WATER & ENVIRONMENT NEWS

A Newsletter of the Isotope Hydrology Section

Photo credit: PANG Zhonghe/IAEA

A geothermal well in vertical discharge in Naqu, Tibet

INSIDE THIS ISSUE

Isotope applications in climate research	2	TCDC in geothermal development	4
Acidic fluids in geothermal systems	3	A national isotope hydrology workshop in China	5
Stable isotope reference materals	3	A regional training course in Africa	5
Isotope applications in urban hydrology	4	Meetings and training courses at a glance	6
Isotope fingerprinting of erosion and sedimentation	4	Editor's note	6

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ISOTOPE APPLICATIONS IN CLIMATE RESEARCH

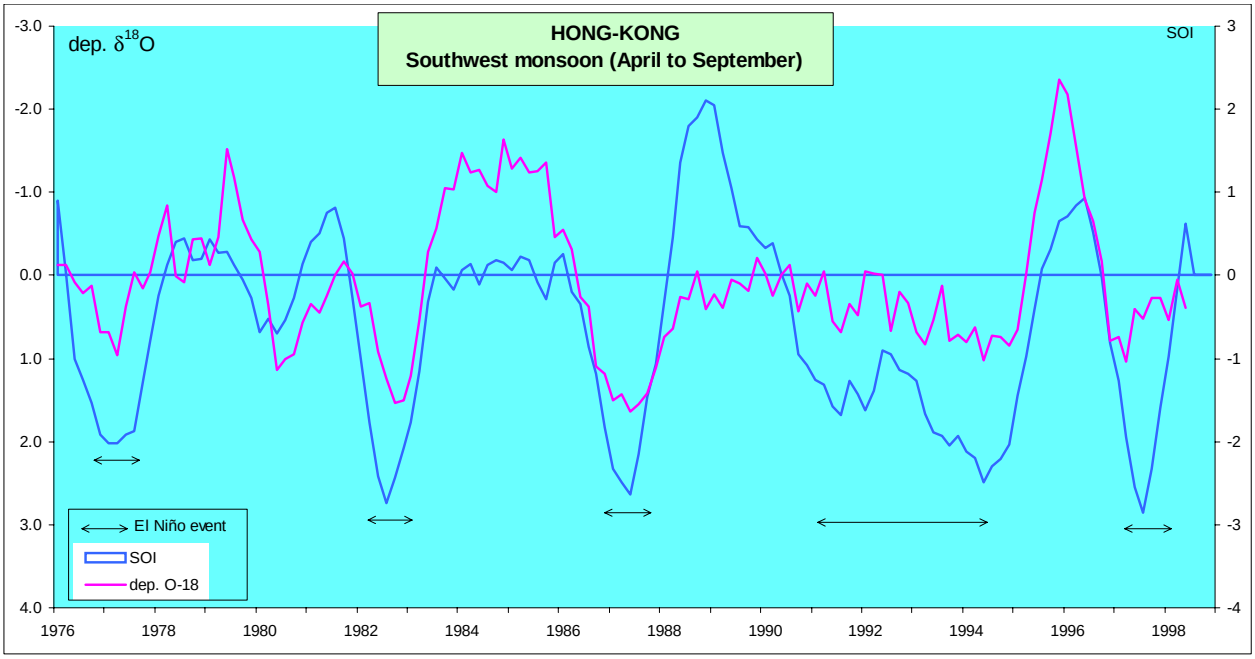
An international workshop was held from 4 to 6 September 2000, in Hamburg, Germany in the memoriam of Hans Oeschger. The workshop was sponsored by the Max-Planck-Institute for Meteorology (Germany), the Institute of Physics in Bern (Switzerland), ISOHYC initiative (Isotopes in the Hydrological Cycle), the World Climate Research Programme (WCRP/WMO) and the IAEA.

The joint WMO-PAGES/IGBP-IAEA-IAHS International Workshop on "Tracing Isotopic Composition of Past and Present Precipitation: Opportunities for Climate and Water Studies", held in Rüttihubelbad near Bern, Switzerland in January 1995, was the fist step for increasing the use of the isotope data in climate studies. During this meeting, under the chairmanship of Prof. H. Oeschger, the importance of GNIP (Global Network for Isotopes in Precipitation) for global change science was widely recognized.

The purpose of the Hamburg workshop was to evaluate existing isotope information (GNIP database) for the understanding of climate variability on interannual, decadal and centennial scales and to develop a research plan for an isotope climatology that allows reconstruction of absolutely dated regional climate variability patterns also into pre-instrumental period.

One key aspect of this study would be the possibility of using isotopes to determine the physical mechanisms leading to climate variability and to study the anthropogenic contribution to air temperature rise and the biosphere feedback.

The workshop focused on several climate phenomena including Asian Monsoon, ENSO, North Atlantic Oscillation (NAO), African climate variability, and Mediterranean climate. The outcomes of the discussions held between climatologists and isotope specialists are very encouraging. The conclusion of the meeting will be outlined in a document to be published in a large audience journal. It is expected to be a new step towards launching an international programme on the use of isotopes for climate variation studies.



Correlation between SOI and departure of O-18 from interannual average in per mil, calculated for the period of 1976-1998 using data of the GNIP station at Hongkong

ACIDIC FLUIDS IN GEOTHERMAL SYSTEMS

A Co-ordinated Research Project (CRP) on " The use of isotope techniques in problems associated with geothermal exploitation" was concluded with the second (final) Research Co-ordination Meeting held in Vienna from 11 to 13 September 2000.

The CRP was implemented from 1997 to 2000 by the IAEA, with the participation of institutions from 10 IAEA Member States, i.e. China, Iceland, Indonesia, Italy, Japan, Mexico, Philippines, Russia, Turkey and United States.

The key development issue addressed by the CRP is acidic fluids in geothermal systems, which are hydrothermal solutions of various origins with pH less than 5.

The basic chemical processes responsible for the origin of acidity in geothermal fluids has also were elaborated during the meeting.

The dominant mechanism is the oxidation of magmatic fluids in geothermal systems when encountered by meteoric water during their ascent. Geothermal fluids are acidic if they are not buffered by reactions with the host rock to a neutral pH.

Field investigations within the framework of the CRP supported by the Agency have considerably improved the understanding on the origin and occurrence of acidic fluids in geothermal systems through the application of isotope techniques.

Isotope techniques were applied during the CRP to some 20 geothermal fields where acidity is encountered in production wells, mostly located along the Circum - Pacific "Ring of Fire".

Investigations show that acidity can be formed both at depth or in the shallower part of a geothermal field.

For example, in the Miravalles geothermal field in Costa Rica, isotope and geochemical studies suggest that there are two possible acidification processes under way: one is mixing between deep neutral Cl waters and acid SO_4-bearing waters produced at shallow levels (steam-heated acid waters). The other mechanism is a mixing with partially neutralised acid fluid of deeper magmatic origin.

The applicability of different isotope geochemical techniques, especially the stable isotopes of sulphur and oxygen as well as hydrogen ($^{34}S_{SO4}$, $^{34}S_{H2S}$, $^{18}O_{SO4}$, $^{18}O_{H2O}$ $^{2}H_{H2O}$) has been assessed in the investigations.

The results of the CRP will be published by the Agency in the form of a TECDOC.

STABLE ISOTOPE REFERENCE MATERIALS

The 8th IAEA Advisory Group Meeting (AGM) on "Future Trends in Stable Isotope Reference Materials and Laboratory Quality Assurance" was held from 18 to 22 September 2000 at the IAEA Headquarters in Vienna.

The meeting was attended by 23 experts from 12 Member States. The variety of topics discussed during the AGM demonstrated the importance of reference materials for the present and future work of the entire stable isotope community. The feedback from external experts and institutions involved in preparation of reference materials will benefit the effort by IAEA to improve the quality and availability of suitable reference materials and to meet the new challenges by implementing new materials. The most important conclusions resulting from the meeting were the following:

- While impure mineral samples were used as sulphur isotope standards in the past, pure and homogenous reference materials are now available from the IAEA and NIST for this purpose. An accurate calibration of the new VCDT scale based on these newly available reference materials was presented at the meeting, providing the sulphur isotope community with a calibration scale on a firm basis.

- With reference to publication of new data sets for reference materials currently distributed by IAEA, the meeting developed a new strategy to review all data available and to apply a consistent statistical approach to the data in order to overcome inconsistencies of evaluation procedures and, finally, to improve the quality of the recommended isotope values for the distributed materials.

The reports of the meeting will soon be published as an IAEA TECDOC.

ISOTOPE FINGERPRINTING OF SOIL EROSION AND SEDIMENTATION

An Advisory Group Meeting was held from 10 to 12 October in Vienna which included participants from Australia, China, India, Japan, UK and the USA.

The objective of the AGM was to evaluate whether nuclear techniques can be applied to sediment fingerprinting, particularly for the evaluation of erosion and sedimentation (E&S) control practices in catchments and reservoirs.

Recommendations from the meeting will be used to develop the scope and objectives of a Co-ordinated Research Project (CRP) to be initiated in 2001 and focusing on the use of nuclear methods in the evaluation of the E&S control practices.

Preliminary recommendations from the meeting outline the following objectives for the proposed CRP:

To evaluate the potential of nuclear and related techniques for providing information for planning and designing E&S remediation strategies and assessing their effectiveness.

To promote the use of the integrated nuclear and non-nuclear techniques in developing water-shed management decision-making tools/models.

It is also planned that the research activities of the CRP will include one or two "flagship" field sites where E&S remediation techniques are being applied.

ISOTOPE APPLICATIONS IN URBAN HYDROLOGY

The second (final) Research Co-ordination Meeting of the CRP on "Application of isotope Techniques to the Assessment and Groundwater Resources in Major Urban Areas" was held in the IAEA Headquarters in Vienna from 11 to 13 September 2000.

Chief Scientific Investigators of the research contracts and/or agreements from eight different institutions involved in the CRP attended the meeting.

The overall objective of this CRP was to assess the usefulness of geochemical and isotopic techniques to address the development and management issues that pertain to urban aquifers.

Three research themes that encompassed all of the eight CRP projects were:

- Assessment of artificial recharge in and around urban areas
- Identification of the processes of groundwater contamination
- Impact of groundwater exploitation for urban areas on the hydrologic system

The results of the CRP will be compiled and published by the Agency as a TECDOC.

TCDC IN GEOTHERMAL DEVELOPMENT ACROSS THE REGIONS

An Experts Group Meeting (EGM) on "Application of Nuclear Techniques to Geothermal Energy Development" was organised by the Agency in co-operation with the government of Mexico and held in Morelia, Mexico from 31 July to 4 August 2000. The EGM aimed at promoting TCDC (Technical Cooperation in Developing Countries) in geothermal development among the IAEA Member States participating in the three Regional Agreements (ARCAL, AFRA and RCA).

The meeting was attended by experts from 6 countries (Costa Rica, El Salvador, Indonesia, Mexico, Nicaragua and Philippines) which are producing geothermal energy. Mr. Pang Zhonghe of IHS participated the meeting.

The current status of isotope applications in geothermal development in the major countries that are producing geothermal energy was reviewed and assessed. The need for future technical assistance from the Agency and the possibilities for TCDC were identified.

As an immediate output of the EGM, a proposal for an inter-regional project on geothermal isotope hydrology was prepared and adopted by the participants of the meeting.

A NATIONAL ISOTOPE HYDROLOGY WORKSHOP IN CHINA

Between 28 and 30 August 2000, IAEA sponsored a National Workshop on "Application of Isotope Techniques in Water Resources Assessment and Management" which was held in Beijing, China. The workshop was organised by IAEA in co-operation with the government of China through the national organizing committee composed of representatives from the Chinese Academy of Sciences, Ministry of Land and Resources and National Nuclear Corporation. The national workshop was attended by 86 governmental officials and scientists.

Mr. Qian Jihui, Deputy Director General and Head of the IAEA Department of Technical Co-operation, delivered a keynote speech entitled "Bringing the Application of Isotope Hydrological Techniques to Water Resources Projects in the Whole of China" at the official opening of the workshop. The purpose of the workshop was to promote interaction and information exchange between practitioners of isotope hydrology throughout all parts of China. Mr. Pradeep Aggarwal and Mr. Jeffrey Turner of the IHS also attended the meeting. Over 30 papers were presented covering a diverse range of isotope applications to Chinese hydrology. The presented papers were of a high standard and demonstrated that isotope hydrology has been successfully applied to many aspects of water studies in China.

A REGIONAL TRAINING COURSE FOR AFRICA ON ISOTOPE AND GEOCHEMICAL MODELLING FOR GROUNDWATER MANAGEMENT

The regional training course was organized by the Agency in co-operation with the government of Zimbabwe and was held from 9 to 20 October 2000 in Harare, Zimbabwe. The training course was hosted by the Department of Water Development, Ministry of Rural Resources and Water Development. The main objective of the training was to provide the participants with in-depth know-how and hands-on experience in the combined use of isotopes and chemical modelling for groundwater studies.

The training course was composed of two major components: 1. Lectures given by IAEA experts; and 2. Hands-on computer work using the hydrochemical software NETPATH under the guidance of the experts. Participants were given the opportunity to model their own chemical and isotopic data, as practical case studies. The course was attended by 20 participants from 14 countries, namely Democratic Republic of Congo, Egypt, Ethiopia, Ghana, Kenya, Libyan Arab Jamahiriya, Mauritius, Senegal, South Africa, Tunisia, Uganda, United Republic of Tanzania, Zambia and Zimbabwe.

MEETINGS AND TRAINING COURSES AT A GLANCE

IAEA Meetings in 2000

AG-1087: New isotopic approaches in studying groundwater flow dynamics and related geochemical processes

Vienna, 4-6 December

AG-1089: Isotope-geochemical methods for the assessment of artificial recharge and modelling in arid regions

Vienna, 12-14 December

RC-824: Origin of salinity and its impacts on fresh groundwater resources: Optimization of isotopic techniques

Vienna, 18-22 December

IAEA Meetings in 2001

CN-80: International conference on the study of environmental change using isotope techniques

Vienna, 23-27 April

AG2001-1: Application of noble gas isotopes in geothermal investigations

Vienna, 25-28, June

AG2001-2: Isotope applications for integrated water resources management (jointly with UNESCO)

Vienna, 10-13, September

AG2001-3: State of the art and development needs for integrating GNIP data in hydroclimatic models

Vienna, 9-12 April

AG2001-4: Action plan for the integration of isotope hydrology in the water sector of Member States

Vienna, 22-25 October

RCM on hydrological response of long-term exploitation

Vienna, 2-6 April

RCM on isotopes in sediment source characterization with particular emphasis on dam stability and safety

to be announced

RC826: Isotopic composition of precipitation in the Mediterranean basin in relation to air circulation patterns and climate

Vienna, 17-21 April

RCM: Application of isotopes to the assessment of pollutant behaviour in the unsaturated zone for groundwater protection

to be announced

Conferences and Training Courses Sponsored by the IAEA

International Conference on Integrated Water Resources Management for Sustainable Development

Roorkee, India, 19-21 December 2000

Joint IAEA-UNESCO course on Isotope Hydrology

Cape Town, November 2000

Editor's Note

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