

## AUSTRALIAN GEOSCIENCE COUNCIL RESPONSE TO NATIONAL SCIENCE CURRICULUM FRAMING PAPER

National Curriculum Board  
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Organisation: <b>Australian Geoscience Council</b>			
Area/s of interest:			
<del>English</del>	<del>Mathematics</del>	<b>Science ★</b>	<del>History</del>
Please choose:			
Academic	<b>Business or industry professional ★</b>	Educational professional <ul style="list-style-type: none"> <li>• CEO</li> <li>• Curriculum director</li> <li>• Curriculum manager</li> <li>• Departmental/sector representative</li> <li>• Principal</li> <li>• Professional organisation representative</li> <li>• School administrator</li> <li>• Teacher</li> <li>• Teacher's aide</li> </ul>	
Community member	Journalist		
Parent	Student		
Union representative	Youth leader		

## **Preamble**

The Australian Geoscience Council (AGC) is the Peak Council of geoscientists in Australia. It represents eight major geoscientific societies with a total geoscience membership of ~9000 comprising industry, government and academic professionals, in the fields of geology, geophysics, geochemistry, mineral and petroleum exploration, hydrogeology and geological hazards. The Australian Geoscience Council comprises the Presidents or CEOs of the following professional and learned societies:

- Association of Applied Geochemists,
- Australasian Institute of Mining and Metallurgy;
- Australian Geoscience Information Association;
- Australian Institute of Geoscientists,
- Australian Society of Exploration Geophysicists,
- Geological Society of Australia,
- International Association of Hydrologists (Australian Chapter),
- Petroleum Exploration Society of Australia.

The AGC's mission is to provide a forum in which representatives of geoscientific bodies can cooperate to encourage the development of the earth sciences in the interest of Australia. Geoscience covers the earth sciences, which includes geology, geophysics and geochemistry. This recognizes the vital contribution that the application of geoscience makes to our quality of life and economic prosperity. The objective of the AGC is to represent the broad range of earth science professions, and in particular to provide Australians with a greater appreciation of the economic environmental and cultural values of earth sciences.

This submission is further to our feedback (19<sup>th</sup> December 2008) to the paper "The Shape of the National Curriculum Proposal" and is supplementary to those submissions made by the Geological Society of Australia (GSA) and Earth Sciences Western Australia (ESWA).

The AGC endorses the key content of the GSA and ESWA submissions, particularly with regard to the critical importance of maintaining Earth and Environmental Science as an essential core subject at Stage 4 of any national science curriculum.

## Introduction

1. Please comment on the Introduction

The AGC endorses the comments made by the Geological Society of Australia

## Aims

2. To what extent do you agree with the aims of the proposed national science curriculum?

Strongly Disagree

Disagree

Agree

**Strongly Agree ★**

3. Please comment on the aims of the proposed national science curriculum.

The AGC endorses the comments made by the Geological Society of Australia and specifically: *Enthusiastically supports the notion that science education should develop students' science capabilities and provide all citizens with a minimum core understanding of science content and method that enables individuals and communities to make decisions based on evidence and reason.*

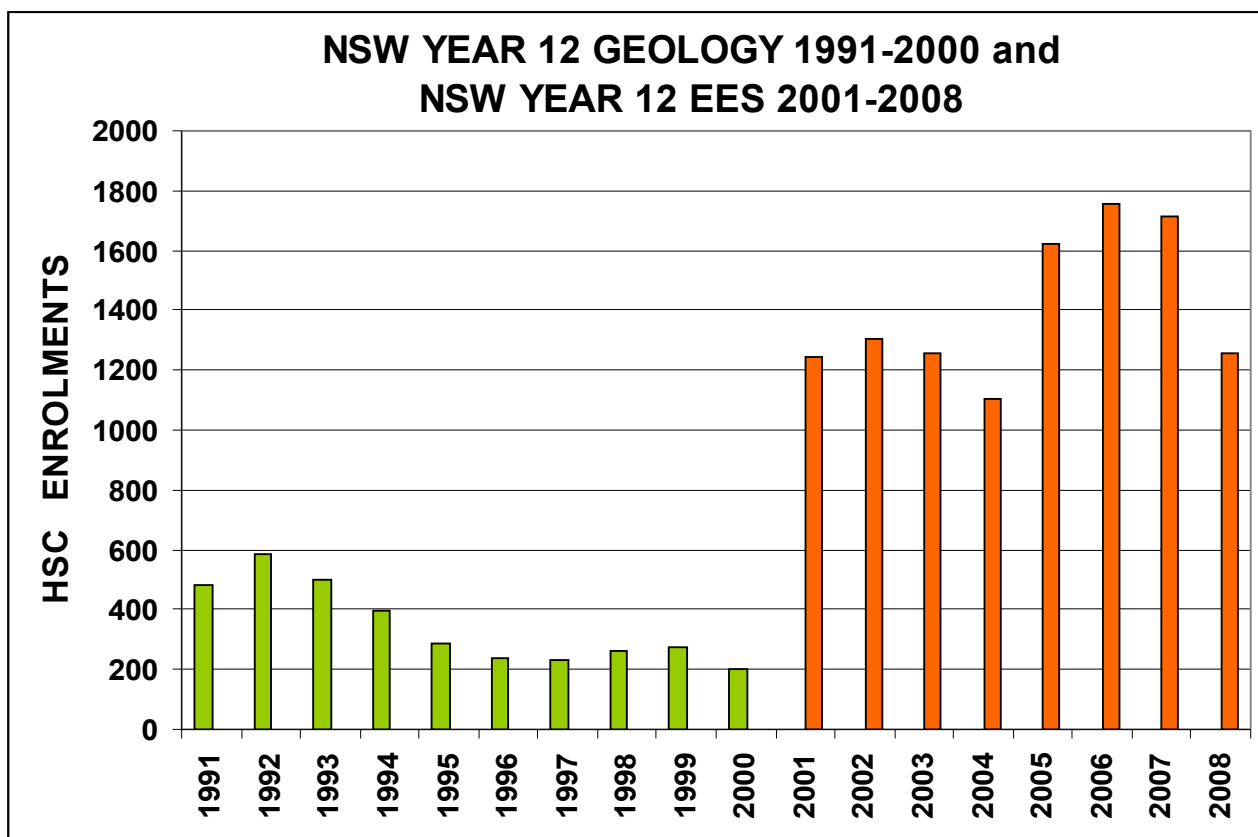
The AGC is further concerned that the current curriculum and that proposed in the Science Framing Paper does not adequately address the revolution in earth systems science that has occurred over the last 20 years that places biological, including human, activity as one of the major controlling forces in shaping the planet and its life support processes. A national science curriculum should recognise the interdependence and feedback mechanisms between geological and biological, particularly human, drivers in shaping the earth's environment and the availability of resources such as water and arable land as well as the minerals and energy resources that support human existence.

This framework is one of those '*big ideas that are essential to deep understanding of a domain of knowledge*' (para 29 *The Shape of the National Curriculum; A Proposal for Discussion*) which will be essential context for future generations of citizens and decision makers in confronting the difficult decisions in the face of global change including climate change (Box 1, *Ibid*). This idea defines the need for Earth and Environmental Science to be taught as an integrated whole and is an exemplar of the necessity for inter-disciplinary thinking (Box 3, *Ibid*). In this context it is significant that many Australian universities have amalgamated their earth science and environmental science departments in recognition of this convergence.

If this can be accomplished, the 'science for life' approach, described in paragraph 20 is a natural fit that will benefit individuals, the community and the economy of the nation.

While the AGC does express strong agreement with the aims of the proposed national science curriculum, we must reiterate that the proposed replacement of Earth and Environmental Science (EES), which is already operating strongly in two Australian states, by the narrow subject of Environmental Science is a seriously retrograde step. As demonstrated in the ESWA submission to the NCB, there has been extremely strong community and industry support for the EES course in WA, with a new textbook to be delivered in 2009. There has been corresponding participation by students in WA in this course.

In NSW, Earth and Environmental Science was introduced in 2001. As shown in the accompanying figure (Source: [www.boardofstudies.nsw.edu.au/ebos/static/ebos\\_stats.html](http://www.boardofstudies.nsw.edu.au/ebos/static/ebos_stats.html)), the very focused course of Geology attracted relatively few students and was declining in participation. The new EES course in NSW has encouraged many more students to participate and is regarded as an effective science subject.



### Terms used in this paper

4. To what extent do you agree with the definitions and applications of the terms used in this paper?

Strongly Disagree                      Disagree                      Agree                      **Strongly Agree \***

5. Please comment.

The AGC accepts the definitions in use by the NCB.

### Considerations

6. Comment on the considerations that need to be taken into account when developing national science curriculum. Are there other considerations not canvassed in the paper?

The integration of Earth Science with Environmental Science is critical to understanding and managing global change and the environment, as indicated above. **Environmentally sound renewable and non-renewable resource development through sustainable development principles is generally recognised as the prism through which humanity will consider its future.**

Unfortunately this has been presented to date as a battle between environment on the one hand and development on the other. **Under sustainable development, mankind's future on Earth depends upon attaining a level of development commensurate with human aspirations whilst achieving a level of balance in the natural world – constancy of capital stock – which is not prejudicial to future generations.**

The basis for sustainable development therefore concerns the scientific knowledge concepts and hypotheses that provide a rational strategy for planning mankind's future on a sustainable development framework. The science addresses the relationships between natural systems and processes and anthropogenic systems and processes (eg agriculture and industry). The critical aspects are those of rates and impacts. This construct provides a fertile area for consideration of the science of the environment and resource assessment and development and represents an amalgamation of traditional themes of geoscience and environmental science with the concept of earth systems and cycles operating at the global scale.

This leads us to reiterate part of the GSA's submission: *Consequently, as foreshadowed in paragraph 31, the content selected for a national structure must contain an appropriate range of science concepts that recognises the fundamental importance of major Earth Science concepts .....This can be achieved through the implementation of an Earth and Environmental Science core subject – as proposed by Earth Science Western Australia – at Stage 4 in the proposed curriculum. It can also be included in the overall curriculum through recognising the over arching nature of Earth Sciences and the ways in which this science can be used to unify and bring further meaning and learning opportunities to the teaching of science in general.*

### Structure of the curriculum

7. The paper outlines three elements: Science understanding, Science inquiry skills and Science as a human endeavour. To what extent do you agree with these elements as the basis for the national science curriculum?

Strongly Disagree                      Disagree                      Agree                      **Strongly Agree ✱**

8. Please comment.

AGC endorses the GSA comments.

9. The proposed structure identifies the curriculum focus, sources of science understanding and the relevant big ideas of science for each stage of schooling. To what extent do you agree with using these headings as organisers for the curriculum?

Strongly Disagree                      Disagree                      **Agree ✱**                      Strongly Agree

10. Please comment.

The proposed structure will allow the design of the curriculum to be easily understood and for new ideas to be incorporated over time.

Unfortunately, the AGC cannot endorse design aspect of paragraph 46 and Table 1. While Earth Science is implicit in the structures proposed for Stages 1 to 3 it is explicitly missing from the proposed structure for Stage 4. At the very least, it is essential that the Environmental Science subject proposed in this structure be rewritten as Earth and Environmental Science in recognition of the significance of the Earth Sciences to environmental and mainstream science studies. This has also been emphasised in the ESWA and GSA submissions. AGC would also add that teaching earth and environmental science together is essential for an appropriate response of the educational system to future societal trends.

11. To what extent do you agree with this approach to organising the science content for Stage 1?

Strongly Disagree                  Disagree                  Agree                  **Strongly Agree \***

12. Please comment

AGC endorses the GSA comments.

13. To what extent do you agree with this approach to organising the science content for Stage 2?

Strongly Disagree                  Disagree                  **Agree \***                  Strongly Agree

14. Please comment.

AGC endorses the GSA comments, especially the need to include “Earth materials and the Relationship between landscape and geology” and also biogeochemical cycles (eg carbon cycle).

15. To what extent do you agree with this approach to organising the science content for Stage 3?

Strongly Disagree                  Disagree                  **Agree \***                  Strongly Agree

16. Please comment.

AGC endorses the GSA comments, especially the view that big topics of Plate Tectonics, Dynamic Earth ( including biogeochemical cycles) and Evolution of the Solar System should be mandated content.

17. How many science courses should be included in the national science curriculum in the senior secondary years of schooling?

The AGC concurs with the comments of GSA and the submission of Earth Sciences Western Australia that the subject simply Environmental Science must be expanded to Earth and Environmental science. Further for the reasons outlined above, AGC considers that the curriculum for this course should be developed in a fully integrated fashion. This would provide the opportunity to address the historical problems concerning advanced study in Earth Sciences outlined by GSA in its submission without expanding the number of science subjects at Stage 4. The AGC believes that the senior subjects in Stage 4, with the inclusion of Earth and Environmental Science as the 4<sup>th</sup> core subject, would mesh with all prior stages and the requirements of producing students capable of further studies or immediate employment but they fail to address the historical problems created by excluding Earth Science content from the realm of senior studies.

The AGC also concurs with comments by the Australian Science Teachers Association (ASTA) who draw attention to the need for and success in integrating Earth and Environmental Science at Stage 4. Consequently, the AGC joins with the GSA and ASTA in strongly urging the NCB to adopt the model proposed by Earth Sciences Western Australia that explicitly places Earth Sciences in the senior curriculum through the establishment of an Earth and Environmental Science (EES) subject (rather than the much narrower subject of Environmental Science).

18. Please comment.

The AGC concurs with the comments made in the GSA submission supporting the ESWA model for EES content and advocating mandated Earth Science content within the Physics, Chemistry and

Biology courses.

### **Pedagogy**

Question 19: This section outlines approaches to pedagogy as they apply to the content of a national science curriculum. To what extent do you agree?

Strongly Disagree                  Disagree                  **Agree \***                  Strongly Agree

Question 20: Please comment:

The AGC concurs with the comments made in the GSA submission.

### **Assessment**

Question 21: This section outlines approaches to assessment as they apply to the content of a national science curriculum. To what extent do you agree?

Strongly Disagree                  Disagree                  Agree                  **Strongly Agree \***

Question 22: Please comment:

The AGC supports the NCB approach to assessment.

23. Do you have any other comments to make on the paper?

The Australian Geoscience Council is available, in concert with its member organisations, to assist the NCB in its further deliberations on the specific details of all aspects of Stages 1 - 4 of the new curriculum and in concert with its member societies and Earth Sciences Western Australia is willing to participate in an advisory body when formulating the content and structure of the Stage 4 Earth and Environmental Science subject as well as the specific details relating to the Earth Science components of the other science subjects.