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## An Interdisciplinary Hydrology of Hagios Ioannis Prodromos Monastery

### I. Introduction

Water is integral to all life; this truism acquires even more significance in the context of the Hagios Ioannis Prodromos Monastery. In the Mediterranean, water is an especially precious resource due to seasonal variations in precipitation. Global climate change could increase the seasonality of water availability even further.<sup>1</sup> Hydrology is thus becoming an increasingly relevant field of study. Within the context of the seminar, the water cycle is a classic example of an earthly rhythm. Water itself also contributes to the cycles in Greek Orthodox practices, due to its use in baptism, holy water, and communion. This paper employs an interdisciplinary approach to investigate the hydrological context of the monastery and the significance of water in the Greek Orthodox Church. We begin with an overview of the hydrology of the Strymon River catchment. Second, we investigate the importance of karst in fulfilling Greece's water needs. Third, we examine how the qanat system in the Menoikeion mountains contributes to the local water supply. Fourth, we observe how the water supply method of the Hagios Ioannis Prodromos Monastery combines both natural karstic aquifers and artificial qanats. Lastly, we briefly discuss the importance of water within the Greek Orthodox context, including monastic perceptions and incorporation into religious rituals.

### II. The Strymon River catchment

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<sup>1</sup> Andreas N. Angelakis and Arie S. Issar, *Diachronic Climatic Impacts on Water Resources with Emphasis on the Mediterranean Region* (Springer, 1996), 279.

Let us first place the monastery within its regional hydrological context. The monastery is located within the catchment of the river Strymon, one of the most important Greek rivers. The river also has a significant portion in Bulgaria, where much of its catchment area is located. The total catchment area is 17,063 sq. km and comprises 45.7% forest and 36.6% cropland;<sup>2</sup> its primary crops are wheat, maize, tobacco, rice, sunflower, sugar beets, and other vegetables. Approximately 95% of this area's water demand is irrigation, and the remaining 5% is domestic.<sup>3</sup>

While the hydrological needs of the Strymon River Basin are met during a normal year, the area faces water shortage during the occasional dry year. More problematically, the river has abnormally high levels of BOD<sub>5</sub> and PO<sub>4</sub>, indicating a possible issue with the system for sewage treatment upstream in Bulgaria. Although NO<sub>3</sub> levels are below the standard, they increase downstream, probably because of the intensive use of fertilizers in the Greek part of the catchment.<sup>4</sup> Therefore, while the monastery is located within an area with a generally safe and reliable hydrological system, the region does have some ongoing issues with drought and water quality.

### III. Karst hydrology

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<sup>2</sup> Nikos Skoulikidis, Elias Dimitriou, and Ioannis Karaouzas, *The Rivers of Greece: Evolution, Current Status and Perspectives* (Berlin: Springer, 2018), 132, 100.

<sup>3</sup> *Ibid.*, 215.

<sup>4</sup> Charalampos Doulgeris, Irkalis Chalkidis, and Dimitris Papadimos, "Hydrological - Hydraulic and Quantitative Simulation of Strymonas/Struma River," *Use of Modern Technology for the Protection and Management of Water Resources in Strymonas/Struma River Basin*, October 2008, 44, January 16, 2016, researchgate.edu.

Karst is a geological terrain that dominates the primarily carbonate landscape of Greece; in particular, karst hydrology plays a large role in the water supply system of Greece. Broadly defined, karst is an environment that is the product of erosion by freely flowing water over soluble rocks. While karst can occur in any kind of rock, carbonate rocks like limestones and dolomites (both of which are very common in the Serres area) tend to be the most susceptible to karsting due to their solubility.<sup>5</sup> Essentially, water erodes the surfaces of these soluble rocks and penetrates them. As a result, large underground cavities form, allowing water to move through rocks as if through a pipe, as opposed to seeping through them like a sponge (as happens in nonkarstic terrains).<sup>6</sup> These natural underground pipes are called aquifers and can serve as a major source of water for human communities.

In addition to these aquifers, karstic landscapes are often characterized by dramatic indicators such as sinkholes, ravines, and caves. Water can seem to “disappear” as it enters an aquifer; such water sources can reappear miles later. The result is an environment that appears to defy nature and reason, as the water moves in apparently random patterns. Predictably, this landscape has inspired much awe throughout the period of human occupation in Greece and continues to do so today. Karstic terrains played a large role in setting the scene for the mysticism of ancient Greek myths.<sup>7</sup> There is even evidence that ancient Greeks performed experiments on their karstic water supplies by putting a large amount of pinecones into the place

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<sup>5</sup> Dora P. Crouch, *Water Management in Ancient Greek Cities* (New York: Oxford University Press, 1993), 68.

<sup>6</sup> Cindy Clendenon, *Hydromythology and the Ancient Greek World: An Earth Science Perspective Emphasizing Karst Hydrology* (Lansing, Mich: Fineline Science, 2009), 252.

<sup>7</sup> See Clendenon, *Hydromythology and the Ancient Greek World* for a comprehensive look at how karstic terrains lay the framework for many ancient Greek myths.

where the water disappears and then searching for where the pinecones came out.<sup>8</sup> Before the advent of remote sensing technologies, humans' inability to determine the course of water underground led to mystification of karst water supplies. While their reactions are less well-documented than those of their ancient counterparts, later Greeks likely also used their aquifer-supplied water with some confusion and awe.

#### IV. Qanats

While plentiful in Greece, karstic aquifers alone are not always sufficient to supply a community with water year-round. In response to seasonal water availability, Greek peoples throughout history developed many methods of supplying their cities with water, such as inverted siphons and cisterns. The Menoikeion mountains are home to a particularly interesting water supply method known as the qanat. A qanat is a manmade subsurface channel that uses gravity to transport water, often at depths of 6 meters or greater.<sup>9</sup> This style of underground aqueduct originated in Iran but spread throughout the Mediterranean and even into central Europe, generally in dry areas.<sup>10</sup>

At least 18 qanats have been found in the region around Mt. Menoikeion. They were probably built after the Ottoman occupation; the most recent one dates to 1895. These qanats have annual variability in discharge, like the variability of precipitation itself. During winter,

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<sup>8</sup> Crouch, *Water Management*, 66.

<sup>9</sup> O. Blumenstein, H. Weingartner, and M. Vavelidis, "Qanats Between Menikion and Pangeon Mountains: A Forgotten and Endangered Resource for Local Water Supply," *Scientific Annals, School of Geology, Aristotle University of Thessaloniki: Proceedings of the XIX CBGA Congress, Thessaloniki, Greece* 100 (2010): 27.

<sup>10</sup> *Ibid.*, 1-3.

their discharge oscillates, probably due to karstic drainage after precipitation; during summer, their discharge is constant and low.<sup>11</sup> Nonetheless, they provide a constant source of water in an area where it might be scarce otherwise. While none of the known qanats are close enough to the monastery to contribute to its water supply, knowledge about the qanats largely disappeared due to the flux of people in and out of the region.<sup>12</sup> Also notable is the fact that qanats have been associated with monasteries elsewhere: some of the nearby qanats supply other monasteries in the Serres area, while the spread of qanats throughout Europe mirrors the spread of monasteries.<sup>13</sup> It would therefore be sensible if local villages and even the monastery itself were to receive some of their water from this unique form of water transport.

#### V. Water at Hagios Ioannis Prodromos Monastery

The monastery's water supply system, as it turns out, combines both karst and qanat elements; the Abbot Christophoros provided a detailed account of the monastery's water supply as of 1904. He begins by describing the site where the water comes out of the fountain next to the narthex of the church; the importance that Christophoros attaches to it and his description of it as *agiasma* or "holy water" suggest that water played some kind of spiritual role in the

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<sup>11</sup> Ibid., 3.

<sup>12</sup> Ibid.

<sup>13</sup> Ibid.; Konstantinos Voudouris et al., "Hydrogeological Characteristics of Hellenic Aqueducts-Like Qanats," *Water* 5, no. 3 (September 11, 2013): 1339, doi:10.3390/w5031326.

monastery at the time. He also describes three other small natural sources of water near the garden, which would have been outside but not far away from the monastery.<sup>14</sup>

The most important source of water, however, seems to be karstic. Christophoros calls it neverending, of distant origin, deep, cold during summer and warm during winter. He claims it goes underground and gets cleaned while there; as a result, it has a very clear, pleasant taste and is not too heavy on the stomach. Most importantly, however, the underground water is abundant. Given its location in a limestone-rich landscape and this description of the water quality, it seems likely that the water comes from a karstic source. Christophoros goes to great lengths to praise the ampleness of the monastic water supply: he records every fountain near the monastery (including seven inside and two outside). One of the outside fountains could water five donkeys, while one of the inside fountains had two heads.<sup>15</sup>

In fact, there was so much water that the monks built a water mill inside the monastery. Originally, it would have been used for grinding flour and olive oil; in the later days of the monastery, it was used for electricity.<sup>16</sup> The monks also maintained their gardens and olive trees with the underground water supply. During the summertime, families from Serres would often move up to the mountain and live in the houses surrounding the monastery. These families also

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<sup>14</sup> Abbot Christophoros, *Προσκυνητάριον της εν Μακεδονία παρά τη πόλει των Σερρών Σταυροπηγιακής Ιεράς Μονής του αγίου Ιωάννου του Προδρόμου / συνταχθέν παρά του Χριστοφόρου ιεροδιδασκάλου και Ηγουμένου αυτής*. (1904), 11.

<sup>15</sup> Ibid.

<sup>16</sup> Sister Parthenia.

took advantage of the plentiful water supply and presumably benefitted from its somewhat enhanced cleanliness as well.<sup>17</sup>

This bounty of water relies on two interconnected sources: one natural and one artificial. The precise path of the natural aquifer was unknown to Christophoros, but three hours north of monastery the aquifer water passes parallel to the main stream; after that point, the underground water is audible in three different locations along its path. About 900 meters away from the monastery, this natural aquifer meets a manmade aqueduct. By diverting stream water into the aqueduct during dry periods, the monks determined that the water took eighteen hours to reach the monastery from the intersection between the two water supply systems. The pipes therefore make many twists and turns on their route to the monastery, for unknown reasons. Despite the frequency of turns, given the high incidence of qanats in the Menoikeion region, it seems likely that this underground aqueduct is simply another qanat whose existence had been forgotten until recently. When the water does finally arrive at the monastery, it goes to the fountains and the mill before pouring out of a hole in the kitchen and into a well at the bottom.<sup>18</sup>

The discovery of the natural aquifer is unrecorded in ancient documents, but the construction of the artificial aqueduct is relatively well-documented. The donor was Hatzi Petkis Spandonis, a woolen dress merchant with some ties to the monastery, and it was built in 1775 under the road that leads to the monastery from the villages to the north. Christophoros does not describe how the monks supplied their water before the construction of the pipes, but Spandonis's sponsorship of the aqueduct construction was probably an important and much-

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<sup>17</sup> Christophoros, *Προσκνητάριον*, 11.

<sup>18</sup> *Ibid.*

appreciated gift. In fact, Christophoros praises God many times for bestowing the blessing of plentiful water upon the monastery, indicating the significance of the clean water supply and the association of water and spirituality.<sup>19</sup>

## VI. Water in the Greek Orthodox Church

Like many religions, the Greek Orthodox Church endows water with a special spiritual significance. After all, three major Church practices depend on water and its healing properties: baptism, holy water, and communion. Interpretations of the significance of water in Church practice has of course varied throughout time and according to individual preferences; however, there is almost always a sense that water is sacred and has powers of spiritual cleansing. For Fr. Sophrony, once a monk of Mt. Athos and later the founder of the monastery of St. John the Baptist in Essex, England, water took on another meaning as well.<sup>20</sup> He encouraged water conservation in the monastery: he never poured more water than he could drink and even saved leftover hot water in a thermos to keep from wasting water or energy.<sup>21</sup> While this practice was apparently unique to Fr. Sophrony, other monastics have likely found their own ways to interact with water.

Of the three major Christian practices involving water, baptism displays the renewing powers of water most clearly. In the Orthodox tradition in particular, baptism typically involves a full immersion in the water, as opposed to the aspersion or affusion techniques popular among

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<sup>19</sup> Ibid., 12.

<sup>20</sup> John Chryssavgis and Bruce V. Foltz, *Toward an Ecology of Transfiguration: Orthodox Christian Perspectives on Environment, Nature, and Creation* (New York: Fordham University Press, 2013), 122.

<sup>21</sup> Ibid., 128.

other Christian groups, meaning that water truly takes the center stage. In this case, water is seen as sanctifying and renewing.<sup>22</sup> In selecting water for a baptism, “living water” was historically preferred; this phrase apparently denotes cold, naturally flowing water such as rivers and streams.<sup>23</sup> Interestingly, ancient Greeks referred to water derived from karstic sources as “living water” as well and also preferred it.<sup>24</sup>

Holy Water likewise has a clear basis in the spiritual powers of water. Associated with the baptism of Christ in the Jordan, Holy Water is sweet and healing as a result of the blessing of the waters service. It helps to mediate the interaction between an individual and the Holy Spirit and can even be used as a medicine, to be drunk or sprayed on the body.<sup>25</sup> While a more tenuous link, communion also relies upon the healing power of water. According to Orthodox tradition, water is the fundamental transformative substance in the preparation of the Eucharist, as it allows both wheat and grapes to grow and thus become the ingredients of communion.<sup>26</sup> While these examples provide merely a brief overview of the ways in which water relates to the doctrines of the Orthodox Church, an entire study could be devoted to examining the myriad depictions of water in religious art and literature.

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<sup>22</sup> Ibid., 160-161.

<sup>23</sup> Robin Margaret Jensen, *Living Water: Images, Symbols, and Settings of Early Christian Baptism* (Leiden: Brill, 2011), 132-3.

<sup>24</sup> Crouch, *Water Management*, 66-67.

<sup>25</sup> Georgia Fouka et al., “Health-related Religious Rituals of the Greek Orthodox Church: Their Uptake and Meanings,” *Journal of Nursing Management* 20, no. 8 (2012): 1062, doi:10.1111/jonm.12024.

<sup>26</sup> Transfiguration 132

## VII. Conclusion

As we have seen, water is integral not only to life, but also to the Greek landscape and archaeology we recognize today, as well as to the Greek Orthodox Church. Water's spiritual powers find their full force in the water supply of the Hagios Ioannis Prodromos Monastery. After all, a karstic aquifer—a gift of God—joins with the manmade aqueduct and thus supplies an entire spiritual community with an abundance of water. Future research will be necessary in order to document the path of the qanat and to determine how much of the system Christophoros described is still in place.

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