

# "Fossil" Aquifers

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## I. Hydrogeology

Non-renewable aquifers are often described in the legal literature as “fossil” aquifers.<sup>1</sup> These are aquifers with no appreciable modern recharge and which cannot discharge naturally. As a result, water in these aquifers is stagnant and has little if any flow. By definition, they cannot be utilized sustainably as any withdrawal eventually will exhaust the resource. Such aquifers generally contain ground water that is trapped in a geologic formation, either because of physical isolation of the aquifer from sources of recharge, impermeability of overlying strata, or paucity of recharge in an arid region. Typically, water in non-renewable aquifers is hundreds if not thousands (or millions) of years old.<sup>2</sup>

Most often found in arid climates, fossil and other non-renewable aquifers are an important water resource for many nations. Some of these aquifers are transboundary, such as the Nubian Sandstone aquifer underlying Chad, Egypt Libya and Sudan. Located at depths ranging from a few meters to a few hundred meters, the water in this aquifer is estimated to be as much as 35,000 years old. While the overlaying strata is still relatively permeable, present-day recharge rates range from miniscule to nil, contingent on the occasional rain and flash flood. Moreover, this aquifer is not related or connected to any other water resource in the region.<sup>3</sup>

Other important transboundary non-renewable aquifers include Qa-Disi aquifer between Jordan and Saudi Arabia,<sup>4</sup> the Complex Terminal Aquifer underlying Algeria, Libya

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<sup>1</sup> The term “fossil” aquifer, as used in the legal literature to describe all non-renewable aquifers, is a misnomer. A fossil aquifer is but one type of non-renewable aquifer. It describes an aquifer (whether confined or unconfined) containing water that was buried at the same time as the geologic formation in which it is trapped. A second type of non-renewable aquifer is a “connate” aquifer, which describes a confined aquifer in which the trapped water is of a different age than that of the encompassing geologic formation. *See* C.W. Fetter, APPLIED HYDROGEOLOGY 288 (3<sup>rd</sup> ed. 1994).

<sup>2</sup> *See* Fetter, *supra* note 1, at 364; H. Bouwer, GROUND WATER HYDROLOGY 7(1978) (noting that connate waters are typically isolated from the hydrologic cycle for millions of years).

<sup>3</sup> *See* G. Eckstein, *Hydrologic Reality: International Water Law and Transboundary Ground-Water Resources*, paper and lecture for the Conference: Water: Dispute Prevention and Development, American University Center for the Global South, Washington, D.C. (October 12 - 13, 1998) (*available at* <http://www.InternationalWaterLaw.org/Articles/GlobalSouth.htm>) (accessed 11/8/01); *see also* D.A. Caponera & D. Alh riti re, *Principles for International Ground water Law*, 18 NAT. R. J. 590 (1978); Fetter, *supra* note 1, at 364.

<sup>4</sup> *See* R. Krishna, & S.M.A. Salman, *International Groundwater Law and the World Bank Policy for Projects on Tranboundary Groundwater*, in GROUNDWATER: LEGAL AND POLICY PERSPECTIVES, PROCEEDINGS OF A WORLD BANK SEMINAR (Salman, ed.) 183-184 (1999); A. Macoun, & H. El Naser, *Groundwater Resources Management in Jordan: Policy and Regulatory Issues*, in GROUNDWATER: LEGAL AND POLICY PERSPECTIVES, PROCEEDINGS OF A WORLD BANK SEMINAR (Salman, ed.) p. 105, 111 (1999).

and Tunisia,<sup>5</sup> and the Continental Interclaire Aquifer also underlying Algeria, Libya and Tunisia.<sup>6</sup>

## II. International Law

The status of fossil and other non-renewable ground water resources under international law is a much neglected topic in international legal discourse and regulatory development. The UN Watercourse Convention,<sup>7</sup> the most recent and authoritative effort to codify international law applicable to fresh water resources, directly omits such waters from its scope.

Under the Convention, a watercourse is defined as: “a system of surface waters and groundwaters constituting by virtue of their physical relationship a unitary whole and normally flowing into a common terminus.” While considered broad in its application to surface bodies of water, the definition limits the treaty’s applicability to certain types of ground water resources, and excludes fossil and non-renewable aquifers. The phraseology restricts the scope of the Convention only to “systems,” and only to systems that have a “physical relationship” between the inter-linked components and that flow to a “common terminus.” This strongly suggests that a system relationship must exist between an aquifer and a surface body of water for the aquifer to fall under the Convention. In other words, a solitary aquifer – such as a fossil aquifer – could not constitute a “system” or “a unitary whole” and could not flow to a “common” terminus for the purposes of the Convention.<sup>8</sup>

At the same time, the International Law Commission of the United Nations, which is the intergovernmental body of legal specialists which drafted the Convention above-mentioned, probably aware of the restrictions stemming from the definition of “watercourse” in relation to non-renewable groundwater resources, exhorted states to follow the rules codified in the Convention also in relation to “confined” groundwater resources. What the Commission meant by the use of the term “confined” is, in actual fact, groundwater resources which are not connected to a surface water body, such as fossil aquifers and other non-renewable groundwaters<sup>9</sup>

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<sup>5</sup> See R. Krishna, & S.M.A. Salman, *supra* note 4, at 163, 181.

<sup>6</sup> *Id.*

<sup>7</sup> Convention on the Non-Navigational Uses of International Watercourses, G.A. Res. 51/229, U.N. GAOR, 51<sup>st</sup> Sess., U.N. Doc. A/RES/51/229 (1997).

<sup>8</sup> The comments to the final Draft Articles provide little guidance: “[i]t follows from the unity of the system that the term ‘watercourse’ does not include [water that is] unrelated to any surface water.” *Report of the International Law Commission to the General Assembly on the Work of its Forty-Sixth Session, The Law of the Non-Navigational Uses of International Watercourses*, [1994] II Y.B. INT’L L. COMM’N 88, 90, ¶ 222, U.N. Doc. A/CN.4/SER.A/1994/Add.1 (Part 2) at 90, ¶ 222. This statement, however, appears in the Draft Articles in reference to the exclusion of so-called “confined” ground water from the scope of the Convention and only focuses on the “unity” of the system; it does not necessarily shed light on a ground water “system” unrelated to surface water.

<sup>9</sup> International Law Commission, Resolution on confined transboundary groundwater, 2 Y.B. Int’l L. Comm’n 135 (1994), Annex 4 GROUNDWATER : LEGAL AND POLICY PERSPECTIVES, PROCEEDINGS OF A WORLD BANK SEMINAR (Salman ed.) 235 (1999)

The *Seoul Rules* adopted by the ILA in 1986, on the other hand, do away altogether with these distinctions and attract all sorts of aquifers, including, in particular, fossil and other non-renewable aquifers, within the scope of the *Rules*.

Due to their non-renewable characteristics, fossil aquifers have sometimes been described as akin to other depletable natural resources, like oil and natural gas.<sup>10</sup> A fossil aquifer, like an oil and gas deposit, is a non-renewable, stagnant, depletable, fluid natural resource.<sup>11</sup> This characterization, however, overlooks the significant issues of contamination and pollution (which have graver consequences on water resources), as well as the societal value of water.

### III. Issues for Discussion

Given the ambiguity and lack of attention to the subject, it is unclear what rules of international law might apply to fossil and other non-renewable aquifers. The UN Convention, while a positive step toward the clarification of international water law, is still inadequate to encompass all transboundary ground water resources. More comprehensive and critical consideration is in order. Some of the issues for consideration include:

Is it technically correct and desirable that non-renewable ground water resources be subject to the same legal regime codified in the Watercourse Convention?

In general, is existing international water law adequate to deal with shared non-renewable aquifers?

Should instead non-renewable ground water resources, due to their characteristics, be governed by a legal regime akin to other depletable shared natural resources, like oil and natural gas? If so, does fresh water's greater susceptibility to contamination and pollution require special consideration?

What rules of international environmental law are applicable to the development, exploitation, allocation, and/or conservation of shared non-renewable aquifers?

What is the State practice (bi and multilateral cooperation) in the development, exploitation, allocation, and/or conservation of shared non-renewable aquifers?

Are there any instances of co-operative arrangements surrounding "fossil" or other non-renewable aquifers where depletion or pollution of the groundwater reserve is an issue?

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<sup>10</sup> See Krishna & Salman, *supra* note 4, at 167.

<sup>11</sup> It is noteworthy that non-renewable ground water is not comparable to natural resources like minerals. Mineral law applies to solid, non-renewable resources like coal and salt, which cannot be polluted or contaminated like water, and is inadequate to deal with the fluid nature of water. *Id.*