

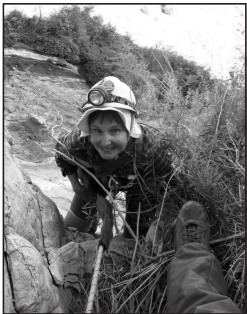


Article

Qualitative Hydrology of Noah's Flood

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Carol A. Hill



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The biblical Flood is viewed by many as irreconcilable with an actual hydrological event.

This paper on Noah's Flood addresses the hydrological questions: (1) How could it have rained for forty days and forty nights? (2) What water sources could have caused prolonged flooding? and (3) Where is the flood sediment left by Noah's Flood? It also discusses the nature of "nature miracles" (such as Noah's Flood) in the Bible.

The biblical Flood is viewed by many as irreconcilable with an actual hydrological event. If the Flood was universal, then this presents numerous insurmountable hydrological problems such as: Where did all of the water for the Flood come from and where did all the water go to? and Why does the geologic record not support a universal flood? If the Flood was local, then other questions can be asked such as: How could it have rained for forty days and forty nights? What water sources could have caused the floodwaters to have stayed backed up for 150 days in the Mesopotamian hydrologic basin? and Where is the flood sediment left by Noah's Flood? This paper qualitatively attempts to answer these three local-flood questions. A companion paper follows that will quantitatively address the most difficult question of all: How could the ark have gone against the current and landed in the mountains of Ararat?

How Could It Have Rained for Forty Days and Forty Nights?

Before this question can be answered, it is first necessary to understand the weather patterns (meteorology) of the Mesopota-

mian region and surrounding mountainous terrain. Then these patterns can be compared to the Genesis account of the weather associated with the Flood.

Weather in the "Land of the Five Seas"

Cyclonic Storms. The "Land of the Five Seas" refers to the lands encompassed by the Mediterranean Sea, Black Sea, Caspian Sea, Red Sea, and Arabian Sea.¹ This entire region is (and has been for thousands of years) controlled by the Asiatic pressure system. During winter, storms originating over the Atlantic Ocean sweep eastward along a low-pressure trough that exists over the Mediterranean Sea, and then they penetrate into southwestern Asia during periods of temporary weakening of the Asiatic anti-cyclone.² These storms bring cold-season rainfall to this region except for the southern part of the Arabian Peninsula.

During a temporary breakdown of the anti-cyclonic system, migration depressions (cyclonic storms) travel along the low-pressure Mediterranean trough to the region of the Aegean, and then, still traveling eastward, these storm tracks bifurcate either to the north to the Black and Caspian Sea areas and the mountains of Turkey, Armenia, and Iran, or to the south to the Palestine, Syria, Iraq, and Persian Gulf areas (Fig. 1). For each of these winter tracks, there are about three storms a month that move across the Mesopotamian region, with the peak of rainstorm activity occurring in March and April.³ During the summer, the low-pressure system over the Mediterranean is replaced by high pressure, and the paths of resulting storms are

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northward of the "Five Seas" area. This pervasive situation has caused both northern and southern Mesopotamia (Iraq) to experience nearly rainless conditions in the summer months for millennia.

In addition to this general weather pattern, when low pressure centers exist both in the Mediterranean and over the Persian Gulf and Arabian Sea, Iraq (Mesopotamia) becomes susceptible to the influence of colliding maritime

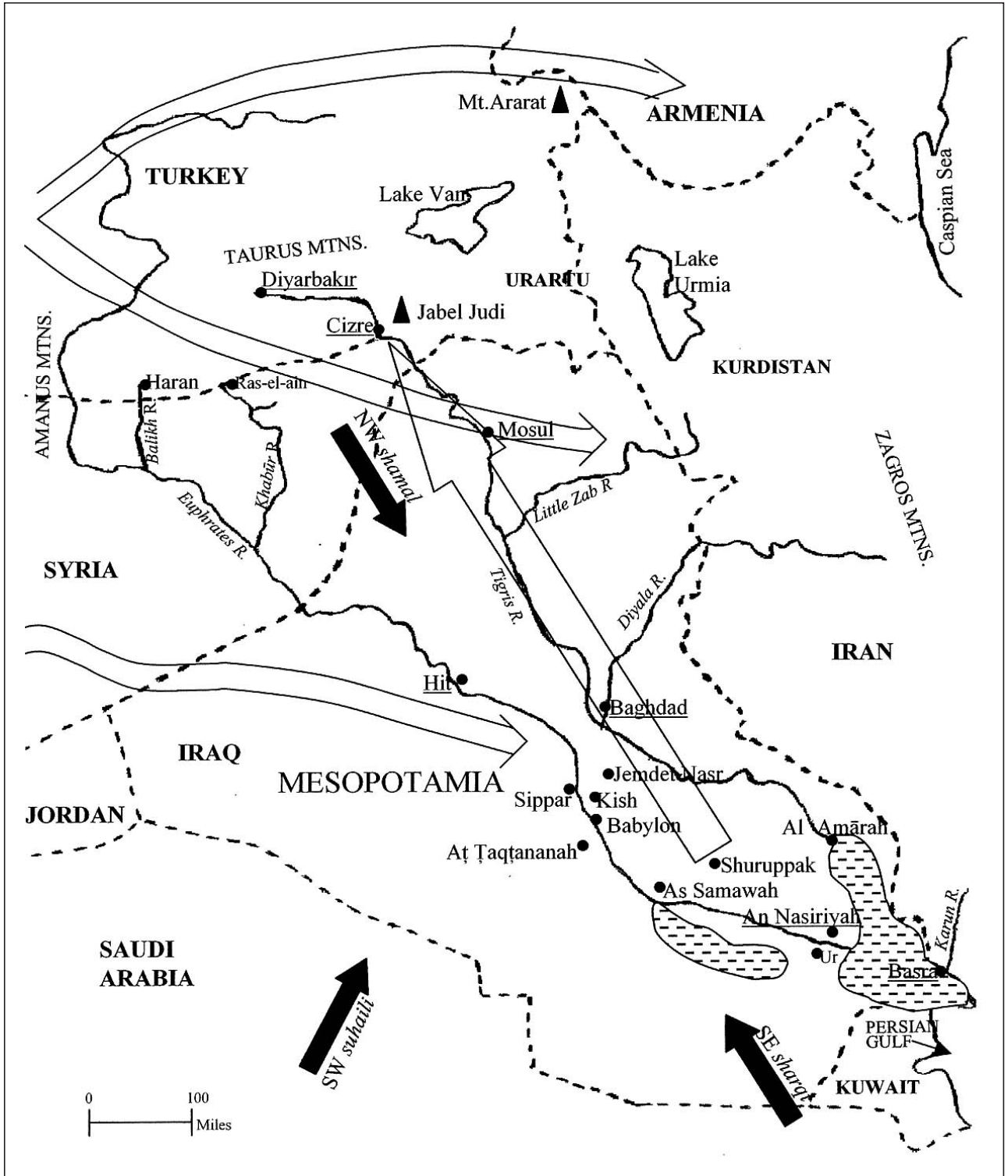


Figure 1. Geography of Mesopotamia, showing the direction of west to east cyclonic storms across the area (curved nonsolid arrows), predominant wind directions (straight solid black arrows), possible route of the ark from Shuruppak to the mountains of Ararat (largest straight nonsolid arrow), marshlands (stippled areas), and locations mentioned in the text. The black triangles show the two most favored landing places for the ark. Modern cities are underlined; river and wind names are italicized.



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air masses. The eastern tropical maritime air masses originate in the Indian Ocean and can travel northwestward via the Arabian Sea and Persian Gulf as far as the Mosul area (Fig. 1).⁴ The lower of these two maritime air masses is usually warm and moist, while the upper layers are cool—conditions that favor instability. This results in heavy rainfall in the mountainous parts of the country and also considerable rainfall in the lowlands. Continuous downpours that last for days are characteristic of this type of maritime condition, and rains are often accompanied by wind and thunder.

Long-duration downpours are caused by the stalling or blocking of a Mediterranean frontal system, and depending on how long the system stalls, a "100-year" or "1000-year" precipitation event can result.⁵ These rare occurrences of extremely high precipitation are referred to as the "Noah effect" by meteorologists and hydrologists.⁶ When circulation patterns persist, then high amounts of rain (and snow in the mountains) can also precede or follow a cyclonic event. An example of this happening was in 1969 over the Jordan basin, when cyclonic circulation patterns persisted for 24 days, and rain and snow fell for almost two months.⁷ The stalling of this front, over a period of 80 hours, brought an average of 75 inches (300 mm) of rain to the basin—the highest amount in 150 years—and caused considerable flooding.

Other stalled frontal systems are recorded for the Mississippi River region, USA. In the Mississippi River flood of 1927, it rained 15 inches in 18 hours, the water rose one inch an hour, the flood waters did not start to recede for two months, and some of the tributaries of the Mississippi actually flowed backward (up into their channels) due to the rapid flooding of the Mississippi River.⁸ In the Mississippi River flood of 1973, the duration of flooding in some parts of the watershed was up to 97 days (over three months).⁹ This 1973 flood was caused by the duration and persistence of a large-scale, anomalous, atmospheric circulation pattern, where the trough (low) existed in roughly the same location for a prolonged period of time in March and April.

Precipitation. Southern Mesopotamia is one of the driest spots on Earth, with an average annual rainfall of less than four inches.¹⁰ The Mediterranean cyclonic disturbances that

pass through Iraq in winter and spring provide practically the only rain of the year for this area, and even this meagerly rain can be "fickle"—with some years having no rain at all and with other years having substantial amounts. In the Baghdad area, yearly precipitation amounts to about 30 mm/year; Mosul, about 85 mm/year; Cizre, about 100 mm/year; and Diyarbakır (headwater area for both the Tigris and Euphrates Rivers), over 150 mm/year (Fig. 1).¹¹ In the extreme north and northeast, in the mountainous areas of Iraq (Kurdistan), the annual total precipitation is 175mm/year and in some localities, can exceed 250 mm/year. In all of these areas, rainfall occurs mostly in the winter and spring and corresponds to the passing of a low-pressure disturbance.

The alluvial plain of Mesopotamia is surrounded on the east by the Zagros Mountains, on the north and northeast by the Taurus Mountains, and on the northwest by the Amanus Mountains (Fig. 1). These mountains receive rain and snow precipitation that feeds the Euphrates and Tigris River basins in the spring. The mountains of Armenia and Kurdistan in the northeastern Taurus range experience especially severe winters of up to six to eight months duration,¹² and snow there frequently reaches depths of six feet.¹³ The Zagros Mountains of eastern Mesopotamia run parallel to the Tigris River, and practically every spring, melting snow feeds the Tigris to overflowing. In these areas, mountain snows come mainly in the winter months (January–February), while the greatest rainfall occurs in the spring (March–April). Spring rainfall can quickly melt the mountain snow, causing the Tigris and Euphrates Rivers to reach their highest flood level in late spring.¹⁴

Wind. The predominant wind in Iraq (Mesopotamia) is the northwest *shamal* (meaning northerly) (Fig. 1). The shamal wind is the more-or-less constant flow of air down the valley of Mesopotamia that follows topography and gradient from the Taurus Mountains in Turkey southward to the Persian Gulf. The shamal operates all year long, but it is especially prevalent from June to October when the wind direction is not interrupted by the passage of cyclonic storms.¹⁵ These are dry, warm, persistent winds, signifying clear skies and stable weather. The very dry air brought by the shamal permits intense

heating (and evaporation) of the land surface.¹⁶ Studies of dune alignment and structure in the Persian Gulf area suggest that this predominant wind pattern has not changed significantly during the last 10,000 years (Holocene).¹⁷

In winter and spring, the regularity of the shamal wind decreases and the *sharqi* (meaning easterly) becomes the predominant wind, up to a height of ~7000 feet.¹⁸ These winds, coming from the Persian Gulf (Fig. 1), are relatively cool and damp and may bring clouds and rain to the entire region of Iraq as they develop in front of advancing cyclonic depressions. Sometimes in the Persian Gulf region, these southeasterly *sharqi* winds are followed, after the passage of a trough, by southwesterly *suhaili* winds. The *suhaili* is often a strong wind that can pose a danger for ships in the Gulf.¹⁹ Only with the passing of a cyclonic storm are pressure gradients steep enough for violent winds to result.

Strong winds are known to have the capacity to blow boats for many miles. In the 1938 Eastern (USA) Seaboard Hurricane, winds up to 186 miles per hour drove boats and broken pieces of piers inland into the city streets of New Haven.²⁰ A boat on an almost completely flat flood plain—unfettered by trees, houses, or hills—would have the potential of being moved far inland by high winds.

Accordance with the Biblical Account

If the “second month, seventeenth day of the month” of Gen. 7:11 is interpreted as denoting the season of the year when the flood started, rather than a month-day extension of Noah’s age,²¹ then the Bible is in remarkable accord with the weather patterns that actually exist (and have existed) in the Mesopotamian area. If one compares the tropical calendar of today with the sidereal calendar of the Mesopotamians for the years around 2900 BC,²² then this would place the “second month, seventeenth day” in about the middle of March when meteorological conditions bring the most abundant rain to the Mesopotamian region. Genesis 7:12 says that it was a “heavy” rain which fell upon the earth (land) for forty days and forty nights,²³ and this is the type of rainfall (continuous downpour) that can result from the activity of maritime air masses characteristic of this season. The duration of the rain (forty days and forty nights) could have been caused by the stalling of a Mediterranean cyclonic front over the Mesopotamian area in combination with maritime air masses moving up from the Persian Gulf and Arabian Sea/Indian Ocean. This stalled storm would have been associated with southerly winds (the *sharqi* and/or *suhaili*), not with the northwesterly shamal wind, and these could have been very intense winds both in strength and duration.

The Bible (Gen. 8:1) also records that sometime before the 150 days of Gen. 7:24 (five months or about in the middle of August, assuming a middle-of-March start-date for the Flood), a wind passed over the earth causing the waters

to subside. This wind could correspond with the northwest shamal wind that blows almost continuously during the summer months. In spring, the melting of snow and steady rain in the mountains of northern Iraq produces flooding in the valleys of the south. Then in summer, the wind howls southward along the narrow fertile strip between the Euphrates and Tigris Rivers, and the drying process begins.²⁴ Thus, the Genesis account accurately records the actual meteorological situation that exists (and has existed) in Iraq (Mesopotamia).

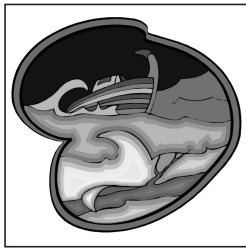
What Water Sources Could Have Caused Prolonged Flooding?

While floods that lasted for up to six months are not unusual for southern Mesopotamia (before modern dams were built), the Noachian Flood was unique in a number of respects: (1) the Bible claims that the Flood was backed up for at least 150 days and that it lasted a total of one whole year (365 days); (2) the Bible claims that the Flood not only covered southern Mesopotamia, but also parts of northern Mesopotamia, at least as far as “the mountains of Ararat” where the ark landed; and (3) the Bible claims that the Flood, Noah’s ark, and Noah’s journey in the ark was instigated and directed by God as an act of punishment on an evil, violent, and corrupt generation. This last topic will be covered at the end of this paper under The Nature of “Nature Miracles.”

Floods in Mesopotamia

The Mesopotamian alluvial plain is one of the flattest places on earth. The surface of the plain 240 miles (400 km) inland from the head of the Gulf is less than 60 feet (20 m) above sea level,²⁵ and at An Nasiriyah, the water level of the Euphrates is only eight feet (<3 m) above sea level, even though the river still has to cover a distance of more than 95 miles to Basra (Fig. 1). Once As Samawah and Al ‘Amārah are passed, the waters of the Euphrates and Tigris Rivers are lost in an immense marshland-lake region (Fig. 1), where water flows very slowly to the Persian Gulf. During spring this whole region—from the Euphrates east to the Tigris—can become severely inundated.²⁶ The level surface of the plain and shallow river beds of the Euphrates and Tigris, which offer the right conditions for irrigation,²⁷ can also cause immediate, widespread flooding. And, however difficult it is to get water *to* the land via irrigation canals, it is just as difficult to get it *off* the land when it floods.²⁸ Before any dams were built (before ~1920), about two-thirds of the whole area of southern Mesopotamia (Babylonia) could be underwater in the flood season from March to August.²⁹

Of the two rivers, the Tigris is characterized by more destructive floods and larger inundations than the Euphrates. The Tigris River floods annually due to spring melting of snow in the Taurus and Zagros Mountains.



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A number of hydrologic factors could have been responsible for 150 days of flooding as recorded by Gen. 7:24: rain, heavy and continuous; snow, melted by heavy rains; springs, groundwater finally exiting; and a storm surge, high winds and tides that drive seawater inland for hundreds of miles.

Its waters first begin to rise in March, reach their peak in May, and normally recede in July.³⁰ At Baghdad, the river is about one-quarter mile wide, with a depth at high water of twenty-six feet and at low water of about four feet: the channel current at flood is about 3–4 miles/hour and at low water it is 1¼ miles/hour. There is hardly a season when the desert, at least for a few days, does not flood, and within a few minutes after a cloudburst, a person can be standing chest-deep in water.³¹ Such an immediate flooding response is due to the lack of vegetation over the flat floodplain and to the very shallow water table depth of only a few feet.³²

There are historical references to floods in Mesopotamia in the tenth, eighteenth, and twentieth centuries BC and seventh and eighth centuries AD.³³ From AD 762–1906, thirty major floods were recorded in and around Baghdad.³⁴ Of these, one of the largest floods is stated to have been in AD 1174, when the Tigris River flooded the whole of Baghdad and where the water was so high that boats entered the Bamarestan Hospital (located on high ground west of the river) through the empty doorways. One recent disaster was in 1954 when an exceptionally rainy spring combined with the melting snows of Armenia and Kurdistan so swelled the Tigris River that it submerged the low-lying plain for hundreds of miles and all of Baghdad was in imminent danger of destruction.³⁵ Noah's Flood must have been of greater magnitude than any of these floods to be preferentially preserved in the literature and history of so many ancient peoples, and the only one so large that it is still remembered as "the Great Deluge." Hydrologically speaking, it must have been a "1000-year flood" – or even a "5000-year flood."

Factors That Could Have Influenced Prolonged Flooding

A number of hydrologic factors could have been responsible for 150 days of flooding as recorded by Gen. 7:24.

Rain. Not only did it rain heavily and continuously for forty days and forty nights (Gen. 7:12), but it could have also rained intermittently after that until Day 150, when Gen. 8:2 says the rain finally stopped. The exact duration of the rain is unclear, and exactly where it rained is also unclear.

It likely rained where Noah lived and built the ark (probably Shuruppak, the traditional "hometown" of Noah), as that is where the ark was lifted above the ground and began to float (Gen. 7:17). But if the cyclonic storm was regional, it could have rained over all of Mesopotamia and the surrounding highlands.

Snow. While the Bible does not specifically mention the involvement of snow in the Genesis Flood, melting of mountain snows by the rains of Gen. 7:17 could also have been an important factor affecting flooding. Vast amounts of water are held in snow storage, and the greatest floods on large rivers (such as the Tigris or Mississippi) tend to occur in spring in response to snow melt.³⁶ Snow melted by heavy rains can be released as water very quickly (producing immediate flooding), but if the snow is deep and not subject to melting by rain, then water will be released over a long period of time.³⁷ If the snow had been exceptionally deep during the winter of the Flood, this snow could have added, as runoff, a great amount of water (both in the short-term and long-term) to the Mesopotamian hydrologic basin. In particular, it could have been responsible for prolonged flooding in the upper parts of the Mesopotamian hydrologic basin in the northern Mesopotamian (Urartu) region. Such a situation is recorded as having happened in the 1954 flood along the upper Tigris River.³⁸ Another important factor in melting snow are warm winds.³⁹ If the "wind" of Gen. 8:1 was a warm, northwesterly, shamal wind, it might have helped to melt snow in the surrounding highlands as well as to dry up the ground in the Mesopotamian alluvial plain.

Springs. The Bible mentions the "fountains of the deep" (springs) twice in its narrative – once when the springs start (Gen. 7:11) and once when they stop (Gen. 8:2). Springs are a prime factor that could have caused prolonged flooding. When it rains or when snow melts, water does not only flow over the ground as stream runoff. It can also travel underground as "groundwater," finally exiting at springs. Genesis 7:11 says that the fountains of the great deep (subterranean water or groundwater) were "broken up." "Broken up" comes from the Hebrew "bâqa," which means to "break forth," or be "ready to burst," and so the literal meaning of Gen. 7:11 is that these springs began gushing water.⁴⁰ The connotation of Gen. 7:11 is that

a surging mass of water burst forth from a deep subterranean water supply.

Springs exist all over Mesopotamia and surrounding highlands, and most of these are limestone (karst) springs. Ras-el-ain (*ain* means “spring”), near the border of Syria and Turkey, is one of the largest limestone karst springs in the world and is the effective head of the Khabūr River, a major tributary of the Euphrates.⁴¹ Water from this spring (actually a complex of thirteen springs) comes from maximum winter infiltration (snow melt and rain in the Taurus Mountains) in January–February, but this water does not actually discharge at Ras-el-ain until the following July or August. This type of delay is typical of many karst springs, where recharge may be distant or convoluted from the spring discharge point. Some springs flow all the time, some springs flow only when it floods, and some springs have a delayed reaction between recharge and discharge. In the case of a delayed reaction, a continuous supply of water may be supplied for many months after a heavy rainstorm (or storms). The Bible seems to indicate that at least some springs began gushing water immediately as the Flood started (Gen. 7:11), but that others continued for up to five months (Gen. 8:2).

Specific springs (among many) that could have contributed water to the Mesopotamian hydrologic basin during Noah’s Flood are those located near ancient Sippar, Babylon, and Kish,⁴² those in the vicinity of Hit,⁴³ and those in the Jezira desert region between Baghdad and Mosul.⁴⁴ Tributaries to the Tigris also emerge from karst springs (large caves) along the foothills of the Zagros Mountains. When severe rains occur in the Zagros, these springs respond with a strong outflow, causing the rivers to swell and overflow onto the plains.⁴⁵ In antiquity, one of the most important of these springs emerged from Shalmaneser’s Cave, which was thought to be the “source” of the Tigris when Shalmaneser III visited the cave in 852 BC.⁴⁶ It is also recorded that Sargon II had learned the secret of tapping water from subterranean strata during his campaign against Ulhu and Urartu (the land of Ararat).⁴⁷

Numerous springs also exist in the deep canyons of the Cudi Dag (Jabel Judi), Cizre region of southeastern Turkey. Various karst features such as springs, sinks, and caves have developed in the Jurassic-Cretaceous Cudi Limestone of these mountains. The best known of these springs is located west of Beytişebab; other smaller ones occur further south.⁴⁸ Runoff from these springs can prolong flooding in the upper Tigris River Valley-Cizre Plain area—just where Noah’s ark may have landed (Fig. 1).

Storm Surge. There is the possibility that a storm surge (in addition to rainfall and snow melt) may have helped maintain flooding in the southern part of Mesopotamia. Storm surges are where a low-pressure meteorological system causes high winds and tides, which can drive seawater inland for hundreds of miles. This hypothesis is

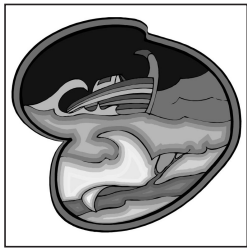
supported by written cuneiform records. The technical word for flood or deluge is “*amaru*” in Sumerian, or “*abubu*” in Akkadian. Specifically, “*abubu*” indicates moving water caused by a rainstorm or a storm that drives seawater into land.⁴⁹ In the Sumerian Gilgamesh Epic, it is said that a “hurricane raged” and after the flood “the sea became quiet, the storm was still, and the *abubu* ceased.”⁵⁰ The term *abubu* not only depicts a rainstorm and inundation, but it also includes the destructive winds and gales along with the rainstorm. In the Sumerian cuneiform tablets found at Nippur, the Noachian deluge is described as: “the mighty winds blew violently ... and the ship moved along over the face of the great waters, driven by the wind.”⁵¹ In the Akkadian Atrahasis epic, the text speaks of thunder and savage winds.⁵² Also in the Gilgamesh Epic, the flood of Ziusudra (Noah) is recorded as having been a “south storm” accompanied by wind and thunder, where the flood-winds blew over the land and the south-wind tempest swept over it.⁵³ Similarly, the Hebrew word “*mabbūl*” for “flood” used in the Genesis text is applicable to both an inundation or an “overflowing” caused by a sweeping (wind-driven) rainstorm.⁵⁴

Where is the Flood Sediment Left by Noah’s Flood?

Universal Flood Sediments

Because of the traditional assumption that the Noachian Flood was universal, most people up to about AD 1750 accepted the church’s official view that all of the sedimentary rock on planet Earth formed at the time of Noah’s Flood (roughly the same position held today by Flood Geologists). Then, starting at the end of the eighteenth century, an agonizing battle over the history of the Earth began between scriptural chronology and the newly-founded science of geology.⁵⁵ During the seventy or so years between 1750 and 1820, the cumulative weight of evidence for an old Earth swayed the vast majority of field scientists (but not the majority of the church). Not only did it become evident that sediments take a long time to be deposited, it also became clear that the transformation of sediments into sedimentary rock involves an even longer span of time (in total, millions of years). In addition, it was discovered that not all sedimentary rocks are composed of flood-type sediments—in fact, most of them are not. There are marine sediments (the majority) interspersed with eolian (wind) sediments, lacustrine (lake) sediments, and evaporative sediments (such as halite and gypsum). Thus, the Earth’s sedimentary record as a whole does not document one catastrophic flood event (Noah’s Flood), but a series of many different sedimentary environments that overlap with each other in space and time.

By 1820 most geologists had abandoned the idea that all sedimentary rock had been formed at the time of Noah’s Flood, but many still believed in the former existence of an extremely violent flood (or floods) that had



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swept over the Earth—floods that had even submerged some of the highest mountain summits and had created great valleys, gorges, and ravines.⁵⁶ The evidence for this belief (called the “diluvialist school of thought” after Noah’s deluge) was that many parts of the Earth (especially northern Europe and the Alps) were known to be mantled by a chaotic assemblage of sediments ranging from mud to silt to sand to gravel—even huge, erratic, strangely-striated boulders of many tons weight. These deposits led some geologists to propose that older *diluvial* deposits (left by the biblical deluge) are overlain by younger *alluvial* deposits containing fossils of a recognizable modern type. Also, fossils such as great mammoths trapped in glacial ice, and “diluvial” fossil deposits in caves were attributed to changes in climate brought about by the Noachian Flood.⁵⁷

This was the setting for the emergence of the glacial theory, which rudely shocked the geological community in the late 1830s and early 1840s by proposing that the action of glaciers accounted for the strangely striated “erratic” boulders and poorly-sorted rock debris (referred to as “till” by geologists) present in many parts of the world. The substantiation of this glacial, “ice-ages” theory then left *no* deposits that could be attributed to the Noachian Flood.

Mesopotamian Flood Sediments

So where are the flood sediments left by Noah’s Flood, if indeed such a historical flood existed? They are present in the Mesopotamian hydrologic basin because that is where the Flood took place. If Noah’s Flood was a *local flood*, then flood deposits over the entire Earth should not be expected. Rather, only some of the sediment in Mesopotamia should be attributable to Noah’s Flood.

Flood sediment layers have been found all over Mesopotamia in places such as Kish, Shuruppak, Ur, Uruk, Lagesh, and Nineveh. This is because floods are endemic to the region, occurring practically every year somewhere within the Mesopotamian hydrologic basin. Some of these flood deposits are from “normal” floods, while others are from larger-magnitude floods. The most famous of these flood deposits was found in the late 1920s by Leonard Woolley, who reported 8–11 feet of “clean water-laid mud” in the

Royal Cemetery of Ur and pronounced it the result of “Noah’s Flood.”⁵⁸ As it turns out, this particular flood deposit seems too early to be a record of the Noachian Flood, belonging to the end of the Ubaid Period (~3800 BC) and not to the Jemdet Nasr Period (~2900 BC). The flood deposits at Nineveh also seem to be too early (~4300 BC) to correlate with the Noachian Flood, while at Kish the opposite occurs: the flood stratum seems to be too late (from the end of the Early Dynastic Period).⁵⁹ At Shuruppak, and also at Uruk, the last Jemdet Nasr remains are separated from the subsequent Early Dynastic I Period by clean, water-lain clay deposited by a flood. This clay is nearly five feet thick at Uruk⁶⁰ and two feet thick at Shuruppak.⁶¹ Since the Sumerian King List mentions that Noah (Ziusudra) lived in Shuruppak (today the archaeological mound of Fara), and since Noah is believed to have lived during the Jemdet Nasr Period,⁶² then these sediments date from the right time and place and may be deposits left by Noah’s Flood.

Flood Deposition and Erosion

A popular misconception is that a great inundation such as Noah’s Flood should have left a widespread layer of sediment all over Mesopotamia. If flood deposits occur at Shuruppak (Fara), then why not at nearby Kish? Why have no flood deposits been found at Ur that correspond to Noah’s Flood, and why in the city-mound of Ur do some pits contain thick flood deposits while other pits nearby contain no flood deposits?

This presumed problematic situation is completely understandable to hydrologists—in fact, it is what they expect. Floods *erode* sediment as well as *deposit* sediment. Rivers in vegetated terrain (like in northern Mesopotamia) are capable of eroding less sediment than in unvegetated, clay-silt terrain (like in southern Mesopotamia). Rivers may scour and down cut sediment along steep gradients, whereas they may deposit sediment in shallow-gradient situations. Or, sediment left from the waters of one flood may be removed by erosion in a later flood. Most Mesopotamian cities were located close to former river channels or canals since commerce and transportation depended on these waterways. Therefore, a temple-mound (zigurat) city in the path of a raging flood might be eroded on its side facing the torrent of water, while on its lee, “backwater” side,

sediment might be deposited in low areas. Or, a city might not be covered with river silt at all, and in such cases, cities constructed after the Flood could appear to continue without an archaeological break from pre-Flood cities. In addition, during periods of high flooding, there is a tendency for in-channel sediment deposition to cause an avulsion, or change, in a river's course,⁶³ thus possibly sparing cities along the banks of that course.

All of the above illustrates that the depth of flood deposits does not automatically indicate the depth of a past flood, and the lack of flood deposits does not automatically mean the non-existence of a flood (i.e., the absence of evidence is not necessarily the evidence of absence). The only absolute way of knowing when a flood occurred is to dig a series of trenches and date the remains (pottery, etc.) both above and below a flood sediment horizon, or carbon-date organic matter within that sediment. Such a comprehensive study has never been done for the ancient cities of Mesopotamia, and certainly not using the most recent techniques. Therefore, not enough data is in yet to say which of the flood deposits in Mesopotamia may have been derived from the Noachian Flood.

It is very important to this discussion to understand the magnitude of sediment build-up that can occur in a major flooding event. As previously mentioned, the Mississippi River flood of 1973 was out of its banks for two to three months in some locations,⁶⁴ and the average sediment thickness left by this flood was 21 inches along the natural levee and 12 feet in the back-swamp areas. Considering that Noah's Flood lasted about four times as long (1 year), one can roughly estimate that a maximum of ~50 feet of sediment might have accumulated in an ideal backwater location during this flood. This is *nowhere* equivalent to the *miles* of sedimentary rock proposed by Flood Geologists as having formed during the Noachian Flood. But it does fit with a "1000-year" or "5000-year" *local* flood model.

Noachian Flood Sediments

Besides occurring in slack places over the Mesopotamian alluvial plain and over or around some ancient city mounds in existence at ca 2900 BC, sediments from Noah's Flood should have also accumulated at or near the lowest point of the Mesopotamian hydrologic basin; i.e., in the Euphrates/Tigris delta of the Persian Gulf. The Euphrates and Tigris Rivers carry their suspended load southward and deposit it either in the marshes and shallow lakes just before reaching the Persian Gulf, or in the Gulf itself (Fig. 1).⁶⁵ Some recent sediments in the Persian Gulf have been dated at ca 3000–4000 BC,⁶⁶ and could represent material derived from Noah's Flood. However, since Gulf sediments are being constantly reworked by tidal currents,⁶⁷ it is probable that any sediment from Noah's Flood would be mixed with sediment from other times and sources and not be distinguishable from them.

A Local Flood Model and Route for Noah's Ark

A possible scenario is proposed for the flooding of the Mesopotamian plain and the route taken by the ark northward to the mountains of Ararat (Fig. 1, largest straight nonsolid arrow). As in an earlier article in *Perspectives on Science and Christian Faith*, the area of Cizre and Jabel Judi are considered the most likely landing place for the ark.⁶⁸

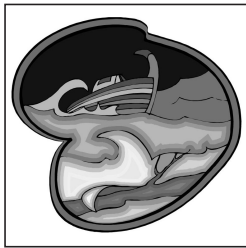
A large cyclonic storm stalled over Mesopotamia provided heavy rainfall for 40 days and 40 nights to the lowland regions and snow (or rain-melt of snow) to the highland regions. This rainstorm was accompanied by an intense south (sharqi and/or suhaili) wind, which blew the ark northward toward the mountains of Ararat (Uratu). The entire Tigris River hydrologic basin was inundated up to the area of Cizre because springs and snow melt kept the water flooded in the upper Tigris River Valley as well as in the lower Tigris River Valley.

A possible route that the ark may have followed along its journey from south to north was from southern Mesopotamia (Shuruppak) along the inundated flood plain between the Euphrates and Tigris Rivers up to the area of present-day Baghdad (112 ft elevation). Then it could have followed the very flat, flooded Tigris River Valley up to the area of Mosul (730 ft elevation), where the Tigris is still a wide stately river.⁶⁹ Northward from Mosul, the terrain becomes more hilly, but there is still a wide valley up to Cizre (~1640 ft elevation).⁷⁰ The ark could have landed somewhere in this area (just south of Jabel Judi), or it could have made it to the Cizre Plain and landed in the foothills of the Jabel Judi Mountains where the mountain tops could be seen (Gen. 8:5), but where the valleys were still flooded (Gen. 8:9). This location is in the "mountains of Ararat" (Gen. 8:4) and was known in antiquity for both its olive trees (Gen. 8:11) and vineyards (Gen. 9:20).

The Nature of "Nature Miracles"

From the above discussion, it may seem that a completely naturalistic explanation for the Noachian Flood is being offered. Such is not the case. The Bible claims that Noah's Flood was *supernatural* in that:

1. It was God who purposely sent the Flood to judge an evil, corrupt, and violent world (Gen. 6:7; Gen. 6:11–13). But Noah "walked with God" (Gen. 6:9) and found grace in the eyes of the Lord (Gen. 6:8). Noah had a personal relationship with the true God and was thus spared.
2. It was God (*I, even I*; Gen. 6:17) who exercised absolute control over the forces of nature by causing the Flood.
3. It was God who commanded Noah to build the ark (Gen. 6:14) and to bring the animals onto the ark (Gen. 6:19), and it was the Lord God who shut up Noah and his family into the ark (Gen. 7:16).



Article

Qualitative Hydrology of Noah's Flood

Noah's Flood was a miracle because God intervened into his physical laws ... Divine action can simply be understood as higher-order laws (God's ultimate purpose) working seamlessly with lower-order laws (God's physical laws).

4. It was God who restrained the floodwaters (Gen 8:1-3) and brought the ark safely to the mountains of Ararat (Gen. 8:4).

5. It was God who established a covenant with Noah (Gen. 6:18) and who made the rainbow a sign of that covenant (Gen. 9:13).

Noah's Flood was a miracle because God *intervened* into his physical laws. One does not have to invoke the notion of the suspension or violation of natural laws in "nature miracles." Divine action can simply be understood as higher-order laws (God's ultimate purpose) working seamlessly with lower-order laws (God's physical laws).⁷¹ Is it any less a miracle because it can be explained by natural processes? This is the nature of "nature miracles": to have the *timely* intervention of God into natural processes.⁷²

One of the best examples of a "nature miracle" that comes to mind is Jesus rebuking the winds and sea (Matt. 8:23-26). In Matt. 8:26, the calming of the winds and sea could be explained by a sudden change of barometric pressure—which was probably the case. But it was God who caused this change to take place *exactly* when Christ commanded the waves and wind to be still.

Three further points should be made at this time about miracles:

1. "Nature miracles"—where miracles can be explained by natural processes—are not the only kind of miracle claimed by the Bible. Jesus' walking on water, the Red Sea parting, the Resurrection of Christ: all of these "nonnature miracles" cannot be explained by natural processes (as we know them). It is not to be implied that "nonnature miracles" cannot or have not occurred.

2. Just because God can perform "nature miracles" does not mean that all natural disasters are judgments of God as Noah's Flood was. Most natural disasters are due to natural happenings, where God allows the natural processes that he set up to operate.

3. In order to explain a "nature miracle" like Noah's Flood, miracles not recorded in the Bible should not be assumed; i.e., miracles should not be "pulled out of a hat" anytime one feels like it. Any theory, no matter how feeble, can be "proved" by recourse to the miraculous or God's omnipotence.⁷³ It is a weak interpretation that has to invent mira-

cles that the text says nothing about in order to compensate for logistical problems.⁷⁴ If the Bible is to be taken at face value, then the miracles that the Bible actually claims should be considered to be miracles, and those it does not claim should not be manufactured.

Conclusion

If the actual meteorological and geographical conditions of the Iraq (Mesopotamia) area are taken into account, the Bible proves remarkably accurate in its record of the Flood account. The proposition that Noah's Flood was local rather than universal thus makes sense both historically and hydrologically from the viewpoint of the questions addressed in this paper. A companion paper on the Quantitative Hydrology of Noah's Flood follows that will attempt to answer the hardest question of all: How could the ark have gone "uphill" against the current (hydrologic gradient) to land in the "mountains of Ararat"? ❁

Acknowledgment

I thank Alan Hill for his contributions to this paper.

Notes

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