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Human Spoon Propulsion Phenomenon

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Abstract: **A "mysterious" flow spins the water along the littoral perimeter of the lake in Warm Mineral Springs (North Port, Florida, USA) only between 9:00 AM and 5:00 PM. Why is the lake on such a puzzling schedule?**

Keywords: **Human propulsion, Lake Hydrology, littoral flow, whirlpool, energy balance, artesian lake, sink hole, Warm Mineral Springs spa.**

1. INTRODUCTION

A famous lake in Warm Mineral Springs, Florida, USA (1) has a very mysterious hydrology. The lake does not have any installation that may affect the lake hydrology. There is no water current before 9:00 AM. Then the water in the littoral zone of the lake starts flowing clockwise around the perimeter of the lake. The water flows only in this part of the lake, which holds 1% of the lake's water. There is no flow in the rest 99% of the lake neither on the surface or in the depth. The flow stops at about 5:00 PM.

The midday velocity of the lake's water is about 10 cm/sec or 0.36 km/hour (particles suspended in moving water pass 50 cm distance in about 5 seconds). The littoral water "whirlpool" makes about two revolutions around the lake in one hour. The flow is slower on cloudy or cold days.

The lake is one of the world's largest warm mineral springs (2). It is on the U.S. National Register of Historic Places (3). It is a deep sinkhole formed in carbonate rock by the collapse of the roof of a cavern 30,000 years ago.

Warm underwater springs feed the lake, keeping the water at a constant 29° C (85° F). Incoming spring water outflows into a small creek. The lake resembles a pond, but why does this pond have a littoral whirlpool?

2. LAKE HYDROLOGY

Fig. 1 is an aerial photo of the lake and Fig. 2 is a north-south vertical cross-section of the lake (4). The lake is 70 m in diameter. The maximum depth is 60 m. The shallow water littoral ring is roughly 10 m wide, its average diameter is 60 m and the perimeter is 180 m. The bottom of the littoral zone gradually deepens to 2 m and then the lake bottom sharply steepens into a vertical drop. The average diameter of the "deep water" is 48 m. Total lake volume is about 1.7 x 10^5 m^3 (calculated from dimensions in Fig 1 and 2). The water outflows into a small creek at a rate of 1.9 x10^4 m^3/day; it is equal to the total volume of the springs' inflow. If the lake were to be drained, the inflow springs would replenish the lake in 1.7 x 10^5 m3 / 1.9 x10^4 m^3/day = 9 days. In comparison, a single drop of water every 20 seconds will fill a 1 liter jar also in 9 days. The spring inflow is very slow and it cannot cause any significant current in the lake.

What else may be responsible for the mysterious whirlpool?

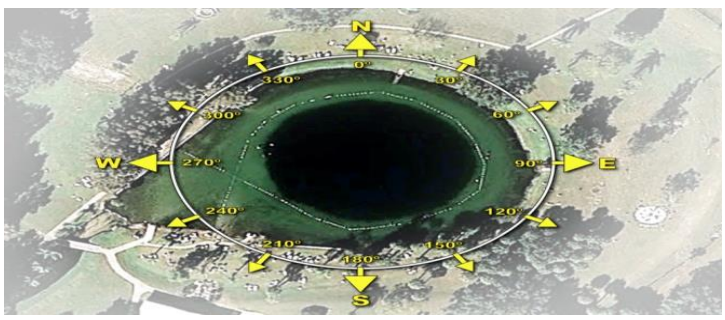

Fig: 1.

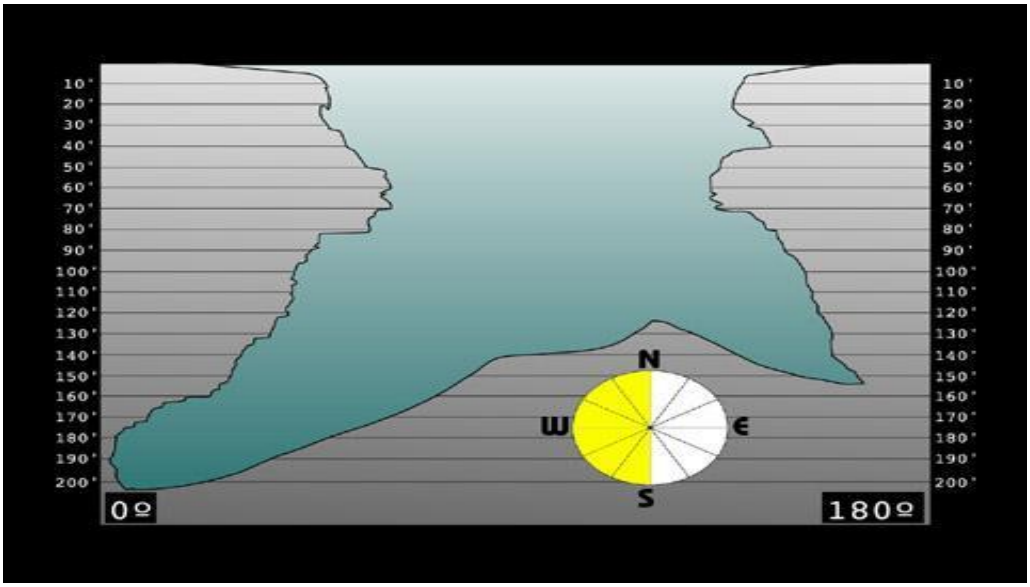

Fig: 2.

Fig:1. Aerial photo of the lake (4). The white dotted line is a safety rope with white floats. The black area in the middle is deep water. The green area along the banks is a littoral shallow water ring. The outflow creek is located between 240 and 270 degrees.

Fig: 2. Vertical North-South cross-section of the lake (4). The littoral rind is in the perimeter of the shallow upper part of the cross-section.

3. LOCAL BELIEFS

Locals mistakenly consider that underwater inflow springs rotate all the water in the lake and then part of the spinning water outflows into the small creek. But why does the water spin only for 8 hours and there is no flow the rest of the day except for the small localized outflow into the shallow creek? Why is the lake on such a puzzling schedule? Why does the water flow only in the littoral zone? Why is the rest of the lake motionless? Why does the water flow clockwise? Even more puzzling: why is the water flowing slower in unpleasant weather and how does it recognize unpleasant weather? Is it just "a practical joke" of a trickster spirit of the lake? Obviously, local beliefs fail to explain the puzzle of the lake. Nevertheless, unlike the disproven Flat Earth axiom, the lake "axiom" is accepted "as is". Is there any logical explanation?

Is there a human factor? There is a belief that this lake water has some healing power. The lake, often called a "Fountain of Youth" (5), has functioned as a natural spa since the 1960s. Patrons come to bathe in the lake in hope of health benefits. Most of the patrons walk in the littoral shallow water, while others swim in the deep central part.

The spa is open daily at 9:00 AM and patrons start walking clockwise in the center of the littoral zone along the lake perimeter, mostly where the depth is about 100 to 150 cm. Their speed is about 0.25 m/sec (0.9 km/hour). Walking clockwise is a traditional direction and patrons push themselves forward as they walk. As they do so, they push the water clockwise in front of them and pull water behind them. Water starts flowing in this direction in the littoral zone along the perimeter of the lake. There is no water flow at the bank edge of the littoral zone and there is no flow at the deep edge of the littoral zone. The patrons' energy propels the water and overcomes inertia, viscous drag, turbulence, etc. This is similar to a spoon which spins water in a pot. Up to 150 human "spoons" simultaneously spin the water clockwise in the littoral ring of the lake from 9:00 AM to 5:00 PM. usually midday velocity of the water is about 10 cm/sec. On cloudy or cold days there are fewer patrons in the lake and therefore the velocity is slower.

At 5:00 PM the spa is closed, patrons come out of the lake and in a short time the water flow stops. Sometimes during midday lightning storms the patrons are asked to come out of the water for safety, and in this case the water flow stops too. When patrons are allowed to come back into the water, they restart the spinning of the water.

The whirlpool is directly synchronized with human activity on the lake. However, can patrons walking in the same direction generate enough energy to create a current in the lake water?

4. ESTIMATION OF ENERGY BALANCE

Randomly spaced patrons in the littoral zone walk clockwise with a speed approximately 0.25 m/sec (0.9 km/hour). Patrons propel themselves forward with a force of approximately 10 Newtons (equals to 1 kg force, measured with a digital scale). 100 patrons generate 100 x 10 x 0.25 = 250 watts of power which pushes the water clockwise.

The littoral zone is about 10 meters wide, with zero depth at the bank and 2 meters at the deep end; the cross-section of this triangle is 10 square meters. The average diameter of the littoral ring is 60 m, and the perimeter of the circle is about 180 m. The littoral water volume 180 x 10 = 1,800 cubic meters and the water mass is 1.8×10^6 kg.

The kinetic energy of the water in the littoral zone at 0 .1 m/sec is $\mathbf{mV^2/2} = 1.8 \times 10^6 \times 0.1^2/2 = 9{,}000$ joules (**m** – water mass, **V** - water velocity). It takes only 9000 joules/250 watt = 36 seconds to bring the littoral water to 0.1 m/sec flow at 100% efficiency.

The actual efficiency is much less than 100% and it takes much more than 36 seconds to come to 10 cm/sec water velocity. The 250 watts of power of human propulsion gradually accelerates the water in the littoral area where the patrons walk, and overcomes viscous drag, turbulence, inertia, etc. At some water velocity, the dissipation of energy in the moving water becomes equal to the power applied by the walking patrons, and then the water velocity does not increase any longer. This is the way human "spoons" create a littoral whirlpool in the lake.

Clearly, this is a very rough estimate of the energy balance; it ignores slower velocities at the sides of the water in the littoral ring, viscous drag, turbulence, inertia, etc. Nevertheless, it explains the basics of the human propulsion phenomenon with regard to water flow and demystifies the littoral whirlpool current in the Warm Mineral Springs lake. This is within the frame of regular hydrodynamics, yet it is still such a surprise that "human spoons" walking in the same direction cause the flow of water in a lake. What a simple answer to a half-century-old puzzle!

5. SUMMARY

Walking in the same direction in water seldom happens, and therefore this human "spoon" propulsion is a rare phenomenon that has not been described before. Warm Mineral Springs Lake is a unique place where this phenomenon is easily observed. Does anyone know other such places?

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