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| **Research Group** | **Sedimentary Basins** |
| **Date due** | **w/c 11/1/2021** |

Please complete this form to tell us about your future plans for your Research Group. You are asked to complete a 1 page strategic three-year plan for your Research Group and also to detail your plans for infrastructure and technical support, highlighting areas where investment is required, what academic hires would help to deliver your strategy, and outline your expected research income generation over the next year.

**Strategic Research Plan for next 3 years 2021-2023**

The Basins Research Group has an internationally leading reputation for research on sedimentary basins, with a strong track record in fundamental sedimentological processes, palaeo-environmental change, basin-scale fluid flow and diagenesis. It is one of a few groups in Europe that has similar expertise in both clastic and carbonate systems. Furthermore, it holds a wealth of expertise and data relating to past climates, from the Pre-Cambrian through to the Quaternary. The group is currently undergoing a transition as we align ourselves with, and define, emerging themes associated with the energy transition. In the short – medium term, this has influenced funding, and in the long term it should provide many opportunities to open up new funding streams and cross-disciplinary research programmes. The UK is on the cusp of this transition with an urgent need to develop new local, regional and national sustainable energy sources. There is also an urgent need to develop resources for carbon sequestration and gas storage facilities to ensure energy security and move towards a carbon-neutral economy and ensure energy security. This provides an opportunity for the group to build new partnerships – as well as nurturing existing ones – to diversify its research funding, evolve its fundamental research outputs and consolidate our world-class reputation in all aspects of subsurface energy geoscience.

In this context, our overarching aim is to grow our reputation, broaden our funding base (in particular via UKRI) and develop strategic partnerships with leading energy companies to play a significant role in the energy transition through provision of world class research, PGR and PGT training. This will be achieved through development of 4 principal themes over the next 3 years:

1. Sustainable subsurface energy, focussing on gas (hydrogen) and carbon storage and low enthalpy geothermal heat. Research into petroleum systems will be maintained in recognition of the continued contribution of hydrocarbons to energy markets over the next decades, with a focus on optimising existing reserves and gas production.
2. Geo-disposal of radioactive waste is the agreed policy for the UK; characterising and defining uncertainties in the subsurface is a key aspect of this.  As an active part of the RWM research support hub, there is the potential to influence and be involved in projects relating to hydro-geology, gas generation and migration, multi-scale characterisation and chemistry/mineralogy.
3. Sedimentary processes and geochemistry in environmental science and pollution control, particularly micro-plastics
4. Reconstruction of palaeo-climates based on sedimentary processes and geochemistry
5. Collaboration with with colleagues in the Geoscience group to identify sources of lithium and REE for next generation batteries

Growth is expected in all of these areas, although the number of staff who focus their research primarily on petroleum geoscience will likely reduce. Research projects within the group deliver to the UNSDG 6, 7, 13 - 15\*. Our research programmes will involve intra-DEES collaboration, particularly the Geoscience and Geomicro research groups. Cross-School collaboration for geothermal and CCS projects (particularly CEAS and MACE) will develop from existing partnerships and those that are evolving through the Subsurface Energy Network established by Taylor, Huuse and Hollis in 2020 and through partnership with MERI. There are also an increasing number of opportunities to work with the Tyndall Centre in the Life Cycle Analysis of energy projects, and public engagement in the realm of climate change / future energy.

Growth will be achieved by continuing to nurture our relationships with international energy companies, as well as using our experience of business engagement to work with smaller energy providers in the UK. The number of UKRI applications (NERC and EPSRC) will be increased through standard round applications and response to specific calls. There will also be greater engagement in large grant calls; Basins played a significant part in an EOI for the NERC Changing the Environment call, for example. We will strive to attract more high quality post-doctoral researchers through support of NERC and Leverhulme Fellowship applications, and will optimise the number of PhD students supervised per person (no more than 6 pp) to ensure that we can offer the highest level of support and focus on the best students. In the long term, we retain the ambition to develop a DTP in subsurface energy in collaboration with other northern universities.

**Outline how you will use university/department infrastructure and technical support in the next year, highlighting where any investment is required**

No new infrastructure is required, but there is continuing high pressure on standard equipment and technical support that is essential to our research delivery (e.g. SEM, electron microprobe, XRF). We need to improve our ability to confidently micro-sample for high resolution geochemical analysis through a small-equipment purchase (~£50K) of a micromill (e.g. http://www.nwrlasers.com/milling/micromill/).

**Outline any upcoming staffing changes or gaps and opportunities to achieve strategic goals or maintain existing strengths**

During 2020, Dr David Hodgetts left the group for a 2 year career break, and has not been replaced, significantly weakening our capability in digital outcrop imaging and geocellular modelling. Prof Chris Jackson will join Basins in Feb 2021 as Chair of Sustainable Geoscience, and will further strengthen the group’s experience of tectonosedimentary processes. Prof Peter Clift (currently Louisiana State University) has approached the group to support him in his application for a Royal Society Professorship, and will be interviewed in Jan 2021. Peter would bring cross-disciplinary expertise in sedimentary processes and climate change.

**Business engagement**

There will be continued engagement with our global industrial partners through SLOPE5 and NARG, as well as existing relationships with BP, Total, Equinor and ENI and industrially-led funding calls. Although there have been perturbations in these funding streams in the last 12 months, we are now starting to rejuvenate them as corporate re-organisations close out. PD3 II was put on hold in 2019/20 as a result of the downturn in the oil price could be refreshed in late 2020 with a future energy theme. New opportunities will also arise through CCS (in particular, discussions with ENI, Equinor and Vår-Energi are ongoing) and imaging. Overseas, we will continue to maintain and develop our relationships with National Oil Companies and associated research organisations (e.g. KOC/KISR in Kuwait and the UAE Environment Agency).

**Research Income Generation for the next year**

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| **PI and team** | **Sponsor/Call**  | **Research Area/Proposal Title** | **Date**  | **Value** | **Chance of success (%)** | **Comments** |
| Cathy Hollis | NERC Standard Round | Hypogene karst: genesis and implications to optimisation of low enthalpy energy resources | Feb 2021 | £800K | 20% | Resubmission from 2020 |
| Kevin Taylor | EPSRC | Shallow – deep geothermal integrated systems | June 2021 | £800K | 20% | Co-I Cathy Hollis, Co=-Pis in CEAS |
| Kevin Taylor | NERC Standard Round | Machine learning using UKGEOS data and experimental data to understand the microstructure variation at variable length scales. | June 2021 | £600K | 20% | PI: Lin Ma (CEAS) |
| Kevin Taylor | JIP | IMAGER | Late 2021 | £500K | 10% |  |
| Kevin Taylor | EPSRC/NERC | Imaging / modelling bentonite barrier porosity evolution for nuclear waste disposal | Mid 2021 | £600K | 20% | PI: Lin Ma (CEAS) and Majid Sedighi (MACE) |
| Kevin Taylor | ENI | Characterisation for CCS in Irish Sea Basin | Mar 2021 | £50K | 50% |  |
| Ian Kane | NERC Standard Round | Biodegradable and compostable plastics in the deep sea: long term fate | June 2021 | £800K | 10% |  |
| Ian Kane | NERC Standard Round | Deep marine reservoirs as CO2 sequestration targets | June 2021 | £800K | 25% |  |
| Ian Kane | Equinor | Deep marine reservoirs as CO2 sequestration targets | June 2021 | £200-600K | 25% |  |
| Ian Kane (CoI) | Leverhulme Research Centre | Plastic degradation and ecotoxicology | Apr 2021 | £10m | <10% | Led by Cyril Bussy, School of Health Sciences |
| Rhodri Jerrett | Leverhulme Fellowship |  | Apr 2021 |  |  | Applicant: Madeline Vickers |
| Rhodri Jerrett | NERC Standard Round | Oceanographic circulation patterns in the Cretaceous as means of transferring heat to the high latitudes | Jan 2022 | £800K | <10% | Early planning stages at the moment |
| Stephen Flint | Slope 5 consortium | Additional sponsors – AKERBP in negotiation currently | June 2021 | £100K | >50% |  |
| Mads Huuse | New JIP | Subsurface gas storage  | 2nd half of 2021 | £1.5M | 25% | Could be developed with a separate umbrella project for CCS |
| Jonathan Redfern | NARG | New sponsors – discussions with Chevron ongoing | Mid-2021 | £155K | 25% |  |
| Stefan Schroeder | NERC Standard Round or BBSRC | Microbial acceleration of carbon sequestration in highly alkaline waste sites | June 2021 | Tbc, ~£800K | 20% | CoIs: Jon Lloyd (UoM), Bill Hayes (U Northumbria), Mike Rogerson (U Hull), Christophe Dupraz (U Stockholm) |
| Stefan Schroeder | NERC Standard Round | Volcanic influence on PETM greenhouse gas emissions | Jan 2022 | £800K | 10% | collaboration with Geological Survey of Denmark and Greenland (GEUS) |
| Chris Jackson | NERC-NSF | Tectonics and structural geology | June 2021 | £800K | 10% | Co- PI – Rebecca Bell (Imperial College) |
| Chris Jackson | Norwegian Research Council (NSF) | Renaissance of Central North Sea (CNS) Salt Tectonics: Implications for Hydrocarbon Prospectivity and CO2 Storage Potential in the Upper Permian and Triassic | Mar 2021 | £700K | 30% | Co-PIs – Oliver Duffy (University of Texas at Austin), Chris Jackson (Manchester), Atle Rotevatn (Bergen), Rob Gawthorpe (Bergen) |