in developing more international collaborations. Israel has 2 marine institutes, one is a collaboration of 7 universities and one is in Eilat, that is also a joint institute. Israel has a new open-ocean seagoing vessel and a new deep water time series with sediment trap moorings. Eilat has easy access to 700-m deep water for process studies. Time series measurements include nutrients, primary productivity, dust fluxes and sediment traps. A 13-year time series shows occasional overturn to at least 800 m.

Adi looks at interaction between dust deposition and phytoplankton response. Dust deposition has been measured weekly for 10 years. Sediment traps were deployed since 2014. Adi measures dissolved epsilon Nd and lead concentrations, ^{234}Th , ^{230}Th and ^{232}Th .

Yeala studies Fe availability to phytoplankton. A video shows that a colony can capture dust particles and transport them to the colony centre to obtain metals. The colonies may leak dissolved metals to surrounding seawater. They also look at the role of bacteria in mobilizing Fe, involving siderophores.

Japan – Hajime Obata

Hajime Obata started his presentation reviewing GEOTRACES related meetings. The annual meeting of the Geochemical Society of Japan, last week, had 16 GEOTRACES presentations. Jing Zhang started a new working group on western Pacific marginal seas with the first workshop scheduled for 28 October 2017.

KH-12-4 was the initial GP02 but could not be completed, so KH-17-3 completed the section at approx. 47°N. The cruise track diverted to Ocean Station P for a crossover with Canada, and diverted to the Alaska coast to study glacial input of Fe to stimulate productivity.

Future: Hajime will apply for GP18 cruise at 155°E and Jing for a process study of TEI transport by the Kuroshio Current.

Science highlight: Nishioka and Obata, L&O, 2017 presented high subsurface Fe in the western subarctic Pacific.

Toshi Gamo has a GEOTRACES program proposal funded until 2020 for travel and meetings.

GP18 cruise will be slightly shifted to the west of the original section line. The new GP18 is designed to study the NW Pacific source of subsurface Fe.

Action: Hajime to send new GP18 cruise coordinates to DMC co-chairs.

Netherlands – Rob Middag

Rob Middag reported that GA02 and GA04N data are still being interpreted and published. Data from GA04N were submitted for IDP2017.

NIOZ has a new Neptune MC-ICP-MS. They are working with Tim Conway on issues related to setting up the mass spec.

A Baltic Sea cruise was held in 2016 to study sources of Fe, led by Caroline Slomp. Pore water work included a study of bio-irrigation as a mechanism to enhance Fe flux from the sediments.

New funding for a study of Fe and viral lysis from the Dutch Polar program in collaboration with Korea KOPRI will support a process study in the Amundsen Sea. They also have a collaboration with AWI in the Weddell Sea. A proposal for a GIN Sea process study is in preparation.

Med Sea GA04 dissolved Fe data are coming out. Dissolved Fe is high at surface (dust input) but low in deep water due to scavenging. Free iron in the surface ocean is low due to binding by ligands. Local mid-depth plumes of high dissolved Fe are thought to be linked to mud volcanoes.

Arctic work is examining Fe ligands. They find a correlation between chromophoric organics and Fe-binding ligands. They find a surface maximum in humic like substances that correlates with dissolved Fe. These features are in the transpolar drift.

Russia – Marina Kravchishina

Marina Kravchishina informed that Russia is interested in river input and estuaries as well as sediment fluxes.

Ludmila Demina measured TEI fluxes in sediment traps deployed in the White Sea. The Tessier leaching method was applied to sediment trap particles to determine the phase holding the trace elements. Trace element concentrations in zooplankton are being measured in the Kara Sea. Large carbonate concretions in the Laptev Sea are being studied. Very low $\delta^{13}\text{C}$ suggests a methane source of the carbon.

Marina showed the Arctic map with the potential Russian transects. A related cruise in the Kara Sea was completed in August 2016. A cruise in the Barents Sea was completed in October 2016. A transect across the North Atlantic at 60°N is done every year. Russia proposed to collaborate with Macquarie University to study trace metals in 2017 but the expedition was cancelled.

Marina participated in a cruise in the Norwegian and Barents Seas in 2017, including samples for trace elements to be analysed by the University of Southern Mississippi. The ship was continuing to collect samples further east at the time of the SSC meeting.

Discussion:

Gideon – He asked about collection of samples for additional types of TEIs on future Russian cruises. Marina mentioned that most sampling is for particles and sediments and they hope to collaborate with other nations in sampling for dissolved trace elements.

South Africa – Alakendra Roychoudhury

Alakendra Roychoudhury (Roy) reported that a research priority is to study dust deposition and its impact on marine ecosystems. Incubation/leaching experiments showed that for 11 different metals, nearly all of the dissolution occurred in the first half hour. Milli Q water was used for the leach experiments.

Seasonal cruise samples from 2014 and 2015 have been analysed. Samples from 2015 and 2016 still need to be analysed. Cd correlates with P and Zn correlates with Si. The Co – Mn relationship is difficult to interpret. Phytoplankton taxa composition south of Africa is being measured using pigment analyses.

Many of the recent publications focus on nitrogen biogeochemistry.

Three MS theses have been completed and all three students will continue to do a PhD.

They hope to continue to reoccupy the Bonus-Good Hope line in summer and winter for the next 2 years.

A recent winter cruise sampled at 7 stations along 30°E. Dissolved, particulate and total trace metals will be measured for many metals. Samples were collected for 8 different isotope systems.

South Africa has an IIOE-II cruise along the coast of Mozambique and Kenya in October 2017. Roy did not find out in time about the cruise to mount a TEI sampling program.

Spain – Antonio Tovar Sanchez

Antonio Tovar explained that the report includes contribution from six PIs. Eva Calvo is a new contributor interested in organic and inorganic proxies. Antonio is studying the impact of river input on trace metals in the Gulf of Cadiz, including Rio Tinto, which carries huge amounts of mine wastes. They are studying Tinto, Guadiana, Odiel and Guadalquivir rivers.

They participated in the French PEACETIME cruise in 2017. GEOTRACES-Spain completed 2 theses and 18 publications in the past year.

Cadiz has a new clean room and a new clean sampling system that can sample to 600 m. The bottles are all Teflon. The system was constructed in Spain and is the only one in the world.

Korea – Bob Anderson

Bob Anderson reported about his efforts in involving Korea in GEOTRACES, he finds it difficult to identify the proper point of contact. Bob alerted that at Goldschmidt 2018 there was a poster from a Korean scientist which was showing plans for Korean “GEOTRACES” cruises that GEOTRACES has never approved. Bob asked SSC members having information on who could be the best institution/scientist to be approached to inform Bob.

Action: Any SSC member having information on who could be the best Korean scientist/institution point of contact to inform Bob Anderson.

Taiwan – Tung-Yuan Ho

Tung-Yuan Ho informed that funded research focuses on aerosol sources of TEIs.

Five people from Taiwan participated in the Asia GEOTRACES workshop in Hokkaido in January 2017.

The new Taiwan research vessel, the *R/V Legend*, was launched in May 2017 and the first research cruise is planned for September 2018. Eventually Taiwan plans to have 5 new research vessels.

Tung-Yuan reviewed aerosol research. Dongsha atoll, offshore, has daily aerosol sampling. Aerosol concentrations are very high. Percent Fe solubility ranges from 1 – 100% and correlates with the V/Fe ratio (indicating anthropogenic sources). Samples with high Fe solubility also have very low $d^{56}\text{Fe}$.

He recommends Abby Ren and Denner Huang as replacements on the SSC. This is Tung-Yuan’s last year and Reiner thanked him for his many years of service.

UK – Tina van de Flierdt

Tina van de Flierdt reported that UK GEOTRACES results were shown at many meetings. There were 27 peer-reviewed publications. 2 PhD completions.

Recent high profile publications include: Derek Vance and Susan Little on metal isotopes; Alessandro Tagliabue et al. Fe review; Bridgestock et al. Pb paper.

The ZIPLOc cruise was just completed. BYONIC – Beyond the iron curtain – is a new proposal from Alessandro.

Amber Annett and Susan Little received NERC 5-year independent research fellowships. Gideon encouraged SSC to urge their best young students and post docs to apply for these NERC fellowships.

Fridge Cruise sails in December (GA13).

All 3 UK research vessels now have trace metal clean sampling systems.

Action: Tina van der Flierdt to send to Elena the information about NERC Independent Research Fellowships to be posted on the GEOTRACES site.

US – Bob Anderson

Bob Anderson reviewed main US GEOTRACES activities and by US cruise:

GA03 cruise: Individual papers continue to be published and also data used on 4 synthesis papers.

GP16 cruise: A novel finding is siderophore-based microbial adaptations to iron scarcity across the eastern Pacific Ocean. Special volume in Marine Chemistry to be published (about 16 papers being reviewed.)

GN01 cruise: The Data Workshop will be held in Miami, Florida, 23-26 October, 2017.

GP15 cruise: Cruise and most key TEIs funded. To be held 23 September to 27 November 2018. Cruise leaders are Greg Cutter, Phoebe Lam and Karen Casciotti. Logistics workshop to be held on 5 March 2018 in Norfolk, Virginia.

Long range plans include the GP17 for 2021 or 2022.

A town hall is planned for OS2018 to explore a process study in Gulf of Mexico in collaboration with the US Ocean Carbon Programme (OCB). Contact person is Alan Shiller.

In 2016-2017, US GEOTRACES authored or co-authored 30 peer-reviewed journal papers, 3 books and 4 PhD dissertations.

BioGEOTRACES – Maite Maldonado

Maite Maldonado reported that senior labs include Penny Chisholm (prokaryotic genomics), Mak Saito (proteomics), Julie LaRoche (N fixation genomics) and Ben Twining (single cell trace metal quotas).

The first BioGEOTRACES data are in IDP2017. All senior PIs but Penny submitted data for IDP2017.

Challenges: The Chisholm lab was the first lab to submit a protocol for intercalibration of metagenomics. They collected samples for 4 GEOTRACES sections. But the Chisholm Lab was not ready to submit their data for IDP2017. They completed 480 metagenomes (i.e., they sequence every gene in each sample). Metagenome data were submitted to NCBI and accession numbers are available at BCO-DMO. 384 single-cell genomes were also completed.

Originally the Chisholm lab was in front of the BioGEOTRACES game, but they decided that GDAC was not the best place for their data because their results, presented as percent abundance of each species, will change with time as the genomic database for other taxa improves. So they need a dynamic database that can change as more data become available.

Maite showed examples of percentage of 4 different organisms and how some abundances correlate with certain TEI concentration data.

The Chisholm lab is placing their metagenome data in the JGI database and they want to link these data to the GEOTRACES database to search for correlations between micronutrients and genomic data. They are also developing tools to visualize the complicated data sets. Krona shows relative abundances of different organisms as pie charts, one for each sample depth.

The Chisholm lab is working on a methods manual. They will make the data available once their paper describing the methods comes out. Maite recommends that the IDP contain links to the genomic data set.

Mak Saito hosted a BioGEOTRACES workshop last May. He developed an ocean protein portal that can be used easily by non-experts. A search on a peptide will reveal where the peptides have been found and which organisms produce them. The portal links to a database that shown the structure of the protein.

Challenge: Many more samples are archived than there are funds to analyse.

The field needs a dynamic web site. A way to link BioGEOTRACES dynamic data to static GEOTRACES data is needed.

Maite showed CLIO – an autonomous vehicle that can collect particles by filtering up to 1000 liters from many depths in the water column. The first CLIO test cruise was in July 2017. It took 5 hours to collect 18 samples.

Reccomendations: Encourage more submissions of BioGEOTRACES data from the GEOTRACES community (open it and not only 5 labs). Integrate complex BioGEOTRACES dynamic datasets in the GEOTRACES IDP. There is a need for a better way to integrate dynamic and static data. Also the unique knowledge that can be gained by combining BIOGEOTRACES with GEOTRACES data should be showcased – beginning with the OS2018 meeting.

Discussion:

Gideon Henderson – He encouraged BioGEOTRACES to acknowledge the name of the person who collected the samples.

Jay - He recommended that GEOTRACES inquire if the IMBER data management committee has experience with the types of data in BioGEOTRACES. No one is sure if IMBER has a data management committee.

International Partnerships

Report on progress of SCOR WG 145 (MARCHEMSPEC) - Vanessa Hatje

Vanessa Hatje reported that WG145 focuses on trace element speciation. Recent products include a paper in *Frontiers of Marine Science* by Turner et al. A web based survey followed the town hall at Ocean Sciences 2016. Simon Clegg, Andrew Dickson and Heather Benway have 3 years of funding to develop a thermodynamic chemical

speciation model for seawater. The web site will move to Monaco and the next group meeting will be next year.

Report on progress of SCOR WG 146 (RiO5) - Reiner Schlitzer

Reiner Schlitzer explained that RiO5 focuses on anthropogenic radioactivity in the ocean. This working group will finish this year. Rio5 is developing eLectures to post on L&O eLectures. In June 2016 they held a training course in Xiamen with 28 trainees from 17 nations (selected from 91 applicants). Public lectures were given in Xiamen coordinated by COSEE China with 250 attendants.

Action: Reiner to ask WG146 chairs for links to eLectures to post on the GEOTRACES web site.

Report on progress SCOR WG 151 (FeMIP) – Alessandro Tagliabue

Alessandro Tagliabue reported that the Iron Model Intercomparison Project (FeMIP) is a new WG chaired by Stephanie Dutkiewicz and him. The goal is to improve model representation of the processes that affect Fe distributions in the ocean. The committee will address how complicated Fe models need to be, and how to assess model skill. The aim is to reduce uncertainty in the Fe cycle and improve models of sensitivity of marine ecosystems to Fe supply. There will be a kick off meeting at Ocean Sciences (before the meeting). Also a joint session with David Turner is planned.

New SCOR working groups proposals – Ed Urban

SCOR selected 3 proposals this year out of 5 submitted. None are directly related to GEOTRACES. SCOR WG 152 Measuring Essential Climate Variables in Sea Ice (ECV-Ice), approved last year, is relevant to GEOTRACES interests in trace metals and isotopes in sea ice. The next call for proposals will go out in February 2018.

ICSU Review of GEOTRACES – Ed Urban

Ed Urban reported that ICSU asked SCOR to establish a review cycle for all SCOR-supported projects – i.e., to implement some kind of mid-life review. The SCOR Executive Committee in turn wants to know when GEOTRACES will end. SCOR counts the duration of a project from when the science plan is published (2006 for GEOTRACES). IMBER and SOLAS had a second phase, and GEOTRACES could as well, but a Phase 2 would require separate planning. SCOR will send a formal letter to the co-chairs requesting a review. It must be a substantial process. This could be an opportunity to gain input from the community about how to improve GEOTRACES throughout the remainder of the program.

Ed Urban would like to know: 1) When is best? Can we have results by end of the annual meeting in 2018? 2) What questions would it be helpful for SCOR to ask? GEOTRACES could identify information to include in the review, such as number of

publications. 3) Should it be a broad community review or a small number of external reviewers? Maybe invite a few original SSC members as reviewers? Or would it be better to canvas a large number of community members. Ed wants to help make the process as painless as possible.

Discussion:

Gideon – He asked “Has ICSU done this before? Is there a precedent to see how it has been done before?” Ed Urban answered that SCAR and SCOR have reviewed the Southern Ocean Observing System project.

Ed Urban said GEOTRACES should emphasise the challenges of a field-based observational program, such as the time needed to set up intercalibration and data management; time to get cruises funded, etc. GEOTRACES has good gender balance, good representation from developing nations, etc.

Catherine Jeandel – She asked if we could plan to complete the global survey in 5 years and then take 10 years for synthesis? Ed answered that 10 years seemed too long.

Maite – She asked “Who will decide if GEOTRACES continues?” Ed answered SCOR. Maite also asked “Can GEOTRACES move toward a more biological component?” Ed replied that it could, but he thinks SOLAS and IMBER should have concluded and let new programs evolve.

Gideon – He noted that the review could be an opportunity to think about the end of the programme. Ed added that the SCOR Executive Committee would like to see how GEOTRACES plans to compete its work.

Bob – He disagreed on the need for GEOTRACES to go through the review. He alerted about the danger of putting an end to the project as this could send a wrong message to those countries that are trying to get involved in GEOTRACES.

Ed Urban – He explained that SCOR Executive Committee cares most about defining the end game – how to conclude GEOTRACES.

Alessandro Tagliabue – Focus on our successes and identify the products that benefit the community. Demonstrate the benefits of maintaining the program a little longer than a typical program.

As an example, GEOTRACES could identify the lines to be completed before the global survey achieves its mission. Then new initiatives could plan process studies or paleo studies or BioGEOTRACES studies to build new programs on the GEOTRACES foundation.

10 years is the minimum to complete the survey and allow at least 5 years for completion of analyses and synthesis of data.

Gideon – He proposed building a longer discussion of this topic into the next SSC meeting. Ed Urban agreed.

Action: Elena to include in the agenda for next SSC meeting to discuss about the ICSU’s review process.

GEOTRACES Workshops

East Asia Workshop – Hajime Obata

The workshop was held on 16 – 18 January 2017. Hajime was a convenor. Man Sik CHOI served as a coordinator as well. There were 56 total participants. Russia and Korea were represented. There will be another East Asia GEOTRACES meeting in Xiamen in 2018 or 2019.

Jing Zhang – She added that the next workshop will double as a planning meeting for the China-GEOTRACES section cruise. Eric Achterberg, Greg Cutter and Martin Frank are invited.

User Workshop on Ocean Circulation Inverse Models – Reiner Schlitzer

Reiner said that there is nothing to report, as no activity has been held.

TARA-GEOTRACES workshop - Maite Maldonado and Alessandro Tagliabue

The idea to partner with TARA evolved from the OCB/GEOTRACES synthesis workshop at Lamont, with the goal of assessing biological trace element demand by ecosystems and to compare the demand with known inventories and with known sources. Andy Bowie published a simple version of this in 2001. Alessandro has undertaken something similar as well.

Main goal is to mine OMIC data such as TARA Ocean, GEOMICS and Malaspina 2010. During the OCB/GEOTRACES workshop the group decided to go with TARA Ocean, a French-led international program coordinated by Chris Bowler. TARA's goal is to characterise biological parameters at a global scale and link them to environmental parameters. TARA sampled 2010 stations over 4 years and produced lots of omic data as well as microscopic samples, supporting data from CTD, nutrients, and HPLC pigments. Samples were submitted to high throughput sequencing and high throughput imaging. But, no trace metal samples were taken.

TARA found 40 million genes and the results constitute 11.5 gigabytes of data. About a third of the organisms sequenced are unknown.

Maite showed a map of GEOTRACES stations overlain with TARA stations. Three targets emerged. GEOTRACES and TARA had a virtual meeting in December. The GEOTRACES participants asked for information about certain genes known to regulate metal metabolism. The initial list was sent to participants of the Lamont synthesis workshop for comment.

It has been suggested that OCB could support a workshop to plan for how to go from micronutrient distributions to biological responses. Yeala Shaked is also involved. A session is planned at Ocean Sciences 2018 with 30 abstracts submitted.

Alessandro – He added that the TARA community was initially unsure about what GEOTRACES wanted but then they were convinced that there is merit in the process. A

planning meeting will be held at Ocean Sciences to plan the next step. They are aware that speciation experts need to be involved as well.

Phoebe – She asked if BioGEOTRACES data from the same samples as the TEI data (e.g., Chisholm on GA03) work better because they are collected at the same time. Maite answered that this is true but the Chisholm data are not ready yet. Also, an advantage of TARA is that they collected zooplankton samples as well.

Catherine – She mentioned that it might be possible to get funding from the CNRS to work with TARA.

Adrian Burd – He added that TARA has some very bright mathematicians contributing, too, and they would be a resource to help connect data collected in different times and places.

Jay – He mentioned other investigators that have done genomics sampling. Gonzalo Carrasco was also involved and could be helpful.

A TARA-GEOTRACES partnership could be a showcase for what BioGEOTRACES could eventually become. The TARA-GEOTRACES partnership could bring expertise to BioGEOTRACES to help best interpret BioGEOTRACES data.

Bob – He recommended that Alessandro and Maite review the report of the 2010 workshop in Los Angeles on a similar topic.

Action: Jay Cullen to send to Maite Maldonado and Alessandro Tagliabue the names of the scientists who have done genomics sampling.

Report on 2017 GEOTRACES Summer School – Geraldine Sarthou

The school covered basic trace element biogeochemistry and steps to mount a GEOTRACES cruise. 60 students and 24 lecturers participated.

The cost was 80k euros. LabEx Mer contributed 50k euros. 19k euros came from SCOR (GEOTRACES funds).

Rob Middag – He suggested that the summer school make the lectures available to the 60 students who were not selected to attend.

Phoebe Lam – She thanked the organisers and noted (a) how much work was involved and (b) how very successful the workshop was.

How frequently we might want to hold a GEOTRACES summer school? – Phoebe Lam

Phoebe invited discussion, beginning with the point that the school was very broad but still it did not contain much biology, so if we do another workshop there could be more biology. A future workshop could be similar to the last one, or it could be smaller and more focused on a single topic. For example, Phil Boyd wanted to run a BioGEOTRACES workshop, but it would be more for GEOTRACES scientists than as

a summer school. Would it be better to have a dedicated BioGEOTRACES school or to put more biology into a GEOTRACES summer school?

Alessandro – He noted that Phil wanted to expose BioGEOTRACES scientists to important topics in related fields (e.g., physical oceanography). He suggested that the 3 introductory talks at the Lamont workshop (physics, biogeochemistry, modelling) served as a way to expose specialists to a broader way of looking at data.

Walter – He suggested that another summer school might be at AWI in 3 years.

Alessandro – He added that biogeochemists have a lot to learn from physicists about water mass structure and water motion in the ocean. At the same time, GEOTRACES offers new tracers for them to use.

If someone is willing to make the effort to host a summer school then they should be allowed some flexibility to define how the school will be organised. The SSC should not attempt to take too heavy a role in defining the school curriculum.

Action: Walter Geibert to explore the possibilities to host a GEOTRACES summer school at AWI.

GEOTRACES Special Sessions and Town Halls

GEOTRACES Special Sessions at Ocean Sciences:

Alessandro reported that there would be 3 GEOTRACES related sessions at Ocean Sciences 2018. Each received quite a few abstracts.

Ocean Sciences Town Hall:

Bob explained that Greg Cutter, Maite Maldonado, Alessandro Tagliabue and Andy Bowie proposed a Town Hall at Ocean Sciences. The agenda of the Town Hall would be adjusted to be different from the Town Hall at Goldschmidt 2017. During the DMC meeting several topics have been suggested.

Bob opened the discussion asking for other topics and how much introduction is needed about GEOTRACES and the IDP2017 versus allocating more time to the science talks using IDP2017 data.

Zanna Chase – She mentioned that in her opinion, the audience should see what is new in IDP2017 relative to IDP2014.

Liping Zhou – He noted some introduction is needed. Reiner responded that covering the process of creating an IDP takes a lot of time, so either cover it all or leave it out.

Maite – She recommended not to emphasise the process of creating IDP2017 or other information already available on the web site, but to emphasise the exciting synthesis results.

Alessandro – He mentioned the IDP2017 offers the possibility to look at processes that involve interactions between different phases (aerosols and water) – opening possibilities for interactions across interfaces.

Ed Urban – He announced that SCOR will have a booth again. GEOTRACES can distribute its data card (SCOR already has 400 USB cards) and there is a need to decide if GEOTRACES wants to have a banner and a video. Ed recommended against having piles of papers to give away. It may be better to advertise the booth as a place to come and talk in a comfortable chair about GEOTRACES. A recommendation is to give good chocolates.

SSC, S&I and DMC Rotations

SSC Rotations

Reiner Schlitzer must rotate off as SSC co-chair. Phoebe led the discussion and thanks Reiner for role as co-chair and creating the IDPs. Reiner thanked the committee for making the service enjoyable, and for stepping up to help whenever help was needed.

Phoebe mentioned that several names for replacements have been suggested. Andy Bowie has been discussed most often with a lot of support. Andy left the room and an open discussion ensued. SSC achieved consensus. Andy is welcomed as the next co-chair.

Decision: SSC recommended Andy Bowie as new SSC co-chair.

Two SSC members are completing their first term: Hajime Obata and Liping Zhou. Both of them agreed to a second term.

Decision: SSC recommended Hajime Obata and Liping Zhou to be reappointed for a second term.

Four SSC members are at the end of their second term: Tung-Yuan, Roy, Katharina Pahnke and Geraldine Sarthou.

SCOR rules do not allow them to continue as SSC members. Each has been asked to suggest replacements.

Possible replacements: Walter Geibert, Kazuyo Tachikawa, Abby Ren, Kuo-Fang Denner Huang, Susanne Fietz and Sarah Fawcett.

Are other nations to be included?

Alessandro proposed India. The SSC needs Indian representation. Phoebe wrote to Sunil asking for potential replacements but he did not respond. Gideon supports Alessandro in recommending another Indian SSC member.

Bill Landing – He suggested Sambuddha Misra who is moving to India and interested in getting involved in GEOTRACES.

Bob – He suggested Ravi Bhushan.

Alessandro – He asked about a contact in Korea.

Gideon – He suggested Germany may be well enough represented.

Alessandro – He suggested including two modelers Tim DeVries and Tom Webber who are getting more involved in GEOTRACES and would be a good addition. Alternatively, consider adding a paleo modeller.

Bob and Gideon both noted that Taiwan, South Africa and France are generating a lot of GEOTRACES data so they should have SSC members.

Discussion about replacing Roy:

South Africa has a small GEOTRACES community. Susanne Fietz has been involved in both synthesis workshops and in BioGEOTRACES. Roy recommended Suzanna because she has been involved in many GEOTRACES activities.

Alessandro talked about a modeller, Marcello Vichi, a developer of the Italian climate model. He is originally from Bologna. Phoebe noted that Susanne sailed on early South Africa cruises and helped train students. She would help keep South Africa momentum going. Even though it would be good to add modellers, it would be good to have data generators in nations with a capacity building effort. Bob also spoke in favour of Susanne for her demonstrated dedication to GEOTRACES.

Discussion about replacing Tung-Yuan Ho:

Tung-Yuan reviewed 2 Taiwanese candidates: Haoija (Abby) Ren from National Taiwan University (Paleoclimate & paleoceanography, Marine Geochemistry & Biogeochemistry by using N isotope) and Kuo-Fang (Denner) Huang Institute of Earth Sciences (Isotope Geochemistry, Paleoclimate & paleoceanography, Marine Chemistry)

Discussion about replacing Geraldine Sarthou:

Geraldine described Kazuyo's Tachikawa background. Catherine noted that Kazuyo is leading the synthesis workshop in Marseille. She has expertise in tracers other than epsNd. Other investigators have been considered including modellers.

General discussion:

Phoebe summarised the discussion, recommending Susanne, Abby Ren, and Kazuyo.

Decision: SSC recommended inviting Susanne Fietz, Abby Ren and Kazuyo Tachikawa as new SSC members.

Tim DeVries comes up again for his enthusiasm to contribute to GEOTRACES. Phoebe suggested adding Tim and also adding a person from India. However this would cause the SSC to grow by one if both India provided a new SSC member and Tim joined to strengthen modelling efforts.

Phoebe proposed to wait until getting an answer from Sunil and continue the discussion by e-mail

Note: Discussion continued by e-mail after the SSC meeting: 5 Indian names were proposed: 1) Ravi Bushan (PRL), 2) Parthasarathi Chakraborty (NIO), 3) Vineet Goswami (PRL), 4) Sambuddha Misra (Indian Institute of Science, Bangalore) and 5) R. Rengarajan (PRL). Given Dr. Goswami's close ties to Sunil, he seemed like the appropriate choice. However, since he is not yet back in India, it was proposed to wait until he returns to India to nominate him. Ed Urban suggested that GEOTRACES could

extend an invitation for him to attend next year's SSC meeting as an invited guest, if his nomination is not yet completed by then.

Decision: SSC recommended inviting Vineet Gowsami to serve as new SSC member as soon as he returns to India.

S&I Rotations

Greg Cutter and Peter Croot are rotating off after years of hard work.

The S&I would like to add someone from Japan to replace Hajime who moved to the SSC. Yoshiko Kondo is proposed. Yoshiko has sailed on 3 GEOTRACES cruises and worked with Jim Moffett.

Also Sea ice will also be a big new data source soon, so S&I would like to add Ana Aguilar-Islas. Ana is leading a sea ice intercalibration with Delphine Lannuzel from Australia.

Andy – He noted that the DMC would be adding someone with sea ice expertise. Maeve replied that Ana also brings expertise with aerosols and trace elements.

The S&I would also like to add Peter Sedwick, who also has expertise in redox chemistry.

With all these addition the membership will be expanded by one. Also, adding someone from Australia increases the cost.

Gideon – He noted that the S&I does so much work that in the case they are budget limited the cost should be expanded over the SSC.

Phoebe summarised the decision: Invite Yoshiko, Ana and Pete for the S&I committee.

Decision: SSC agreed to invite Yoshiko Kondo, Ana Aguilar-Islas and Pete Sedwick to serve the S&I.

DMC rotations

Alessandro reported that DMC discussed rotations and recommended Bill Landing as co-chair to replace Andy as co-chair. Also, Jing Zhang rotates off after 13 years of serving the Committee. Since it is really important to have a Japanese representative on the DMC to help compile Japanese data DMC proposes to add Jun Nishioka. Jun has led voyages, he has experience with sea ice, and he has collaboration with Russians.

Lastly, since the committee is one down, DMC would like Reiner Schlitzer to rotate onto the DMC as regular member, when he steps down as SSC member.

The current membership does not respect gender balance so this subject should be discussed at next DMC meeting.

Decision: SSC approved Bill Landing to be appointed new DMC co-chair starting in January 2018.

Decision: SSC approved Jun Nishioka to be appointed new DMC regular member starting in October 2017.

Decision: SSC approved Reiner Schlitzer to be appointed DMC regular member starting in January 2018.

TUESDAY 19 SEPTEMBER 2017

S&I report – Maeve Lohan and Walter Geibert

Maeve Lohan reviewed the committee's meetings over the past year, which involved a lot of work on IDP2017. She then reviewed the committee membership and their respective responsibilities.

Accomplishments include posting the revised Cookbook on the web; intercalibration of Si isotopes (11 labs); and intercalibration of leachable metals in particles (5 labs). REE analysts are now using GEOTRACES consensus seawater samples. Ongoing intercalibrations include Hg (June 2017 cruise) and sea ice (April-June 2017, Ross Sea). Pete Morton and Bill Landing are arranging an aerosol intercalibration.

Consensus values: GSP (2009 GEOTRACES Pacific surface seawater) and GSC (2009 GEOTRACES coastal surface seawater) data are being collected, but consensus values are not available yet. SSC members are urged to submit their data. GA08 samples were distributed by Achterberg and Schlosser; they are awaiting initial results to complete consensus values. Eric will collect new surface water in February.

Action: Maeve to draft an email to be distributed by the IPO encouraging all investigators to submit data from consensus samples.

Walter reviewed the flowchart (<http://www.geotraces.org/sic/about-s-i/flow-chart-s-i-data-quality-assessment>) of the intercalibration process for IDP2017, beginning with the dual submission of data to GDAC and submission of the S&I report to the S&I committee. Walter then reviewed the possible strategies for intercalibration and ranked the methods by preference (crossover stations are the most preferred). Sharing duplicate samples is an alternative. Exceptions to these methods (not preferred) can be made for various reasons, and there the S&I can accept alternative methods of traceability. Walter reviewed a list of problems that prevent sharing duplicate samples. The main criterion for accepting intercalibration is that the data generator can demonstrate consistency (comparability) to a reference material for the analyte that comes from a source other than the lab generating the GEOTRACES data.

Problem: The existing document notes that these approaches to deal with exceptions exist, but the text is vague so the community did not understand the methods that could be used to satisfy the intercalibration criteria.

Walter showed a graphic illustrating the level of intercalibration and the steps involved in each level of intercalibration. GEOTRACES aims to move each parameter as far toward the top level of intercalibration as the state of the art allows.

Point: It is not sufficient for a lab to be intercalibrated once for all cruises because sampling methods change from cruise to cruise, and analysts in the lab change from cruise to cruise.

Walter showed the new flow chart that tracks the intercalibration process, including the various methods of external validation.

A list of questions is posted on the web page for PIs to consider when preparing an S&I report: <http://www.geotraces.org/sic/intercalibrate-data/intercal-report>

Then Walter reviewed a list of 5 questions asked of PIs whose data are overseen by another program's quality control process (e.g. CLIVAR):

- 1) Did your lab participate in an intercalibration exercise for these specific isotopes/methods? If not, what else has been done to ensure consistency with intercalibrated labs?
- 2) How did you monitor internal consistency of your data? E.g. replicates...precision
- 3) Please report external consistency (e.g. CRM, consensus materials, interlab comparisons).
- 4) If you occupied a crossover station (including in another program) how does your data compare
- 5) how do your data compare with historical data?

Discussion:

Roy – He asked “Do nutrients and other supporting data need to be intercalibrated?” Walter responded that it is important to intercalibrate nutrient data; for example, so that metal – nutrient ratios can be evaluated accurately. In regions where the water masses move over time (e.g., fronts or the Southern Ocean) it is important to have hydrographic data to know if a water mass is changing positions.

Maite – She raised the question of who checks for non-intercalibration-related errors, for example if a PI multiplies all data by a wrong factor (systematic error) or report data in the wrong units. Reiner answered that errors happen and he relies on users to report errors when discovered. He try to minimize errors but need to engage users if locating errors.

Adrian – He mentioned that he works with an LTER program that has developed Matlab tools to help with data quality control. He offered demonstrating the tool to the DMC co-chairs. Walter agreed that this would be a useful product for the DMC.

IDP2017 intercalibration process: S&I received 111 intercalibration reports for 458 parameters. Data that are not intercalibrated have that status because S&I reports were not submitted for those data.

Things that worked well: Excellent communication among all committee members and PIs; good interaction with the parameter naming committee; the S&I is gaining experience in handling “exceptions.”

Things that could be better: DMC committee members spent a lot of time contacting PIs to request that their data be submitted. Manual processing of data needs to be improved and automated. Communication with the community needs to be improved – emailing flow charts hasn't been effective. Complete parameter names need to be defined; e.g., “lead isotopes” isn't sufficient.

Action: SSC members to send ideas on how to improve communication about the intercalibration process to Walter and Maeve.

Moving forward: The S&I anticipates more automation, more BioGEOTRACES and artificial radionuclides; sea ice.

Future meetings: The S&I would like to organise a meeting in March/April to catch up on late S&I reports and mainly to start developing automation methods.

Discussion:

Eric Achterberg - He mentioned that he hosted a workshop on calculating uncertainty in reported results. Eric, Maeve and others are producing a manuscript that outlines how to evaluate uncertainty properly and report the uncertainty associated with each reported value. This involves precision of results for external standards, internal standards, and samples. The methods are relevant to all types of data: nutrients, metals, etc. Eric also informed about the following manuscript on the use of the Nordtest approach for uncertainty calculation for trace metal measurement:

Rapp, I., Schlosser, C., Rusiecka, D., Gledhill, M., & Achterberg, E. P. (2017). Automated preconcentration of Fe, Zn, Cu, Ni, Cd, Pb, Co, and Mn in seawater with analysis using high-resolution sector field inductively-coupled plasma mass spectrometry. *Analytica Chimica Acta*, 976, 1–13. doi:10.1016/j.aca.2017.05.008

Walter – He added that the S&I wants to see all of the data that are involved in assessing uncertainty when comparing results from crossover stations (or shared duplicate samples).

Adrian – He noted that in addition to reporting uncertainties for measured values, it is important to report uncertainties in regressions between parameters based on large data sets.

In general, the S&I feeling is that reported uncertainties are too small.

Action: S&I to discuss at its next meeting the best methods to assess uncertainty associated with TEI data and develop examples of how to assess and report uncertainty of GEOTRACES results, without prescribing (mandating) that uncertainty be calculated by any specific format. The S&I will draft a report/manuscript describing these methods that will be circulated to the SSC for comment.

Alessandro – He asked if it would be helpful to have a physical oceanographer on the S&I committee to help interpret hydrographic data where crossover stations reveal offsets in TEI data. Reiner answered that it may be sufficient to have good communication with a physical oceanographer.

Action: S&I to discuss value of adding a physical oceanographer during their next meeting.

Alessandro – He asked how the S&I deals with TEIs on sections that lack high quality nutrient, oxygen, and possibly T and S data. There is a problem that the new nutrient standard reference materials, produced by a SCOR WG, are not being used widely (not a problem for GEOTRACES but for other programs). He urged GEOTRACES to set an example by using these standards.

Action: S&I to discuss how to deal with ancillary parameters and specially, how to deal when no response is received by the PI and who could make the decision.

GDAC report – Graham Allen

Graham Allen presented a flow chart for processing GEOTRACES data from submission through quality control and parameter code assignment to delivery to the IDP. GEOTRACES data are very complex, creating challenges to create an IDP. Graham holds up GEOTRACES as a model project for data management.

Graham presented statistics on data sets approved by S&I (1213 or 1219), received at GDAC (1102, 97%) and included in IDP2017 (1078, 98%). BODC created >900 new parameter codes for IDP2017 (BODC creates parameter codes for errors as well as for data this is why there are more codes than parameters in the IDP2017).

He then reviewed statistics for datasets:

	Approved		Received		Ingested		Included in IDP2017	
	No.		No.	% of Approved	No.	% of Received	No	% of Received
Atlantic	781		774	99%	671	87%	756	98%
Pacific	242		229	95%	229	100%	229	100%
IPY	29		29	100%	29	100%	29	100%
Process Cruises	37		36	97%	28	78%	30	83%
Compliant Data	50		34	68%	34	100%	34	100%
Total	1139		1102	97%	991	90%	1078	98%

IDP2017 access is available via a BODC web page. The login and download agreement are the same as for IDP2014. As of 11 September 2017, 146 downloads by 40 unique users had been made. Of the 146 downloads, 64 were in ODV format. About half of the downloads were for discrete samples data (water and particles) rather than sensors or aerosols. See slides for other statistics.

As of 18 September, there were 189 downloads from 59 unique users.

GDAC staffing: IDP2017 involved two main types of activities: processing the data (Donna Cockwell did this exclusively) and interacting with data generators and other

management responsibilities (Helen Snaith). Gwen deals with parameter codes. Kay Thorne worked on the download page.

Last fiscal year GDAC exceeded its budget by 60% and this fiscal year GDAC has already spent 80% of its budget in the first 4 months. Graham has a new slide since the DMC meeting proposing a staffing and budget forecast for the next four years that leaves an excess to support an additional workload during the preparation of IDP2021.

DMC report – Andy Bowie and Alessandro Tagliabue

Andy reviewed committee membership and showed a slide summarizing the activities and discussion topics during the recently completed DMC meeting. He announced that Jun Nishioka agreed to serve on the DMC committee.

GEOTRACES Intermediate Data Product – Andy Bowie and Alessandro Tagliabue

Lessons learned from IDP2017

Alessandro covered IDP2017 lessons learned. Main topics included:

DOI delivery: Currently there is no way to reference IDP2017. Having a DOI would make it easier to cite the data set and it also allows for version control. For now, the only option is to prepare a paper with all data generators as authors for submission to the special issue of Chemical Geology coming out of the Goldschmidt meeting. Reiner agreed to draft a first version of this paper. The paper will include a summary of the S&I process that was summarised earlier today by Walter.

Jay – He asked for the rationale for including a registration step. Alessandro described the concerns of some PIs about putting unpublished data in IDP2014 that were alleviated by including the registration step. Jay noted that with only a few hundred unique people downloading IDP2014, maybe a registration step is unnecessary. Andy mentioned that an alternative policy for the next IDP could be considered.

It was clarified that many data journals will not accept a paper on a data set if the data set does not have a DOI, and a DOI cannot be granted if a registration step is required.

Decision: SSC approved Reiner taking the lead on an IDP2017 paper. The goal is to have a paper submitted by Ocean Sciences.

Communication: Communication via email where email volumes are large is awkward. The DMC will test message boards and wikis as a way to share information more efficiently. Other people can be added to the discussion after the fact, allowing new people to be added to a conversation. The DMC will try this and report back to the SSC next year.

Communication with the wider community is a problem as well. The DMC will look into better methods of communication.

Parameter Names: Assigning correct parameter names was a challenge for IDP2017. Alessandro reviewed the process.

Bob – He asked all SSC members to urge their communities to learn the parameter name convention and use the correct parameter names so that users will find the correct data when using search tools.

Alessandro informed that the parameter naming committee would continue to work as an informal ad hoc committee.

Free text: Alessandro reviewed problems encountered because the data submission process involved many entries of free text, including many ways of naming a cruise. Reiner had to manually convert these free text submissions into a common format. In the future this information needs to be collected more systematically.

Permissions: Securing permission to release data into IDP2017 involved a lot of manual work that can be done more efficiently by automation. For IDP2017 permission requests were generated automatically and data generators could respond into a google doc. Nevertheless, this automated process created too many emails. Some PIs received dozens of permission requests and it was a burden to respond to so many requests. The DMC will search for a more efficient method of seeking permission.

Alessandro emphasised that all SSC members should be aware that all data going into the IDP must be reviewed by the S&I committee, so an S&I report needs to be submitted for every data set (distinct cruise).

Solutions: More automation of the process. For example, there may be a standardised online portal that barcodes the data so that all components of the data process are working with the same data sets. The process also needs to identify the actual data generators, not the co-authors of a paper. Cruise names and parameter names will be generated using drop-down menus. Parameter names are organised under a hierarchy of categories to facilitate location of parameter names.

The portal could include a drop down menu to specify the type of intercalibration that will be followed, as well as places for the PI to release data.

Action: DMC to identify specific needs and come back to the SSC next year with recommended features to be included in the automated data portal.

The portal will also be linked to the reference data list maintained by the IPO to help ensure that data users find the relevant publications that present the data.

Adrian – He noted that a lot of these online features including drop down menus are available and have been used by the LTER program. In his opinion, these existing tools will meet the needs of GEOTRACES. He sent information about the tools to the DMC leaders. The tool allows uploading of data files and handle quality control issues. It does require some front end manual involvement to handle QC issues, but it could be very helpful to GEOTRACES. It is all in Matlab.

Adrian – He also noted that EXPORTS is facing an identical problem. GEOTRACES may benefit by sharing experiences with EXPORTS.

Gideon – He expressed concern about potential cost and recommends that existing tools be assessed before deciding to build new tools. It could be helpful to involve BODC more as well.

JIRA is a software identified by Graham that may be helpful. Graham recommended defining the process to be followed and the minimum features required to fulfil the needs of the process to create an IDP.

Action: DMC co-chairs to explore the tool used by LTER, EXPORTS and also JIRA software as a potential portal for GEOTRACES.

Bill – He added that DMC should have examined the multiple tools by the next S&I meeting to be able to make a recommendation.

Reiner – He suggested that a small ad hoc committee be formed to examine existing tools. The committee includes DMC co-chairs, Adrian, Graham, and the S&I co-chairs.

Tina van de Flierdt – She asked if the S&I should stop receiving and reviewing S&I reports until the new data portal is completed to avoid putting some data part way through the process of getting it ready for the next IDP and leaving it in a format that requires manual addition to the automated process.

Discussion: Will the actual data sets be submitted through this portal instead of to GDAC or will the portal only be the interface for S&I review and granting permission to release data?

Graham – He noted that it is very important to identify the date by which a product (portal) is needed because this will help define the process to be followed.

There was rapid exchange of ideas and concerns about how to handle data that need to be submitted in the very near future, before the new portal is available.

Phoebe – She proposed that as a first step we publicise the parameter name list and criteria for defining parameter names so that data being submitted immediately have the correct parameter names. Walter added that this should be extended to include the list of cruise names.

Bill – He reviewed a recommendation from Graham the day before and proposed that something be developed quickly to allow the S&I to continue its work. Bill was optimistic that it could be implemented quickly. And then the rest of the portal could be designed later.

Alessandro – He expressed the concern that if multiple versions of interfaces were released then the data generators would be confused. The new data portal must be able to handle all of the existing data within IDP2017 as well as data sets that are partially processed by the S&I before the data portal is ready. The entire process needs to be simple for the community to use it.

Decision: SSC agreed to establish an ad-hoc working group to design the new IDP portal. This working group should start focusing on the S&I requirements.

Maeve – She noted that the two things most important immediately for the S&I are correct cruise names and correct parameter names.

Andy – He agreed and reminded everyone that the parameter naming convention will be sent to the GEOTRACES email list within a week or so.

National cruise identifiers will be used. Reiner has the final list of cruise IDs that will be distributed.

Andy summarised that the email going out from the IPO will contain (a) a link to parameter names and criteria for naming parameters and (b) a link to the official list of cruise identifiers. The email will ask data submitters to select the appropriate cruise IDs and parameter names.

Action: DMC co-chairs to send an e-mail to the GEOTRACES community containing (a) a link to parameter names and criteria for naming parameters and (b) a link to the official list of cruise identifiers. The email will ask data submitters to select the appropriate cruise IDs and parameter names.

Action: Elena/GDAC to publish on the GEOTRACES web site (a) a link to parameter names and criteria for naming parameters and (b) a link to the official list of cruise identifiers.

Version 2 of IDP2017: It will be released at Ocean Sciences in February 2018. The version 2 should be a limited product. It will fix known errors in IDP2017. It will contain data that have already been approved by the S&I but did not make it into IDP2017. No new data will be solicited and the S&I committee will not be asked to review any additional data sets for Version 2. SSC agreed.

Decision: SSC agreed version 2 of the IDP2017 to be a limited product. It should fix known errors in IDP2017 and contain data that have already been approved by the S&I but were not included into IDP2017. No new data will be solicited and the S&I committee will not be asked to review any additional data sets for version 2 with the exception of the the LaRoche data.

Alessandro informed that a message from the DMC co-chairs to the GEOTRACES community will be sent in the next week or so to ask people to check for errors, especially errors in parameter names but other errors as well. Feedback is needed by 30 November 2017 so corrections can be made in V2.

A broader survey will also be released to solicit feedback on IDP2017. Early responses will allow implementation of some recommendations in version 2.

Reiner – He informed that eGEOTRACES would also be updated. There are some errors in the version 1 of eGEOTRACES and some data sets were not approved in time. The deadline for graphics was 3 weeks before the deadline for data so eGEOTRACES does not have graphics for all of the data in IDP2017.

Reiner proposed to start making corrections and updates to eGEOTRACES immediately. Bob suggested that the community be informed. Reiner said that there will be a “changes” page linked to the home page of eGEOTRACES and the changes page will contain information about corrections and updates. The SSC agreed to this.

Action: Reiner to update the eGEOTRACES and create a “changes” page link on the eGEOTRACES home page informing about corrections and updates.

Discussion: Will older versions of the IDP remain available online?

General agreement was that old version should be available to maintain access to old versions for traceability. But they should be published less prominently on the web sites.

Decision: SSC agreed old versions of the IDP (including webODV) to remain available, but in a form that identifies each old version as an old version. If a user goes to IDP2014 then they will be directed to IDP2017 (or whatever product is the most recent).

Action: GDAC/Elena to publish IDP2014 in a form that identifies this version as an old version.

Action: Reiner to make old version of webODV available.

Timing and Planning for next IDP

Andy described the DMC process of selecting a date for the next IDP. Aiming for 2021 (4 years) maximizes new data submissions, allows for fluctuating effort at GDAC to balance the budgets, and allows for training of successor personnel to prepare subsequent data products.

The DMC decided to split the role on a data processor and data manager at GDAC. The new data manager should be assigned as soon as possible, and then additional data processors will be assigned as needed.

Data types: The DMC discussed what data types will be included in the next IDP that includes phases sampled (e.g., sediments) and sampling platforms. Sea ice data will be included in the next IDP but the DMC proposed that sediments, land-based aerosols and fog data not be included.

Registration step: The DMC recommended that the registration step be removed for the next IDP so that the next version can be assigned a DOI, and a new DOI can be assigned for each new version. A download agreement will be maintained. Removing the registration and adding a DOI allows the data paper to be published in prominent scientific data journals. The proposal to remove the registration step needs SSC approval.

Graham – He noted that other programs allow anonymous downloads simply by clicking on a DOI link.

Andy – He mentioned that if the registration step is removed DMC should inform data generators that the registration step has been removed.

Discussion: Can PIs request a separate DOI for an individual data set?

It is possible for each separate data set to have a DOI. It was decided that these would not be assigned automatically, but a PI could request one for his/her data. It is valuable to GEOTRACES to have a single DOI for the entire data set.

Graham – He recommended that each format of the IDP (e.g., ODV, netCDF, Excel) have its own DOI because if there is a single DOI then when a user clicks on the DOI they download all formats, which is a large file of 480 MB.

Reiner – If individual datasets report individual DOI this could be included in IDP metadata.

Action: DMC to consider the new IDP data portal/S&I form to include a box to report individual datasets DOI so that this could be included in the IDP metadata.

Adrian and Jay – They recommended removing the registration step and asked if there have been any problems since IDP2014 that support maintaining a registration.

Zanna – She asked if some PIs would refuse to submit data without the registration.

Rob – He noted that the registration step does not actually prevent the misuse of the data so why not remove it.

Decision: SSC agreed IDP2021 will no longer have a registration step and the download agreement will be expanded to include appropriate citation protocols.

Action: DMC to draft a new download agreement that includes recommendations for appropriate citation of data products. The SOCAT download procedure is a useful example.

Decision: SSC agreed the decision to remove the registration step to be announced at the Ocean Sciences Town Hall in 2018.

Action: DMC co-chairs to contact, shortly after OS2018, PIs who submitted data to IDP2017 to inform them that the registration step will be dropped for IDP2021 and offering the opportunity to remove their data from IDP2021.

Reiner – He asked if subsets of IDP data extracted using the online data extractor should have their own DOIs.

Adrian – He said that assigning an individual DOI makes no sense because the data subset would not be accessible by other investigators.

Decision: Only the full IDP DOI will be associated with subsets of data.

Action: Elena to include in the agenda for next DMC meeting the discussion about whether to produce one DOI for all data formats or a separate DOI for each data format (e.g., netCDF, ASCII, Excel, ODV).

Review of GEOTRACES Sections

Update regarding forthcoming UK GA13 cruise – Alessandro Tagliabue

Alessandro reviewed GA13 (FRIDGE) on the *James Cook*. Maevé and Alessandro are the cruise leaders. The section evolved out of a previous effort to supplement another program. The cruise track will follow the mid-Atlantic ridge, with two short cross-ridge sampling segments, one of which, at TAG, will run along GA03. The section has crossovers with GA01, GA02 and GA03. Stations will be carried out at high resolution

along GA03. Other vent sites to be studied, Rainbow, Lost City, and Snake Pit, have different plume chemistries. One goal is to see how the vent chemistry affects the longer range cycling of hydrothermal metals.

Sampling will involve a trace metal rosette, a standard rosette and an in situ pump.

All key TEIs except ^{13}C will be covered, largely with bootlegging by volunteers. Gideon will measure REE, Ba and Cd isotopes. Chris Hayes will measure Pa-Th.

There was a discussion of whether or not samples could be collected for ^{13}C . No decision was reached.

Discussion: Process of obtaining approval for section cruises.

The GEOTRACES section cruise criteria were approved by the SSC in April 2017 and that information is posted on the GEORACES web site.

Since the beginning of the programme there has been the global map of sections but there has never been official approval by the SSC of these sections. Is it necessary to ask permission to SSC for these sections?

Gideon – He noted that these sections are a product of a planning workshop and there has been discussion about them.

Andy – He mentioned that it is 10 years since the basin workshops so it might be necessary to review them again.

Decision: SSC agreed that all GEOTRACES sections must be approved in advance by the SSC.

Action: DMC co-chairs/Elena to update the section cruise criteria to clarify the process for obtaining permission for GEOTRACES section cruises.

Review requests for section cruises

US GP15 cruise:

The GP15 plan was presented by Phoebe Lam. GP15 was part of the original Pacific basin plan. The section follows CLIVAR P16. Cruise dates are 23-27 November 2018. Cruise leaders are Greg Cutter, Phoebe Lam and Karen Casciotti. Phoebe reviewed the science goals of GP15. Several hydrothermal plumes and oxygen minimum zones will be sampled as well as strong gradients in biological productivity and its associated particle flux.

All 8 criteria are satisfied.

Decision: SSC approved US GP15 cruise as GEOTRACES section cruise.

Australian re-occupation of SR3 line GI08 cruise:

GI08 plans, a reoccupation of SR3, were presented by Andrew Bowie. The voyage sails 11 January 2018, reoccupying GIPY06. Physical oceanographers are in charge of the cruise so berths are limited (8 for GEOTRACES sampling). Nevertheless, the plan is to

collect samples for nearly every key TEI. 13C and 15N are missing. Dates are 11 January (Hobart) to 21 February 2018 (Hobart) on board *RV Investigator* (IN2018_V01).

Discussion: Should the repeat of a section require a new SSC approval?

Since this section has a new number, GI08 rather than GIPY06, it should be approved.

Decision: The SSC approved GI08 as GEOTRACES section cruise.

But in the future, a repeat section that is repeating a previous full section rather than an IPY section may be better designated as a process study.

Action: Elena to add in the agenda for next SSC to discuss whether a repeat section that is repeating a previous full section rather than an IPY section may be better designated as a process study.

French GI06 SWINGS cruise:

Catherine reviewed the plans for this cruise in the South West Indian Ocean. The cruise track is from Durban (South Africa) to Heard Island. The cruise will study margin fluxes off Africa and island sources of TEIs, especially active island hydrothermal fields. The cruise track concludes close to the end of the Australian process study cruise track. There will be crossover stations with both Australian process study cruises. All key TEIs will be covered.

Decision: The SSC approved SWINGS GI06 cruise as a GEOTRACES section.

German cruise in the Pacific Ocean:

Eric Achterberg will submit a proposal 30 September for a *RV Sonne* cruise along 32.5°S to link up with GP13 (Australia) at approximately 179°W. There will be crossovers with GP13 and GP19 and perhaps GP17. The section will capture the 3He plumes off South America as well as the 3He plume coming out of topography at approx. 180°W, seen on CLIVAR P6. The track crosses the ultra-oligotrophic gyre. N fixation will be examined. N-Fe co-limitation will be examined. Gideon Henderson plans to measure Th-Pa. GEOMAR will do REE and Nd isotopes.

Andy – He noted that combining with GP13 will close off the South Pacific basin.

Decision: The SSC approves Eric Achterberg's cruise proposal as GP21 section cruise.

Cruise proposal from Pedro Monteiro:

Alessandro explained that Pedro Monteiro is putting in a proposal to repeat the Bonus-Good Hope section. Between Pedro and Roy, most of the conventional metals will be covered, but other TEIs are not covered. Alessandro can provide Pedro's contact to those interested in getting samples for other TEIs. The cruise would sail in late 2018 so the next SSC meeting would be too late for the SSC to approve it at the next meeting.

Decision: Pedro Monteiro should request approval as process study or section cruise and the SSC will deal with it via email.

Repeating Japanese GP18:

Hajime reported that GP18 was run in 2011 but it was cut short because of the Fukushima accident. Now Japan wants to re-run the section at 155°E in 2020 rather than at 165°E (2011 section) where the original GP18 was run. Hajime will submit a proposal this year for the new section. The cruise track was moved to better study NPIW.

It is necessary for Hajime to prepare a presentation and formally apply for section cruise status later during the meeting.

Review of proposals for Process Studies and Compliant Data

Process Studies

Alessandro and Andy reviewed the 6 proposals for SSC comment and approval. They informed that Sunil Kumar Singh reviewed all proposals and presented a report during the DMC meeting.

The main request from the DMC was to modify the application for a process study to include information about who will analyse samples for each type of TEI.

Action: Elena to update the process study form in Point 3 to indicate include information about who will analyse samples for each type of TEI, if known.

The SSC had no further comments.

Decision: SSC approved the following requests for GEOTRACES process studies: Amazon-GEOTRACES, Surface2Sediments cruise, KOPRI Amundsen Project, SOTS project, EAC project and TONGA cruise.

Compliant data

The DMC proposed to amend the compliant data request to include a requirement that the investigator obtain S&I approval of the intercalibration steps that were applied to the data before requesting compliant status of a data set. Zanna and Vanessa requested clarification because, previously, compliant status was granted before S&I approval was sought. Zanna and Vanessa agreed that this change in policy, to seek S&I approval first, makes sense.

Two requests for approval as GEOTRACES data has been received. These requests are REE data from cruise ARK-XXVII/1 (Arctic Ocean, Fram Strait, 2012); and Nd and Hf isotopes from AR7W transect (Labrador Sea, 2013).

For the two requests, Bill Landing proposed to give a provisional acceptance conditional on the data passing S&I review.

Decision: SSC agreed to give a provisional acceptance of two requests for compliant status conditional on the data passing S&I review.

Action: Sunil to inform Martin Frank, Alexandra Filipova and Georgi Laukert that they must submit an S&I report for the two requests for compliant data.

Targeted process study: Dutch cruise in the North Atlantic Ocean

Rob Middag proposed a process study in the Greenland and Norwegian Seas to study TEI transformations of water masses as they cross the sills on either side of Iceland. Fe, Ti, Mn, Co, Cu, Zn, Ni, Ga, Y, Cd, La and Pb will be measured – both particulate and dissolved. Biological and hydrographic parameters will be measured. Rob requested feedback this year and solicits interest in getting samples for other key TEIs.

Rob will submit a proposal next year for the cruise, probably as a process study.

Rob also informed about a new Dutch National Initiative Changing Oceans. It could provide ship time for a program. The cruise would take place in January-August 2018, so there is no time to prepare for a GEOTRACES effort.

Continue discussion about ICSU's review of GEOTRACES

Bob revisited the mid-term review requested by SCOR and supported Gideon's suggestion that the review be defined to create a product of benefit of GEOTRACES. This would be an opportunity to showcase GEOTRACES accomplishments, which include international collaboration, capacity building, training, networking and more, as well as the research findings. Tung-Yuan Ho volunteered to help compile East Asian accomplishments and benefits.

Ocean Implementation Plans

Gideon led a discussion of whether or not to retain section status for cruises that do not include most of the key TEIs. Gideon asked the SSC to consider whether certain sections should be changed to process studies if they don't cover the vast majority of the key TEIs. If the decision is to downgrade the status, then what would be the criteria to change the status.

Alessandro – He noted that one reason to change the status is that having a section designated in our global map may prevent another group from proposing a section in the same location to cover all of the KEY TEIs.

Catherine – She added that in many cases PIs move or retire and samples will never be analysed.

Ed Urban – He alerted that review of GEOTRACES may lead to criticism if it is known that some parameters are not measured. It gives the appearance of misrepresentation of GEOTRACES products if the anticipated data are not available.

There are various permutations of this issue: data exist but not submitted; data not approved by S&I; samples collected but not analysed; samples not collected.

Walter – He suggested a 2-year warning that if data are not provided then the cruise status would be changed.

Bob – He agreed that a warning could be effective, but it would be difficult to define the appropriate criteria at this meeting.

Rob – He noted that this is a very serious issue and should be approached carefully.

Tina and others advocated making decisions on a case by case basis. It is especially difficult to make a decision where many of the key TEIs were proposed to be covered on a voluntary basis and after the cruise the volunteers failed to make the measurements.

Decision: SSC agreed reviewing those sections that do not include most of the key TEIs.

Action: Gideon to draft a document providing options for action for cruises that are missing key TEIs. This document will include a set of criteria for adjusting the status of a cruise from Section to Process Study.

Removing sections from the GEOTRACES section map when it is clear that they will not be pursued

Ed Boyle proposed removing sections that will never be done, such as the section from Monterey to Hawaii (GP05), which was originally proposed by Ken Johnson who would now never pursue it. There was strong disagreement among the SSC. Some people feel that it would be false advertising to leave an orphaned section on the map. Others feel that having a track on the global map identifying an area of known scientific interest may help stimulate investigators to pick up the section.

Decision: SSC agreed to keep sections that might never been completed on the map and review the decision in 2018 or 2019.

Action: SSC members to think about the benefits and liabilities of removing sections that will never be completed and reach a decision in 2018 or 2019 about dropping those sections.

Action: Elena to include in the agenda for next SSC meeting to discuss about the benefits and liabilities of removing sections that will never be completed.

Review GEOTRACES cruise maps

Alessandro led a discussion of GDAC maps that are out of date, both with respect to sections (e.g., for the Atlantic, GA13 is missing; the GA02 track is inaccurate; also for GA01 and GA04) and section colours (colours of completed cruises should be changed to yellow). Graham noted that now that IDP2017 is completed, the Data Manager can work on the map.

It is important to be able to click on a section name and get a link to cruise information.

There was a long discussion of showing data availability graphically. This is very difficult to achieve because different sections have different degrees of completion, and the status is constantly evolving. It would take too much effort to monitor and continuously adjust the section status.

Reiner proposed to maintain the existing colour code and update the section accuracy.

Phoebe proposed that the Arctic cruises that cover the Atlantic should be included in the Atlantic map. The same principle applies to the Pacific.

Decision: SSC agreed to add the Arctic cruise tracks to the Atlantic and Pacific basin maps as well.

Action: SSC members cruise leaders need to send GDAC the correct coordinates of completed cruises and improved coordinates of planned cruises.

Andy proposed that Southern Ocean cruises be designated GS rather than GI for SWINGS and SR3.

Decision: SSC agreed to design Southern Ocean cruises as GS rather than GI.

During the Yokohama Indian Ocean workshop (Goldschmidt) a new Indian Ocean map was constructed. That map contains a lot of inaccuracies.

Action: Andy and Catherine to update the Indian Ocean map. Remove sections without firm commitments.

Arctic map: GN01 and GN04 are inaccurate. GN04 should not be dashed.

Action: Jay, Bill and Walter to ensure that GDAC has the correct coordinates for the 3 Arctic expeditions in 2015.

Southern Ocean map: Remove the cruise names.

Action: Andy to coordinate the review of the Southern map and send the new coordinates to GDAC.

Process study map: Update to include recent process studies (e.g., ZIPLOC). The ATOS cruise is on the GEOTRACES web site but not on the GDAC web site.

Compliant data map: It has many sections missing. Only 3 of 9 compliant data sets are on the map.

Action: Elena to distribute the comprehensive list of process studies and compliant data.

Action: GDAC to update the maps as follows:

- Add the Arctic cruise tracks to the Atlantic and Pacific basin maps as well.
- Rename all cruises in the Southern Ocean with an S (for example GS08 instead of GI08).
- Change colour code of basin maps to: yellow for completed cruises, red for planned cruises and black for IPY cruises.
- Atlantic map changes: Add GA13, GA02 and GA04 should be updated. Add the Arctic cruises.

- Pacific map changes: Correct (lengthen) GP13. Add GP21 and GP22. Correct the coordinates of GP15. Correct GP19. Remove the horizontal dashed line of GP17. Add the Arctic cruises.
- Indian map changes: The map should be updated to follow the 2016 Yokohama workshop. The Yokohama map needs to be updated – redraw the SWINGS track and the GI08, turn to red GI05 line... Catherine and Andy will oversee this.
- Arctic map: Update GN01 and GN04 tracks as they are inaccurate. Also, GN04 should not be dashed.
- Southern Ocean map: remove the cruise names.
- Process Studies and Compliant data: update the maps as they are missing several cruises.

Action: Elena to rename all cruises in the Southern Ocean with an S (for example GS08 instead of GI08) on the GEOTRACES web site and documents.

Update on SSC rotations

Phoebe reported that Sunil has answered her e-mail and recommended Vineet Goswami to be the Indian SSC representative. Vineet is currently a post doc at Colorado State University. Sunil said Vineet will take charge of Indian GEOTRACES. Tung-Yuan said he spent a year in his lab as a post doc. Hajime noted that he sailed on the Japanese Indian Ocean cruise.

Continue discussion about ICSU's review of GEOTRACES

Phoebe returned to the SCOR mid-term review to clarify what needs to be done and by when. Ed Urban suggested that we complete the accomplishments portion before the next SSC and spend the next SSC discussing the timeline to the end of the program. Ed suggested that the accomplishments would be short, no more than 5 to 10 pages.

Action: Exec. to write a draft accomplishments report that covers science, capacity building, data management, S&I, benefits of international collaboration and more. Tung-Yuan will help compile Asian accomplishments.

WEDNESDAY 20 SEPTEMBER 2017

Elena opened the session with information about reimbursements. Boarding passes must be saved and submitted to Ed Urban. SSC members have received information about taxis to the airport.

Section cruises, continued

Repeating Japanese GP18:

Hajime continued presenting information about the revised GP18 to complete the goals cut short by the response to the Fukushima disaster. The cruise will focus on TEI transport by surface currents and intermediate waters. As noted yesterday, the section will be moved from 165°E to 155°E. Crossover with the K2 station is planned. All key TEIs will be covered. Hajime will collect samples for 230Th and 231Pa, but no one in Japan can analyse them. He is looking for volunteers to analyse the samples. Hajime confirmed that the other criteria be met. Bob expressed interest in helping with the Th-Pa samples.

There was a discussion about the GEOTRACES cruise ID. GP18 already has data in IDP2017, so GP18 cannot be used again.

Decision: SSC agreed the forthcoming Japanese cruise along 155°E section (GP18) to be approved as GP22 section cruise.

Hajime will approach Jun Nishioka to ask him to apply to the S&I for approval of historical data as intercalibrated and therefore as compliant data.

Action: Hajime to approach Jun Nishioka to ask him to apply to the S&I for approval of historical data as intercalibrated and therefore as compliant data.

German cruise in the Pacific Ocean:

Eric Achterberg reviewed the criteria for GP21 (32.5°S). Each criterion is confirmed. Crossover stations are planned with New Zealand (GP13) and Japan.

Andy recommended that the GDAC Indian Ocean map be updated to include proposed sections that came from the Indian Ocean workshop in Yokohama. This is justified because the proposed sections came from a formal basin workshop and therefore should have the same status as sections that came from other basin workshops.

Decision: SSC agreed to replace Indian Ocean map from 2007 Goa workshop with an updated map from the 2016 Yokohama workshop as the official GEOTRACES “wish list.”

Sharing information about planned research that is relevant to GEOTRACES

Catherine Jeandel reported that Martin Frank's group analysed samples from the Labrador Sea in the vicinity of the GEOVIDE cruise track. Catherine and others would have adjusted GEOVIDE to sample differently if they had known about the results from cruises in 2012 and 2013 by Martin Frank.

Decision & Action: Elena to publish a "best practices" list in the GEOTRACES newsletter periodically that reminds people about procedures, such as informing the IPO about GEOTRACES-related cruises (including opportunistic sampling), using correct parameter names, etc. Emphasise that GEOTRACES does not seek to influence plans, but having knowledge of non-GEOTRACES activities helps improve GEOTRACES planning.

Tina – She noted that GEOTRACES scientists do a lot of opportunistic sampling. Therefore, in addition to informing about the IPO about planned cruises, it is also requested that PIs inform the IPO about opportunistic sampling, especially for GEOTRACES Key TEIs. The challenge is getting people to submit information.

Walter – He asked about implications for the S&I committee. Phoebe emphasised that we are not requesting information about future compliant data, but only about plans that may affect future GEOTRACES priorities.

GEOTRACES Synthesis of Results Initiative

PAGES/GEOTRACES Workshop – Bob Anderson

Bob presented the PAGES workshop. Proposed dates are 3-5 December 2018. The Workshop will be held in Aix-Marseille in France. Local hosts are Kazuyo Tachikawa and Laurence Vidal. Funding support is available from PAGES, SCOR, US NSF and France.

Discussion about organizing this workshop started at the GEOTRACES session at PAGES Open Science Meeting (9-13 May, 2017, Spain). This session received 37 abstracts.

Bob presented the tentative science themes/working groups: (1) Tracers of biological productivity and particle flux including first order issues about whether or not the stable isotope systems are influenced by biological uptake (e.g., Zn isotopes); (2) Tracers of ocean circulation (REE patterns and Nd isotopes, C isotopes, $^{231}\text{Pa}/^{230}\text{Th}$ ratios) (3) Tracers of water mass structure and chemical composition and (4) Modelling of proxy behavior in the modern and past oceans.

Bob would like to discuss about the themes, the speakers and the objectives of these workshop.

Discussion:

Gideon and Zanna – They suggested arranging the working groups by tracers and then by all the applications of the tracers.

Gideon – He asked whether organic proxies would be included or otherwise this should be made explicit. Bob answered that since the workshop would focus on GEOTRACES data then they would not be included and he agreed this should be explicit.

Catherine – She suggested to make a matrix of research goals versus proxies.

Brief update on the products of the joint OCB/GEOTRACES Synthesis Workshop – Bob Anderson

Bob presented a list of 12 anticipated products including:

- 1) Estimate Bioavailability of Fe using GEOTRACES data sets
- 2) Estimate Bioavailability of Fe in natural systems by examining phytoplankton single cell Fe quotas across concentration gradients of dissolved and (labile) particulate TEIs,
- 3) Test the hypothesis for light and Fe co-limitation in deep chlorophyll maxima (DCM)
- 4) Explore Redfieldian concepts of elemental stoichiometry using dissolved and particulate GEOTRACES TEIs data and ocean models
- 5) Controls on biogeography based on organismal quota approach, community trace metal demand and trace metal inventories and relative resource supply
- 6) A Synthesis Paper on “Paradigms of ligand composition and cycling and the degree of confidence in them”
- 7) Comparison of radionuclide-based methods to estimate the downward flux of particulate C, N, P, ^{232}Th , Al, Cd, Fe, Co, Cu, and Mn from the surface to the sea bed.
- 8) Modes of regeneration: desorption/dissolution vs. biotic respiration. Combine measured TEI distributions with calculated AOU, depth-dependent OURs, and preformed TEI concentrations to discriminate among effects of abiotic scavenging, biotic uptake and regeneration, and physical transport.
- 9) Improve simple models for particle aggregation and disaggregation by adding 2nd order rate kinetics for aggregation, and by including the aggregation of small and large particles.
- 10) Residence times for the spectrum of elements based on K_d values measured concurrently with ^{230}Th and ^{232}Th .
- 11) Combine beam transmission with abundance and composition of particles to define particle distributions that affect TEI scavenging as well as the optical properties of nepheloid layers.
- 12) Prepare a synthesis paper [and corresponding data set] on the distribution of nepheloid layers, and the properties of particles that regulate their impact on dissolved TEI distributions.

Bob then presented the status of the anticipated papers for the above actions 1 (Shaked, Maldonado, Twining et al., Results of Summer 2017 lab experiments to be published before synthesis of field data), 7 (Paper Hayes, Black et al., GA03 data compiled and

graphed; working on manuscript; Application to GP16 data: Black et al., ms. near submission; Pavia et al., Goldschmidt presentation – manuscript to follow), 10 (paper by Hayes et al. ready to submitted), and 12 (paper by Gardner et al submitted to EPSL and other in preparation, global transmissiometer database under construction).

Bob invited Yeala Shaked to present the synthesis effort in iron availability:

Synthesis Effort in Iron Availability – Yeala Shaked

Yeala gave an overview of evaluating bioavailability of Fe, with the range defined to fall be extremes of free iron and siderophore-bound Fe. She showed how culture results fall within the theoretical limits of bioavailability, all indicate similar Fe availability; i.e., a single bioavailability value for a specific water mass. Then a number of different water sources were compared and the surprise is that the Fe bioavailability is similar in all water sources. Exposure of 6 water types to natural sunlight increased bioavailability by an order of magnitude. Application of this approach to *in situ* conditions involved cell quotas from Ben Twining and growth rates from PISCES-2. Bioavailability *in situ* seems to be about an order of magnitude greater than availability in the lab in dim light, consistent with the lab experiments in the lab using intense natural light, suggesting that photochemistry increases Fe bioavailability.

Yeala specially thanked Phoebe for finding and sending un-analysed samples and Bob for endless encouragement.

Discussion: Should we follow this approach for the “Paleo” synthesis workshop or adopt a different approach? e.g., more like the Royal Society meeting?

Gideon – He spoke in favour of following an approach like the OCB workshop.

Maite – She noted that if so, there would be a need to identify a leader in each working group in advance. Bob pointed that the problem of this is that it might exclude people that take an important role during the meeting. Maite suggested identifying these people the last day of the workshop.

Tina – She agreed it would be good to have some people identified in advance. Bob agreed it would be good to have some people identified that stimulate discussion.

In summary, there was a general sense that it would be better to organise the PAGES workshop with an organic approach in which participants were tasked with identifying high priority topics for further synthesis, as well as provocateurs to stimulate discussion and heroes to lead the synthesis effort.

IPO report

Catherine began with a quick summary of IPO’s responsibilities. New this year is a major update to the publication database: <http://www.geotraces.org/library-88/scientific-publications/peer-reviewed-papers> Elena obtained support from the OMP data centre to generate a searchable database. The database serves two functions: a) providing references linked to data in IDP2017 (e.g., it lists relevant publications in response to a query by parameter name, such as: Fe_D_CONC_BOTTLE @ GP16);

and b) a search feature that allow searching on key words. Three types of searches are supported: 1) Simple, where you can search by parameter, section, etc. 2) Advanced that includes drop-down menus. Document type includes theses, so students should send Elena links to their online theses. 3) Parameter search allows searching by keyword, subgroup or parameter.

Action: SSC members to test the publication database search features and send feedback to Elena.

Action: Elena to update the web page to clarify distinction between IDP2014 reference database, which must be maintained to support IDP2014, from the new IDP2017 publication database.

Action: Elena to add “publications database” in the web-page quick links.

Reiner noted that eGEOTRACES uses the reference database as well and then he congratulated Elena on a successful and very useful product.

It is difficult for Elena to identify specific parameters in papers for which data are included in IDP2017. Elena will set up an on-line form so that can provide the DOI, cruise and parameter names.

Action: Elena to prepare an on-line form so that investigators can provide DOI for all the IDP2017 papers.

Catherine presented the “Discovery Digest” which is a new type of special issue GEOTRACES eNewsletter combining multiple science highlights on a specific topic.

Catherine reminded the SSC that archived presentations are posted in a password protected web page that is available to SSC members. She also reminded SSC members to encourage colleagues to submit science highlights.

The GEOTRACES email list has 1022 subscribers. Twitter has 544 followers.

The IPO has a long list of tasks to carry out during the next year. Some are novel, like creating short videos on certain topics. The IPO would like to purchase software that captures content from a computer screen and create a video.

GEOTRACES publications

Status of the GEOTRACES Special Issues in preparation:

Elements Magazine – Catherine Jeandel

Catherine reviewed plans for the *Elements magazine*, including a review of the nature of Elements magazine papers. The papers need to be very general to be understandable by a broad audience. Catherine is working with Vanessa Hatje and Zanna Chase.

First drafts of manuscripts are due by 15 January 2018. The review will be handled by the guest editors. Publication is planned for October 2018.

Annual Review of Marine Science – Bob Anderson

Bob summarised plans for the article on GEOTRACES for the *Annual Review of Marine Science*. He solicited suggestions for science topics.

Gideon – He noted that it would be good to highlight synthesis topics from the science bullet talks at the IDP2017 town halls at Goldschmidt and OS2018. Featuring the synthesis products emphasises to the ocean sciences community that GEOTRACES is much more than a mapping survey and in fact is generating high level products of broad interest to the ocean sciences community.

Bob welcomes topics and co-authors. Tung-Yuan Ho volunteered.

Action: SSC members to suggest Bob Anderson any new topic for the *Annual Review of Marine Science*.

Action: SSC agreed to purchase open access for the *Annual Review of Marine Science* article.

Goldschmidt Session 10i Chemical Geology Special Edition – Phoebe Lam

Phoebe summarised the *Chemical Geology* issue led by Tim Conway. This issue is connected to Goldschmidt session 10i. Chemical Geology have approached the convenors with the idea of a special edition based around the session, but also including research papers from non-attendees.

Action: SSC members having suggestions for titles for the Chemical Geology to contact Tim Conway.

New GEOTRACES Special Issues

Maite – She noted that the BioGEOTRACES community will discuss a special issue at Ocean Sciences.

Geraldine – She reported that a GEOVIDE issue is in preparation.

Bob – He noted 16 papers accepted so far for the GP16 special issue in Marine Chemistry, for which Jim Moffett is the guest editor.

Other special issues?

Jing Zhang – She reported discussions with Tom Bianchi about a special issue on East Asian GEOTRACES in *Marine Chemistry*. Guest editors will be Jing, Pinghe Cai and Greg Cutter, who will also help with the English. The submission window will close at the end of January 2018, with 25 titles already submitted from Japan, South Korea, China and Russia. Investigators from other nations can contribute on topics relevant to western Pacific GEOTRACES.

Action: Jing Zhang to send the information about the special issue on the East Asian GEOTRACES in *Marine Chemistry* to the IPO to be distributed to the GEOTRACES community.

Eric – He informed about a special issue of *Frontiers* on rare earth elements dedicated to Harry Elderfield.

Outreach and Publicity Discussion

New Scientist paper

Phoebe reported on her interaction with an editor from *New Scientist* about a paper on TEI cycling. The editorial board at *New Scientist* approved the paper. Andy Ridgway from Bristol has been commissioned to write the paper, which will be on nutrient cycling in the ocean, not on GEOTRACES exclusively. Phoebe, Ed Boyle and Bob Anderson have been interviewed by Andy.

GEOTRACES video

The GEOTRACES video was shown. The movie is on YouTube. Elena would like to prepare a Special Issue of the eNewsletter presenting the video. The eNewsletter will provide a link for each question as this is how people are most likely to seek information.

Action: Elena to set up the questions on the web site with links to the time slot on the YouTube file where the question is answered.

Maite – She suggested that if another video is done consider having each person speak in their native language (e.g., include German, Portuguese and Chinese) to have broader international outreach. Then subtitles could be just in English (subtitles in 6 languages would be difficult).

New ways of organising and recovering information from the science highlights

Bob presented the idea to tag the Science Highlights with searchable keywords.

Action: Interested SSC members contact Bob and Elena to volunteer to help organise a search system. (Note: by the end of the meeting Phoebe, Maite and Zanna volunteered to help Bob organise science highlights by topic and assign appropriate key words.)

Publicising IDP2017 at meetings

Catherine led a discussion on steps that could be taken to promote IDP2017 at various types of meetings (e.g., other programs, national meetings, etc.). It would be good to carry a 1-slide information item to meetings to promote IDP2017 such as the slide that Elena prepared for special session convenors.

Chemical and Engineering News

Bill reported that he would follow up with his previous with *Chemical and Engineering News*'s writer to prepare a follow up article in this journal.

Action: Bill to follow up with the writer of *Chemical and Engineering News* to publicise IDP2017.

Capacity Building

Bob presented recommendations extracted from Greg Cutter's document based on his experience in Xiamen. The recommendations include:

- All the scientists and crew need to be fully trained in deployment, recovery, and sampling procedures – both for safety and to avoid contamination
- Clean sampling system deployment may require special clearance, fairleads, etc.
- Manufacturers change product designs – check products for surprises
- GO-FLO, OTE GO-FLO and NISKIN-X bottles each have liabilities
- Test cruise should include:
 - Bottle salinity to compare with sensors; nutrients to compare with conventional rosette samples – to test for leaks in TM-clean bottles (a problem with GO-FLOs)
 - Shipboard Zn (ideally shipboard Fe and Al, too) to test for contamination
 - Fire all bottles at same depth (~100 m) to test for internal consistency
- Clean lab (van) design.

Discussion:

Geraldine Sarthou – She suggested adding this information in the Cookbook.

Bill Landing – He suggested starting a forum where people implementing a clean sampling system can pose questions to “experts.”

Action: Bob to contact Greg Cutter to ask whether he would be willing to serve as moderator of a forum where people implementing a clean sampling system can post questions.

Bob – He noted that Greg plans to prepare more videos such on the OTE GO-FLO, etc.

Maeve – She noted that there are a variety of videos that demonstrate sampling practices. Maybe they can all be organised into a single source.

Phoebe summarised: SSC members favours posting the general recommendations on the GEOTRACES web site.

Action: Elena to add a quick link to the cookbook on the GEOTRACES website.

GEOTRACES training course in Brazil

Catherine reported on the GEOTRACES training course in Brazil, hosted by Vanessa. This course was supported through the SCOR Visiting Scholar program. The course

emphasised REE, Th/Pa and Nd isotopes. An ICP-MS was not available for practicals, so the practicals focused on data reduction and the principles of isotope dilution. Vanessa publicised the course widely and the response was excellent, with 16 students attending from all over Brazil.

Budget (Ed Urban)

SCOR has just started the 3rd year of its current NSF grant. A new NSF grant will start 1 Sept 2018. For 2017 and 2018 total income, including rollovers, is \$435k. Local funding for the IPO amounts to ~\$18k/yr.

Expenses: GDAC \$110k/yr, IPO \$81.7K/yr; SSC and other meetings ~\$70k/yr. Summer school \$16k, IDP2017 Launch \$13,239. Balance in 2017 is \$160k.

2018: If the next SSC meeting is in Hobart then the cost is \$75k. But cost should not be the deciding factor. Ed budgeted \$17k for 2018 S&I meetings, although it may not all be needed. Ed budgeted for the PAGES workshop \$15k and for DMC meetings \$10k. Open access fee for IDP2017 *Chemical Geology* paper and for the *Annual Reviews of Marine Science* paper \$6.7k. Ed anticipates \$118k left at the end of 2018, so the SSC could allocate some funds to a BioGEOTRACES meeting or other meeting.

Total expenses are about \$302k/yr.

In 2017, NSF funds 70% of total GEOTRACES management costs. In 2016 NSF supported 80% of GEOTRACES management costs. In 2017 there were large contributions from France for the summer school and from Brazil for the SSC meeting. Ed Urban thanked Vanessa Hatje and Geraldine Sarthou for these contributions.

Japan will contribute \$3k this year.

Maite – She suggested that while she is on sabbatical in Spain there could be a BioGEOTRACES meeting in France near the TARA headquarters for a couple of days. Maite suggested \$15k would be sufficient. A list of key participants will be generated after the Ocean Sciences meeting. This would be a preliminary meeting to plan a much larger event, so it would not be an entirely open meeting. The \$15k may be sufficient to include 6-8 people from the U.S.

Ed Urban – He noted that the BioGEOTRACES meeting in Woods Hole was instrumental in getting BioGEOTRACES off the ground.

Decision: SSC agreed to allocate \$15k for a BioGEOTRACES meeting.

Rob – He noted that he might be able to contribute some funds.

Action: Rob Middag to explore whether NIOZ could contribute funding to the project.

Discussion: What should be done for GEOTRACES at the SCOR Booth?

Have a meeting site where people can gather to ask questions. Include a drop in session like at the summer school where young people can come and speak with expert in the field.

Next SSC meeting venue

There are two offers to host the 2018 SSC meeting: Australia and Taiwan.

Tung-Yuan noted the growth of GEOTRACES activities in East Asia with new ships in Korea and in China and growth of capacity in Taiwan. His governmental funding director encouraged him to propose a meeting in Taiwan. He noted he could raise \$20k USD to support the meeting.

Zanna noted that Hobart could host a meeting in 2018 or 2019. Next year Australia has a big voyage from 13 Sept to 8 October, and other voyages as well. In general 2019 may be better. Australia has conference grants that could pay travel for speakers at a meeting, or Hobart can cover some travel costs for a speaker. These are not large amounts of money but travel expenses for a couple of people represent a significant contribution. ICP2019 will be in Sydney 1 – 6 September 2019 so holding the SSC meeting back to back with ICP could help save money. As many as 6 SSC members may go to ICP.

Decision: SSC agreed to host the 2018 SSC meeting in Taiwan and the 2019 SSC meeting in Australia.

Liping offered to host the 2020 SSC meeting in Beijing.

Discussion about the 2018 SSC meeting dates:

Mid July is the best time for people given the US cruise schedule.

Action: Elena to send out a doodle poll for 2018 SSC meeting.

The meeting adjourned at 15:15.