MORE THAN JUST BUGS AND BIOPROSPECTING IN THE ABYSS. DESIGNING AN INTERNATIONAL LEGAL REGIME FOR THE SUSTAINABLE MANAGEMENT OF DEEP-SEA HYDROTHERMAL VENTS BEYOND NATIONAL JURISDICTION

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The Academic Senate on 16 December 2005 resolved that Mr David Kenneth Leary had satisfied the requirements for admission to the degree of Doctor of Philosophy.

This thesis represents a major part of the prescribed program of study.

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ABSTRACT

The unique biological communities associated with hydrothermal vents are of intense interest to science and for the potential the microorganisms associated with these ecosystems offer for developments in biotechnology. Rich deposits of gold, copper and other minerals associated with hydrothermal vents are also of increasing interest to the mining industry. Mining, bioprospecting, marine scientific research and other emerging activities, such as tourism at hydrothermal vents, pose as yet unquantified threats to deep-sea hydrothermal vent ecosystems.

With the exception of deep-sea mining, these activities are largely unregulated in areas beyond national jurisdiction under international law. Neither the Convention on Biological Diversity or the 1982 United Nations Convention on the Law of the Sea have meaningful application to such activities beyond national jurisdiction. It has previously been suggested that given a comprehensive legal regime already exists for the mineral resources of the deep-sea beyond national jurisdiction, an "intriguing question" needs to be addressed as to whether a legal and institutional regime should be created for the genetic resources of the deep-sea beyond national jurisdiction. It is argued that the issue of the fair and equitable utilization of the genetic resources of the deep-sea beyond national jurisdictions is only a subsidiary issue to a much broader question. That is how can all human activities that have an environmental impact on the deep-sea hydrothermal vent ecosystem be sustainably managed, so that

this particularly unique ecosystem of international significance is preserved for future generations?

Reasons to justify the design of an international legal regime for the sustainable management of deep-sea hydrothermal vents beyond national jurisdiction are outlined. While there is a lacuna in the law with respect to the application of both LOSC and the CBD, measures could nonetheless be developed within the framework of other existing treaties. A number of regional and other treaties arguably apply to some hydrothermal vent sites. The uncertainty of the coastal States sovereign rights in relation to hydrothermal vents on the continental shelf and, in particular, problems in applying the sedentary species definition under the Continental Shelf Regime are also considered.

It is suggested that no useful purpose is served by considering whether or not to designate hydrothermal vents and their associated genetic resources as the common heritage of mankind. This concept has no defined meaning under international law (as distinct from its political or rhetorical meaning) except as expressed in LOSC.

Examination of emerging domestic legal regimes in Canada, New Zealand, Portugal and Papua New Guinea highlight that any future legal regime will need to accommodate multiple and at times conflicting uses. In reconciling the conflicting uses it will be important to harness the skills of key stakeholders such as the scientific

community. Similarly existing tools such as environmental impact assessment and marine protected areas must have a role to play in any future legal regime.

Evidence of the extent of commercialisation of hydrothermal vent genetic resources is presented. For any future regime to properly address the issue of benefit sharing in relation to hydrothermal vent genetic resources it is argued that it will be necessary to link any such regime with existing mechanisms associated with intellectual property rights, especially patents. A proposal is outlined linking the grant of future patents to payment of royalties to a global commons trust fund. This fund could be managed by existing institutions such as the Global Environment Facility and regional development banks, and could be used as a mechanism to provide a new source of funds for measures for the sustainable management of hydrothermal vents beyond national jurisdiction and the marine environment more generally.

The core issue associated with scientific research is its environmental impact. A proposal is outlined for scientific research to be regulated by States implementing an environmental impact assessment procedure under domestic law modelled on the *Madrid Protocol* to the *Antarctic Treaty*, which is linked to government funding for scientific research.

Finally the thesis rejects the idea of an expanded mandate for the International Seabed Authority.

I certify that this thesis has not been submitted for a higher degree to another University or Institute.

David Kenneth Leary

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[1] Hereinafter MPA.
[2] Hereinafter JAMSTEC.
[3] Hereinafter GNS.
[4] Hereinafter EEZ.

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In Australia, a country not known for its active volcanism, I was very fortunate to meet, interview and exchange ideas with several scientists from the Australian Commonwealth Scientific and Industrial Research Organisation[5] involved in groundbreaking research on the hydrothermal vents of the Manus Basin of Papua New Guinea,[6] and elsewhere in the Asia-Pacific Region. Dr Tim McConachy was a useful source of information on hydrothermal vent research carried out for several years by the CSIRO in PNG. I am also grateful to Dr Peter Nichols who provided me with information on CSIRO's work on microbiology and biotechnology from hydrothermal vents and other geothermal areas in PNG, and developments in biotechnology more generally.

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[5] Hereinafter CSIRO.

[6] Hereinafter PNG.

Biotechnology Institute of Macquarie University also provided me with information on current research on thermophiles in a range of environments including terrestrial environments and their biotechnology potential. Dr Roberto Anitori of the Department of Biological Sciences, Macquarie University also provided me with information in relation to scientific research techniques in relation to the isolation of thermophiles and biotechnology research. I am also grateful to Ms Carol Oliver of the Australian Centre for Astrobiology who provided me with information in relation to the ongoing research of the Australian Centre for Astrobiology, science education, and a number of projects that the Australian Centre for Astrobiology has recently been involved in that relate to hydrothermal vent science.

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[7] Hereinafter UNICPLOS.

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[8] Hereinafter ISA.
[9] Hereinafter NGO.

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[10] Hereinafter IUCN.

[11] Hereinafter WWF.

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[12] See D K Leary, 'Law Reaches New Depths: The Endeavour Hydrothermal Vents Marine Protected Area' In J P Beumer, A Grant A and D C Smith (Eds), *Aquatic Protected Areas. What works best and how do we know? Proceedings of the World Congress on Aquatic Protected Areas* (2002), 85-96.; D K Leary, 'Emerging Legal Regimes regulating bioprospecting for thermophiles and hyperthermophiles of hydrothermal vents', (2004) 6 *Marine Biotechnology* S351, and D K Leary, 'Bioprospecting and the genetic resources of hydrothermal vents on the high seas: what is the existing legal position, where are we heading and what are our options?' (2004) 1(2) *Macquarie Journal of International and Comparative Environmental Law* 137.

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I dedicate this thesis to the memory of my Grandparents Mrs Olive (Joyce) Patterson, Mr Raymond Patterson, Mrs Elsie Starkey, and Mr Jack Leary.

David Leary

TABLE OF ABBREVIATIONS

ASMA	Antarctic Specially Managed Area
ASPA	Antarctic Specially Protected Area
AUD$	Australian Dollars
BBC	British Broadcasting Corporation.
CBD	Convention on Biological Diversity
CDFO	Canadian Department of Fisheries and Oceans
CCAMLR	Convention on the Conservation of Antarctic Marine Living Resources
CDFAIT	Canadian Department of Foreign Affairs and International Trade
COP	Conference of Parties
CSIRO	Australian Commonwealth Scientific and Industrial Research Organisation
C$	Canadian Dollar
DNA	Deoxyribonucleic Acid
DOE	Deep Ocean Expeditions LLC
EEC	European Economic Community
EEZ	Exclusive Economic Zone
EPA	Environment Protection Authority
EU	European Union
FVCRP	Foreign Vessel Clearance Request Process, Canada.
GEF	Global Environment Facility

GNS	New Zealand Institute of Geological and Nuclear Sciences
ICJ	International Court of Justice
ILC	International Law Commission
InterRidge	International initiative facilitating international and multi-disciplinary research associated with mid-ocean ridges
ISA	International Seabed Authority
IUCN	International Union for the Conservation of Nature (World Conservation Union)
JAMSTEC	Japan Agency for Marine-Earth Science and Technology (formerly Japan Marine Science and Technology Centre)
LOSC	United Nations Convention on the Law of the Sea, 1982
MOMAR	Monitoring the Mid-Atlantic Ridge Project
MPA	Marine Protected Area
MSR	Marine Scientific Research
NASA	United States National Aeronautics and Space Administration
NIEO	New International Economic Order
NEAF Convention	Convention on Future Multilateral Co-operation in North-East Atlantic Fisheries
NIWA	National Institute of Water and Atmospheric Research, New Zealand
NCI	National Cancer Institute, USA
NZ$	New Zealand Dollar

Part XI Agreement	Agreement relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea
PCB's	Polychlorinated biphenyls
pH	A quantative expression denoting the relative hydrogen concentration in a solution.
PNG	Papua New Guinea
rDNA	Recombinant Deoxyribonucleic Acid
RFMOs	Regional Fisheries Management Organisations
ROPOS	Remotely Operated Platform for Ocean Science
SBSTTA	Subsidiary Body on Technical and Technological Advice to the Convention on Biological Diversity
TAG	Trans Atlantic Geotraverse
TRIPS	Agreement on Trade Related Aspects of Intellectual Property Rights
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNICPLOS	United Nations Informal Consultative Process on the Law of the Sea
UNEP	United Nations Environment Program
USA	United States of America
WIPO	World Intellectual Property Organisation
WWF	World Wide Fund for Nature