Profile of Activities
for
May 2013 to April 2014

International Centre for Environmental and Nuclear Sciences (ICENS)
Jamaica

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ICENS is a research centre that was inaugurated in 1984 by the Government of Jamaica and the University of the West Indies (UWI) and became a node of the COMSATS global network of Centres of Excellence for research and training in selected areas of science and technology important for sustainable socio-economic development in the Developing World.

It is affiliated to the Ministry of Science, Technology, Energy and Mining (MSTEM) and the University of the West Indies (Mona).

Its main activity is the chemical analysis of environmental media and foodstuffs using nuclear and atomic spectroscopic methods. The results are applied to the socio-economic development of Jamaica.

ICENS is a 'hands-on' Centre that offers no internal teaching courses but it welcomes visiting graduates for training and collaborative research attachments, supported for example by agencies such as TWAS and the IAEA.

ICENS has 16 scientific/technical and 9 administrative/support staff and runs three laboratories:

Neutron Activation Analysis:

Inorganic chemical analysis of solids (NAA, TXRF, EDXRF)

Spectrometry Analysis:

Inorganic chemical analysis of solutions (ICP-OES, GF-F-AAS, FIA)

Information Management:
Storage and interpretation of analytical data, GIS map production

In 2013 an IAEA evaluation programme for NAA laboratories placed ICENS at the topmost level of proficiency (‘consolidated state of the practice’), recognizing it as a laboratory that consistently and competently delivers quality chemical analysis.

In 2013 another IAEA expert group reviewed 31 strategic plans submitted by research reactor managers around the world and graded the strategic plan of the ICENS Reactor Laboratory as the best of those evaluated.

ICENS research continued to target the pathways by which trace elements pass from soils through crops to people, combining all its laboratory facilities as appropriate. Special attention was paid to the distribution of potentially harmful elements such as cadmium in the bauxitic soils of Jamaican agricultural areas**.**

The ongoing island geochemical survey of paired soils and crops was extended on a more detailed 2 x 2 km^2 sampling grid planned with reference to the ICENS database of trace element chemistry in Jamaican soils and produce which contains results of over 1,100 analyses for up to 35 inorganic elements.

Collaboration was developed with geochemical specialists in Canada, China, Japan and the United Kingdom in order to update methods and interpretations, including methods such as cadmium isotope ratio analysis of soil samples which is not yet available in Jamaica.

Compilation of a new review of the impact of cadmium on crops, animals and human systems began and will be based on research carried out from 2011 to the present.

The ICENS Spectrometry Laboratory investigated a number of powerful natural biogeochemical systems which influence the fate of organic matter (OM) entering soils in order to assess its roles in carbon and nitrogen cycling and as a natural modulator of soil-atmospheric carbon fluxes. This feedback mechanism is traced by molecular-level information on the origin of labile and refractory inventories of OM in soils. Multi-analytical work provided such information on :

- The occurrence and stabilization of OM in a bird guano concretion of Late Miocene to Pliocene age, helping to decipher what specific organic structures persist in the concretion and the possible contribution of fossil organic matter (FOM) to the OM pool of carbon and nitrogen in modern environments.

- Molecular-level information on the structure, source and role of dissolved organic matter (DOM; the largest pool of mobile carbon) on metal bioavailability and toxicity in the environment. A molecular weight-selective passive sampler (built in-house) and various analytical approaches were used in this work.

- The role of microbial-derived organic matter in metal bioavailability and the use of locally extracted plant-growth promoting rhizobacteria as bioaugmenting agents in the phytoremediation of soils.

OpenNAA

The ICENS NAA Laboratory began a 4 year coordinated research programme (CRP) with the IAEA to develop a modern open system architectural framework specification (OpenNAA), and reference implementation for Neutron Activation Analysis (NAA). The work aims to optimise interoperability among NAA hardware and software systems to ensure that all components will work together 'out of the box'.

Rare earth elements

The ICENS NAA Laboratory continued to analyse routinely for eleven rare earth elements (REE) in all soil samples collected and began a study of the provenance of the REE present in Jamaican bauxites and Tertiary volcaniclastic rocks.

Mineral exploration

As part of the new National Minerals Plan led by the Ministry of Science, Technology, Energy and Mining (MSTEM), ICENS continued collaboration with MSTEM Mines and Geology Division and the UWI Geography and Geology Department to compile a new digital geological map of Jamaica in full colour with a separate overlay of mineral occurrence data. These compilations will be made available for online reference by the public, researchers and potential international investors in the country's mineral industry.

Import substitution by new materials made from waste

With Mines and Geology Division, ICENS searched for natural and industrially generated pozzolans in Jamaica. A pozzolan is a mineral material that contains silica and alumina which when moist reacts with calcium hydroxide to develop cement-like properties. Such materials can be used in cost effective road construction and repairs, trench filling and other civil engineering applications and in 2014 ICENS will carry out a proof of concept project designed to assess their suitability in Jamaica.

During the year ICENS planned two other research projects for developing new materials from Jamaican agricultural and industrial wastes in order to substitute imports and create new local job opportunities for Jamaican SMEs and small urban or rural communities.

- Development of environmentally friendly materials for packaging and food containers from banana plant waste as a means of substituting polystyrene.

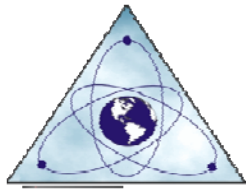
- Development of a methodology for local SMEs or community groups to concentrate REE-bearing components from end-of-life electronic waste goods (e-waste) such as mobile phones, computers and television sets, in order to make an exportable ‘urban ore’ material which could be richer, more accessible and easier to refine than many naturally occurring REE ores.

Public understanding of science and transfer of technology from ICENS to the wider community

ICENS continued to promote the value of science as an aid to solving day to day problems relevant to the practical needs and protection of Jamaicans and which also demonstrates the key contributions that science can make to building a safe, prosperous future. With scientists from Namibia and Sweden it planned a new project to improve urban air quality in Jamaica by monitoring of pollution by aerosols and particulates.

All countries with successful economies recognise R&D and STI as key capital investments in their future wealth and wellbeing and many have used them to power out of the financial recession.

During the year ICENS worked to improve its outreach to society and started construction of an online viewer system for displaying selected island-wide geochemical maps for use by any enquirer. During the year, it set up the core of a wider Caribbean-wide system for sharing digital information on science and technology and became the Jamaican node of the Caribbean Knowledge and Learning Network (CKLN) linked to the new C@ribNET broadband backbone which links the Caribbean to the global community of research and education networks (RENS) in the USA, Latin America and Europe.



More information about ICENS can be seen on our web site at www.icens.org