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MANPOWER TRAINING AND EDUCATION NEEDS  
IN THE FIELD OF WATER RESOURCES IN IRAQ

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This paper has been prepared by Prof. Dr. Riadh H. Al-Dabbagh, President of Al-Mustansiriyah University, Baghdad, Iraq. The views expressed in this paper are those of the author and do not necessarily reflect the view of ESCWA. This paper has been reproduced without formal editing.

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Man Power. Training & Education  
Needs in the field of water resources  
in Iraq .

Dr. Riadh H. AL-Dabbagh\*

INTRODUCTION :

The scope of this paper is to review the experiences, obtained in the most part over the past ten plus years, of trying to transfer hydrogeological knowledge, primarily to professional engineers and geologists, but also to university students .

Rather than explain in detail the different syllabi or curricula developed, I think it would be more interesting to give some background and describe the different types of educational activities current in Iraq in terms of their relationship to water resources policies and the results obtained to date .

THE ROLE OF GROUNDWATER IN IRAQI WATER RESOURCES POLICY:

Because a great part of Iraq is semi-arid, water has always constituted a primary economic factor in the development of agriculture as well as in urban and industrial growth .

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\* Professor of Hydrogeology,  
AL-Mustansiriyah University, Baghdad - IRAQ .  
Vice President, IHP National Committee .  
Vice President IHP, 8th Session Intergov . Council  
Vice President IAHS, ( ICWQ ) .

Since 1940, the Government has developed a policy of aid for the construction of hydraulic works whether done directly or through foreign companies or through private firms ( the latter principally for the production of hydroelectric energy ) . The result is that Iraq is now one of the leading countries of the world in terms of the number of large dams constructed .

However, until the middle of the 1950s, the attention given by state agencies to the study and use of groundwater was, in general, very limited . In spite of this, individual concerns or local governments in some regions achieved and continue to achieve a relatively important exploitation of groundwater . On occasion, these operations have caused undesired effects, such as continued decline of the groundwater table, intrusion of saline waters, etc .

The statistics on the uses of water in Iraq need considerable updating, but it can be said that groundwaters account for approximately 20-25 per cent of the supply for irrigated land and 30-35 per cent of that for urban areas . ( Ralph Mparson, 1955 ) .

The causes for the neglect of groundwater in national water resources policies are naturally diverse and

include political, administrative, social, and economic factors that have been analysed in some other papers; ( Technical bulletins Institute for applied research on Natural resources ) but the basic and principal cause has been the relatively limited development that education and hydrogeological research have had until the 1960s.

With the object of apportioning hydrogeological "know-how" to Iraqi geologists and engineers, some government agencies initiated a core of educational activities in the 1970s that, in my opinion, have been a success and will be described below .

#### Training :

Training can be divided into two broad areas: in-house training and training abroad .

Training abroad consists of: (1) courses and workshops offered by universities, research institutes or professional training associations; (2) scientific attachment to research institutes or educational institutes with special expertise in the required field; and, (3) tailor-made training programs for individual needs at a reputable center .

In-house training takes many shapes for Hydrologists and Hydrogeologists . It can be divided into two subcategories :

In-house training offered and organized by the Universities through the programs of Continuing Education including workshops and courses whether totally initiated, organized and conducted by the Divisional staff or in cooperation with outside lecturer. A number of courses were offered all the Iraqi Universities .

#### Training and Continuing Education Opportunities Available to Personnel :

Our goals in utilizing and continuing education opportunities can be summarized as follows :

- To ensure the availability of manpower well versed in the activities conducted by the Division .
- To update and expand the knowledge and expertise of the staff .
- To maximize the utilization of the major natural resource of Iraq , i.e., the local personnel, to achieve, in the long term, independence from expatriates.
- To provide to all levels of management, the necessary tools for the operation and conduct of research and development to support local and regional industry by offering specialized courses and specialized training in the Division's of expertise .

These goals are met by a variety of programs and training tools . Figure 1 provides a systematic diagram of the available tools .

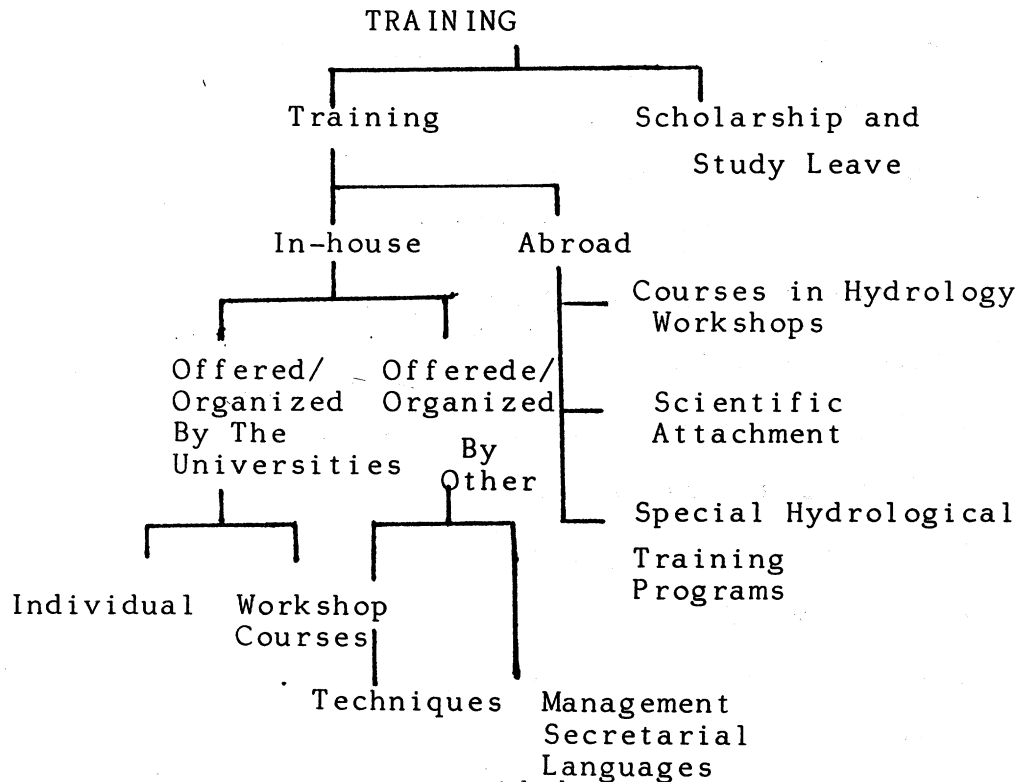


Figure 1: sketch of Courses provided

The Type of syllabus used for the the courses given by the Iraqi Universities :

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1. Auxiliary Disciplines:
    - Principles of Climatology .
    - Principles of Fluid Mechanics
    - Principles of Surface Hydrology
    - Applied Statistics for Hydrology
    - Elements of Hydraulic Economics .
  2. Flow Characteristics in Porous Media :
    - Properties of porous Media
    - General Flow Equations and Solution Methods

Hydraulics of Waterwells

Relationships between Surface and Groundwaters.

3. Physical, Chemical and Biological Characteristics of Groundwaters - Contamination and Treatment :
  - Elements of Hydrologic Chemistry .
  - Nuclear Techniques in Hydrology .
  - Relationship between Chemical Characteristics and Hydrogeologic Media.
  - Biological Characteristics Water .
  - Quality and Treatment of Water .
  - Contamination of Aquifers .
  - Prevention of Contaminating Effects .
  - Detection and Control of Contaminating Agents .
  - Correction and Treatment of Contamination .
4. Techniques of Regional Hydrogeologic Exploration :
  - Geologic Methods in Hydrology .
  - Exploration of Different Climatic, Structural, and Lithologic Environments .
  - Exploration of Karstic Regions .
  - Hydrogeologic Mapping .
  - Geophysical Prospecting .
  - Boreholes and Observation Wells .
  - Inventory System of Hydrogeological Data .



5. Exploitation of Aquifers :
- Hydrological Balances .
  - Analog & Digital Models .
  - Construction of Waterwells and Galleries .
  - Artificial Recharge..
  - Introduction to Water Resources Engineering .
  - Water Legislation .

An essential point in the design of this syllabus was the desire to train people to have their feet on the ground. All participants must have at least an introduction to the more sophisticated and specialised subjects of statistical analysis, groundwater modelling, ect.; but special emphasis is placed on having them become well-acquainted with the "know-how" of groundwater exploration and waterwell technology .

#### Difficulties on Problems :

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As a whole, the development of the courses has presented few problems, and the fact that the the same basic structure has been maintained for almost a anumber of years, except for a few minor modifications, indicates that the courses have responded adequately to a real social need for hydrogeologists in Iraq as well as in other countries.

Perhaps the principal difficulty that the courses have is the diverse backgrounds of the participants. On the one hand, the predominant focus of the geologists (the prevalent group up to now) is qualitative or naturalistic; on the other, that of the engineers or physicists is physical-mathematical. This difference demands that, on occasion, a middle road be found that naturally does not satisfy either of the two groups. At the same time, the coming together of these two kinds of people has advantages in that it facilitates the interdisciplinary focus so necessary in almost all the problems related to water resources.

Very rarely and in a very sporadic manner, some resistance to the course has been demonstrated by a few individual students with regard to the taking of tests or examinations. However, the posture of the Educational Commission for both courses has been clear on this matter; "If the tests are not successfully completed, there is no certificate" I believe this posture is very necessary if one wishes that the participants get the most benefit possible from the courses. And in general, when a student has not received a certificate, it is because he has not dedicated sufficient time to the course because of working in another place at the same time. In order to avoid this problem, it has been suggested the course be made more concentrated eg some 40 hours of work per week should be required in the course time. Unfortunately, this solution would have the effect of curtailing

the possible number of participants in Iraq and impede participants from other cities or countries from taking part-time work in a state agency or personal office to assist in the cost of the course and generally from receiving a good apprenticeship.

#### The Impact of these Courses on Iraqi Hydrology

In the last ten years, the achievements of regional hydrogeological studies through different state organisations, directly or through contracts with private engineering firms, permit it to be said that Iraq is no longer a "terra ignota" for the hydrogeological point of view.

Within a few years (probably less than five) these studies will provide regional reports and hydrogeological mapping of the entire country (scale 1/100,000--1/200,000). A large number of the engineers and scientists who worked in this field were foreigners. Today, the number of foreign hydrogeologists that work in Iraq is very reduced, and probably very inferior to the Iraqi hydrogeologists that work outside of Iraq. The number of Iraqis dedicated to hydrogeology full-time is now approximately 100, and the absolute majority of them have participated in the "Hydrogeology Course" in Iraqi Universities or in the "International Course of Groundwater Hydrology" abroad.

Another indication of the development of Iraqi hydrogeology is the arrangement of three International Hydrological conferences arranged by the IHP National committee in Iraq.

#### Hydrogeology on the Doctoral Level

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At this point, as is too well known, education is much more

individualised. The major part of the work is geared toward the student and his training, and is very directly related to the research that he is doing personally or as part of a team. Therefore, I do not think it would be of interest to discuss here the different types of short courses or seminars that have developed within our research team .

#### FUTURE PERSPECTIVES OR OUTLOOK

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With regard to Iraq ,I believe that hydrogeologists with their basic foundation as geologists, need to make a concerted effort, if they want to continue to approach the progress of modern hydrogeology, to acquire the necessary basic information that is not included in the past or present curricula, especially in those areas involving mathematics, with added emphasis on numerical methods and statistics. Also, it seems important that they acquire at least the rudiments of hydro-economics. In the case of hydrogeologists with a civil engineering background, the principal problem I believe, is the general disregard or reduced attention given in the current curricula to the role of groundwaters in water resources systems. And taking into account the progressive preoccupation with the protection

of the environment and the growing participation of different social groups in the decision of hydraulic projects, it seems very necessary also to apportion to future hydrogeologists some minimal knowledge of environmental sciences, administration, and political science to facilitate the dialogue with the social groups involved in the decision regarding hydraulic projects.

Although the short courses described here have fulfilled a very important role in the training of Iraqi and other hydrogeologists, one must realise that this importance will be reduced in proportion to hydrogeology beginning to be presented more as a conventional course in the various university departments interested in water resources.

On the other hand, the short courses dealing with specialised themes, with a duration of one week.

#### RESEARCH PLANS AND DIFFICULTIES FACING GROUNDWATER RESEARCH STUDIES:

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A very wide range of research topics are presently being planned to solve most of the hydrogeological problems facing the country. Particular attention is being given to groundwater studies, in an attempt to solve the problems of supplying water to the small villages, as well as endeavouring to speed up plans for the cultivation of parts of the western desert in Iraq. However, there are a number of obstacles which delay, to a certain extent, the development of hydrogeological work in Iraq. One of the main difficulties we are facing at present is the lack of a strong centralised hydrological office for the control and planning of the continually increasing demands for water utilization, as well as for the keeping of all necessary hydrogeological and hydrological statistics, records and related information. Similar data and records are being collected at the present time by different offices belonging to various ministries that have departments of hydrology or groundwater namely;

Ministry of Industry and Military Manufacturing  
Ministry of Municipality, Local Government ,  
Ministry of Agriculture.& Irrigation .  
Ministry of Oil.  
Ministry of Higher Education and Scientific Research  
(including all Iraqi Universities ) .  
The Board of Scientific research.

There is an obvious lack of co-operation between these offices, yet there has been, to date, no general plan for the co-ordination of their work .

A number of suggestion were put forward to the Government by different individuals, as well as by the Geologists Union, in an attempt to establish one centralized office that would take the responsibility of hydrogeological work all over the country , under the suggested name "Institute of Water Resources in Iraq". Unfortunately, no response or action has yet been apparent, but there are great hopes for the future.

#### CONCLUSION

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Hydrological and hydrogeological education in Iraq is basically carried out by the different universities in the country, either as a part of the requirements for the under-graduate courses, mostly at the Geology Departments, Civil Engineering Departments, and the Irrigation and Machinery Engineering Departments, or as a specialized post-graduate course that leads

to the award of a post-graduate diploma or an MSc Degree.

The Geology Department at Most Universities are planning to arrange a training course in hydrogeology, concentrating principally on aquifer studies as well as on the exploration of groundwater resources. This course is basically for people concerned with hydrogeological studies who have never had the opportunity to have specialized training in the subject .

Hydrogeological education in Iraq is facing one great problem, which is the lack of a strong centralized Hydrogeological Office which could control and plan hydrogeological work all over the country. If such an office was forthcoming, then the Universities could in turn strive freely towards the training and education of the relevant professional hydrogeologists, who could in their turn play an important part in solving the problems of the utilization of water and groundwater all over the country.

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