

9 December 2011



**The
Geological
Society**

Science Review Team
National Curriculum Review
Department for Education

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Dear Sir / Madam

What are the key concepts in Earth science to which all students should be introduced at school?

The signatory organisations to this letter welcome the inclusion of Earth science in the National Curriculum, and believe it is vital that this continue.

Earth Science is the study of the processes and structure of the whole Earth system - its past evolution, contemporary processes and future predicted models. This includes the atmosphere, the continents, the oceans and rivers, ice, landforms, landscapes and the evolution of life on Earth. Earth science is inherently multidisciplinary, and within current mainstream school subjects, different aspects are most appropriately taught in science (physics, chemistry, biology) and geography.

To assist with the review of the National Curriculum for England, our organisations have worked together, in consultation with a wide range of other societies and organisations and with practicing teachers at primary and secondary level, to identify the key knowledge, understanding and concepts in Earth science which we believe all school students should be introduced to through the combination of science and geography. The attached document is structured progressively, showing what content is best delivered at of the key stages 1-4, building on earlier stages, and which should be taught in science (upper part of the diagram) and which in geography (lower part of the diagram). It also indicates a field/experimental strand for each. The central line running through the document indicates the conceptual underpinning that informs both the science and geography teaching.

Because Earth science can provide a holistic view of our planet, across vastly differing scales of distance, time and rate of change, it is valuable to articulate the links between the aspects taught in science and geography, and teachers should be supported in doing this. All students should be taught about the knowledge, processes, concepts, and main interpretive models, in Earth science, to give them a fundamental understanding and to equip them as well-informed citizens, and to stimulate the next generation of Earth scientists on whose skills achieving this will depend. The direct observation of evidence in the field, and its use to formulate and test scientific theory, is central to Earth science - experience of such fieldwork through school

Executive Secretary:

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science and geography, as well as the interdisciplinary thinking and problem solving inherent in Earth science, equips students with valuable knowledge, understanding and skills.

Our organisations would be happy to discuss any of these matters with the DfE Curriculum Review team. A key dependency is which subjects are mandatory at which stages in the curriculum. We would also be pleased to work with the wider science community to discuss which topics within the science programme of study might best be taught in physics, chemistry and biology, respectively – a matter we have not attempted to address here – and to assist with further development of the content suggested across the key stages.

Those science teachers who teach Earth science and the geography teachers who teach physical geography should continue to be strongly supported, for instance through professional development initiatives, and the signatory organisations to this document are involved in such initiatives.

Yours faithfully

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<p>Fieldwork Observation and description of what is around you</p> <p>Rocks: Sorting and grouping rocks based on appearance</p>	<p>Fieldwork Observe and record local fossils and rock types</p> <p>Fossils as a record of extinct species and of evolution</p> <p>Formation and identification of sedimentary, metamorphic and igneous rocks, their resultant properties</p> <p>Solar system – Sun, Moon and Earth and their effects – light, heat, seasons, night and day</p>	<p>Lab/Fieldwork Observe, record and experiment to test hypotheses about past processes and environments</p> <p>Life has evolved over billions of years – observing fossils and properties of rocks in the geological record informs our understanding of past environments and the development of life and the planet</p> <p>The Rock Cycle – formation and cycling of igneous, metamorphic and sedimentary rock by Earth processes Earth structure – core, mantle and crust The age of rocks at the Earth's surface can be estimated by their pattern of distribution and radiometric dating</p> <p>Formation of the solar system and of the Earth; evolution of atmosphere, oceans and solid Earth Climate has varied through Earth history and continues to do so</p>	<p>Observation of the present and evidence about past processes and environments can be used to model future change</p> <p>Life has evolved over billions of years and continuously modifies Earth systems</p> <p>Earth and its atmosphere consist of dynamic and complex interacting systems of rock, water, ice, air and life; feedbacks operate, and energy and mass are cycled Greenhouse effect - composition of the atmosphere controls the balance of incoming and outgoing energy, and hence the temperature and climatic conditions for life The carbon cycle – fossil fuels, limestone etc as sinks which lock away atmospheric carbon, which is rapidly released when fuels are burnt</p> <p>Global distribution of mineral resources depends on past geological processes</p> <p>Plate tectonics as a unifying theory caused by mantle convection Plate tectonics has shaped the continents, ocean circulation and climate, and the development of landforms and active geological processes at plate margins</p> <p style="text-align: right;">Science programme of study</p>
<p>KS1 - The world is made up of what you see around you</p>	<p>KS2 - Natural processes shape the Earth and its surface</p>	<p>KS3 - The Earth, its environments and landscapes change and evolve over time</p>	<p>KS4 - Earth and its environments as dynamic and complex systems</p>

<p>Landscapes and Environments: Identifying key land forms, soil, vegetation, water (rivers and coasts) and weather</p> <p>Fieldwork Observation and description of what is around you</p>	<p>The world's major physical features – locations, patterns, characteristics and scale: continents, oceans and currents, mountain chains, river basins, coasts, and hot and cold deserts</p> <p>World climate zones, environments and vegetation belts</p> <p>The UK: Climate and weather patterns; types of landscapes</p> <p>Fieldwork Observe and record local landscapes and weather</p>	<p>The processes shaping the Earth's surface including the water cycle; weathering and erosion and the formation of soils Landscapes as distinctive collections of landforms, soils and Earth surface processes; focus on rivers and coasts</p> <p>Weather systems, climate zones and ocean currents; their properties, processes and patterns</p> <p>People-Environment interactions Renewable and non-renewable resources from the Earth and its atmosphere Human activity affects climate, oceans and landscapes Humans are affected by natural hazards: distributions and patterns (volcanoes, earthquakes, flooding, landslides, hurricanes etc)</p> <p>Fieldwork - Observe, map, measure, analyse and interpret UK landscapes/surface processes e.g. rivers, weather</p>	<p>Fragile landscapes and environments - deserts, polar regions, mountains and reefs – Earth surface processes and human interactions</p> <p>Human life has rapidly modified Earth's systems and surface resulting in climate change, ocean pollution, land degradation and flood risk</p> <p>Ecosystems as the balance and interconnections between climate, soil, water, plants and animals</p> <p>Sustainability and use of renewable and non-renewable resources</p> <p>Fieldwork - Observe, map, measure, analyse, interpret and evaluate UK landscapes/surface processes e.g. rivers, weather</p> <p style="text-align: right;">Geography programme of study</p>
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