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When the Ground Drops
Sinkholes and the Verticality of History

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Abstract Focused on a massive sinkhole in Winter Park, Florida of 1981, the article investigates evolving human environment relationships within Central Florida's karst environments as an interplay of logics and logistics of above *and* below ground. The article argues that these relationships are formed both in acute situations due to the pressures of increasing urbanization and groundwater extraction in the twentieth century and over the course of millennia due to long-term karst formation processes. The piece focuses on the different types of property damage caused by the sinkhole and introduces insurance companies as guardians of above-ground order. It illustrates that, although the sinkhole briefly overpowers the above-ground logic, it ultimately does not distort existing social inequality. Using the sinkhole as an interscalar vehicle, the article shows the intersection of the horizontal and vertical planes and with it the volumetric intersection of place, space, and time.

Keywords History. Verticality. Sinkholes. Florida. Critical zone. Place. Space. Time. Anthropocene.

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> "If a sinkhole forms in the woods, does anyone hear it drop?" (Brinkmann 2013, Preface)

1 Introduction

On the evening of 11 May 1981, Mae Rose Owens had just stepped out of her house into the cool air when she heard a peculiar swishing noise. The African American woman turned around and saw the tall sycamore tree at the end of her plot in the small town of Winter Park, a suburb of less than 25,000 people north of Orlando, Florida, "quivering and shaking as though in the grasp of a giant's unseen hand". Next, she noted a sound as if "a hundred beavers [were] chewing on a log all at once", before the massive tree slipped out of sight beneath the earth's surface. All that was left were "a few stray leaves drifting down in the same direction" (McLeod 1986). Sycamores are a long-lived species, typically surviving at least 200 years and possibly as long as 500-600 years (Keeler 1900, 263-8). This one had only been on Mae Rose Owen's plot for forty years – as long as she had lived in that house – a life cut short within minutes by the appetite of an earthly crater.

The hole in the ground was not done eating – to remain in the multi-species vocabulary of the news at the time. Its savoring of the sycamore tree marked only the beginning of rapidly evolving events over the course of the weekend (Associated Press 1981b). On Saturday at 4:00 a.m., Mae Rose Owens woke to a "cracking of the earth", which indicated the substantial expansion of the crater in the ground. By noon that day, the sinkhole had reached Mrs. Owens' house, which subsequently toppled into the opening, followed by the rear part of a car repair shop and five Porsche cars. "Still hungry", so contemporaries' assessment, the hole next took a big bite out of Winter Park's public swimming pool and large portions of Denning Drive, a four-lane thoroughfare (Carrasco 1982). By Sunday, the diameter of the hole had increased to 107 meters, with a depth of 30 meters (Walker 2024).

Sinkholes are a common geological phenomenon in Central Florida. The region's landscape, shaped by geological legacies from the early Cenozoic era 66 million years ago, features a bedrock of limestone known as the Ocala Uplift. This has created a landscape that on the surface "looks like Swiss Cheese" with numerous groundwater-filled lakes dispersed throughout (Brinkmann 2013, 108). Yet even within the context of a karst landscape, Winter Park's sinkhole exhibited distinctive characteristics that transcended conventional geologic parameters, thereby integrating social, legal, economic, and geological dimensions. At the time, the incident received significant media attention and to this day aerial photographs of

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the hole garner textbooks in geology and physical geography. U.S. property remediation companies utilize Winter Park as sounding base, estimating that the frightening image of a home in a hole helped convince potential customers. Additionally, the Winter Park disaster spurred a plethora of inquiries regarding the state of the underground, thereby giving rise to a robust sinkhole science and law in Florida. Both aided insurers to become guardians of the status quo (Brinkmann 2013, 108, 218).

On a broader level, Winter Park's sinkhole is emblematic of the evolving human-environment relationships in the Anthropocene era, a period characterized by the profound impact of human activities on global ecosystems.[1] Starting in the mid-nineteenth century when large-scale white American settlement began in the former indigenous territory, Florida's existing sinkhole landscape – which had been rather static up to that point – was increasingly encroached upon by residential and agricultural development. In the twentieth century, the world-famous but water-hungry Disney World amusement park added pressure to the karst underground (Brinkmann 2013, 61). As a result, the close habitation between settler people and rock formations along with their competing thirst for water led to conflict and disruption. Due to growing human-engineered pressures from above and below – from urbanization and water extraction – the karst landscape became increasingly volatile and new sinkholes appeared with greater frequency (McLeod 1986). Although Winter Park's sinkhole was the most dramatic in terms of its size and impact, it was only one of thousands that appeared in Florida and around the world in response to human pressure on the underground. It exemplifies what Martin Siegler reading Gavin Bridge characterizes as the *Hohlozän* – the "hole world" formed by centuries of global resource extraction (Siegler 2024, 58; Bridge 2009).

Honoring the tenth anniversary of the Winter Park sinkhole, the *Orlando Sentinel* ran the headline "Time Swallowed Up Sinkhole" (Pankowsky 1991). Ambiguously framed as the headline is, it begs the question: Had time swallowed up the sinkhole, or had the sinkhole swallowed up time? The *Orlando Sentinel* offered no explanation. Yet analyzing the sinkhole's "eating" offers a conceptual entry point for the volumetric intersection of the horizontal and the vertical planes as proposed by this special issue that can be, I argue, particularly fruitful for historians.

In the Western world, history tends to be linear, emphasizing change over time and horizontal logics and logistics (Berber 2019; Barak 2009). In this history, the world is usually rather flat, with

1 Publications on the Anthropocene amass in rapid speed, for a start see Erle 2018; Will 2021; Antweiler 2024; Banjohr 2020; Chakrabarty 2021; Maß 2024.

surface logic trumping subsurface logic. According to Eyal Weizman, it is a world that builds on geopolitical discourse "that tends to look across rather than cut through landscapes" (Weizman 2002). In contrast, a few historians have shifted their focus downward. "Unten ist das neue Oben" (down is the new up; transl. by the Author) historian Sylvia Berger Ziauddin subsumes the scholarly movement that has discovered the underground as the "ultimate resource", adopting a vertical gaze to history that was previously found in political ecology, architecture, culture, literature, and urban studies (Berger 2016).[2] Inspired by Bruno Latour's concept of critical zones as a permeable layer from tree tops to groundwater, this special issue, and this contribution, move beyond the vertical to the volumetric (Latour, Weibel 2020). Winter Park's sinkhole, emerging from combined pressures of urban development, infrastructure, and extracting groundwater reservoirs, demonstrates the movement of matter between above- and below-ground.

Alongside verticality, historians nowadays also struggle with scale and the big picture (Poskett 2024; Coen 2016). In particular, with the rise of global history, historians have continuously expanded the spatial scope of their studies, albeit horizontally. Fascinated by the nineteenth-century expansion of global commerce and communication, historians have documented the importance of steamships, submarine and radio telegraphy, and railroad networks (Müller 2016; Tworek 2018; Wenzlhuemer 2012). Recently, some global historians have turned to big data collection and broad structures and geographies. However, as more histories became global, this invited the methodological critique that people and events were getting lost in more general, macro narratives. How could one ground – 'place' – research that only seemed to scale out and up? (Ghobrial 2019).

Similarly, the growing importance of the Anthropocene as a conceptual framework for the humanities presents a challenge for environmental historians. In addition to global networks of human-made connections and disconnections, historical inquiry is now also influenced by the biosphere, the atmosphere, and the hydrosphere. In response, a kind of writing termed planetary history has emerged that is heavily influenced by Earth System Sciences and large-scale, more-than-human imaginaries. While these studies have demonstrated the material fabrication of a globally interconnected ecosystem, they have not adequately illustrated how this planet emerged through the workings of global capital, international organizations, and other very human activities (Müller, Mueller 2025). Consequently, alternatives such as the Capitalocene, the Wasteocene, or the Chthulucene have

2 Furthermore see Hardenberg, Mahony 2020; Barak 2009; Williams 2008.

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emerged (Moore 2015; Armiero 2021; Harraway 2016). Another key point of critique has been the presumption of the existence of *one* humankind (Yussof 2018). Where, then, should the Anthropocene be placed, and how should difference be accounted for?

In response to the conceptual challenges of studying the big picture, both Global and Environmental historians, such as John Paul Ghobrial and Gabrielle Hecht have interestingly found merit in considering scales. Ghobrial does so in a micro-history of the global, while Hecht emphasizes the interconnection of scales and the importance of inter-scalar work for "locating" the big picture, in her case, the Anthropocene (Ghobrial 2019; Hecht 2018). Combining micro- and macro-scales while navigating between them has also influenced my own thinking (Müller 2024). Focusing on the 1981 sinkhole in Winter Park as an interscalar vehicle, this contribution unpacks the entanglements of different vertical and horizontal scales, ranging from the Cenozoic era to the present and from the locality of Winter Park to Disney World's global tourist infrastructure. This approach offers a conceptual reading of the volumetric intersection of place, space and time. It also enables me to recount a (not 'the' as Hecht notes, Hecht 2018, 112) history of the Anthropocene in which the world is neither geologically flat, nor socially flattened. Ultimately, one big, hungry hole holds "planetary temporality and specific human lives in a single frame" (Hecht 2018, 135).

2 Florida's Porous Underground Archive

Approaching Winter Park's 1981 sinkhole as an interscalar vehicle for the Anthropocene, it is best to start with the hole's habitat: the underground. From a geological perspective, Florida's underground is a porous archive filled with many holes, such as Winter Park's (which turned out to be more than just a hole) (McLeod 1986). It is an archive based on a stone and clay-turned memory of an ocean that existed 66 million of years ago at the onset of the Cenozoic era, our current geological era. The Cenozoic comprises the Pleistocene, the Holocene, and possibly, the Anthropocene. The Cenozoic era is characterized by the dominance of mammals, following the dominance of dinosaurs. It is also the era when large deposits of organic matter were preserved in swamps, laying the foundation for today's petroleum and coal deposits – key resources in the age of humankind (Brinkmann 2013, 19-20, 23).

There are no exploitable petroleum or coal deposits beneath Florida's surface, solely limestone. Limestone is primarily composed of the mineral calcite, which is formed from mud consisting of the remains of small marine life, animal bones, and crustacean exoskeletons. At given temperatures and pressures, the remains

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of these animals and crustaceans help form limestone rock, which also contains fossils of mammals that once lived there, such as giant sloths and saber-toothed tigers. Along the Panhandle and the east coast of Florida, a deep layer of clay covers the limestone, preventing the topsoil from collapsing into pockets in the limestone. However, in the lake region of the Central Highlands, which extends around Winter Park, the clay layer is relatively thin or nonexistent, and the limestone – the Ocala Uplift – is close to the surface. This creates a pronounced karst landscape with lakes, dunes, and primarily underground waterways (Brinkmann 2013, 19-20, 23; Marcus, Caviedes 1983, 3).

More than the earthly memories that fill the limestone rocks, Winter Park's story is about the voids between them – the negative space between the solid rock particles. These voids formed as the line between the surface and the seafloor continuously shifted throughout the Cenozoic era. The carbonate limestone rocks in Central Florida formed in shallow, warm seas. However, the karst processes that created the voids through corrosion only occurred when the rocks were not saturated with seawater. Over thousands of years, Florida's underground archive gradually became "honeycombed with cracks and pockets, some room-sized, caused by water seepage" (McLeod 1986). These voids represent the birthplaces of sinkholes, or dolines as geologists call them.

Sinkholes in Florida are usually between three and nine meters deep, though some reach up to 30 meters (Brinkmann 2013, 24; Marcus, Caviedes 1983, 4-5). Their diameter can range from less than one meter to hundreds of meters **[fig. 1]**. They can be divided into two groups according to how they form. One type forms when the roof of an underground limestone cavity collapses under the weight of the overlying layers. This is called a collapse doline. The other type is formed when the overlying soil layers erode. Slow penetration of the overlying soil into the limestone cavities causes mud-filled holes and leaching phenomena to develop in the overlying rock. Eventually, the overlying rock collapses too (Spear 2001). Before sinkholes enter the human sphere through collapse, they wander sideways and primarily upwards. This process begins when rainwater drains through the soil, dissolving the limestone at a rate measured in millennia. Over time, caverns form in the rock, growing outward at up to five feet every 1,000 years. Then, tunnels emerge and extend upward from the limestone cavern into a thick layer of clay. Over time, these soil pipes work their way upward through as much as 80 feet of clay. Once they break through the clay, only 40 feet of sand blocks a soil pipe from poking its head into the blue sky (Spear 2001).

Experts slowly deciphered the seasonal pattern of sinkhole formation starting in the 1980s. While dolines' underground processes were "unhurried and unpredictable", according to a

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sinkhole expert, the moment when "the earth takes a bite out of its own surface" followed a schedule that aligned with droughts and periods of heavy rain, which was increasingly understood (Spear 2001). Almost half of all sinkholes in the Orlando area occurred in April and May, due to a growing gap between the groundwater and the limestone aquifer below. Normally, the aquifer has enough pressure to support the groundwater table, but in Spring when "the ground [is] tremendously thirsty" from the very little rain that usually falls then, the aquifer pressure is low, and groundwater can flow downward more easily (Spear 2001). The dry ground then triggers sudden collapses, sending dirt, grass, trees and buildings plunging toward huge and deeply buried caverns. Even the moon, experts such as Barry Beck, director of the Sinkhole Research Center at the University of Central Florida, learned, can trigger sinkholes. The earth 'flexes' imperceptibly in response to the moon's gravitational pull, which influences the equilibrium between water and earth. Over time, this can cause enough stress on the fractures to have an effect (McLeod 1986). However, the largest effect on sinkholes is human cohabitation.

Figure 1 Winter Park Florida Sinkhole of 1981. Washington D.C., US Geological Survey, Winterpark. Photo by Anthony S. Navoy. Public domain

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3 Florida the Empty Canvas

Hardly anywhere else in the world exists such a close cohabitation between people and sinkholes as in twentieth-century Central Florida. For nearly 12,000 years, the area of Central Florida had been loosely populated by various Native Peoples, such as the Timucua, Calusa, and the Apalachee. Theirs was a territory marked by three mighty rivers, numerous wetlands and more than 7,800 inland freshwater lakes, by salt marshes and a vast river of grass – the Everglades stretching southward from Central Florida to the end of the peninsula. The indigenous groups primarily lived with the land and its waters. Then came the occupation by different European powers – the Spanish, the French, the British, and the United States. Particularly the latter dramatically reshaped the peninsula in terms of its culture and politics, but also its hydrology and geology (Ste. Clair 2017, 9, 18).

While the Spanish had violently claimed the surface landscape as La Florida in the sixteenth century, large-scale European settlement only started after the Third Seminole War in the latter half of the nineteenth century. In 1821, when Florida became U.S. territory, the non-Native population only stood at 8,000 people. Even with counting slaves, it took Floridians a long time to reach the required 50,000 people to apply for statehood in 1845. Meanwhile, the landscape witnessed a violent emptying of Native settlements whipped out by military violence and European diseases, followed by the massive in-migration of other Native groups pushed south from the Carolinas, Alabama, and Georgia by Euro-American colonizers. These diverse groups of Natives, that also included runaway slaves, formed the Florida Seminoles. Over the course of the early nineteenth century, three violent conflicts erupted between Seminoles and white settlers. In their course many Seminoles were relocated to the American West, while others resisted and fled south into the Everglades. The conflict ended in 1858 without a peace treaty. War weary and facing starvation, most of the remaining Seminole agreed to be moved to 'Indian territory' out West in return for save passage and cash payments; others retreated even deeper into the Everglades (Ste. Clair 2017, 19-20; Coogan 2022, 13; Gannon 2013).

A European settlement called Lake View was established in 1858. It was renamed Osceola in 1870 and rebranded as Winter Park in 1887. Located about 70 kilometers from the Atlantic Ocean and 130 kilometers from the Gulf Coast – former Seminole territory – it drew American colonists and settlers to the region of Central Florida. They came few and slowly. A turning point came in 1880 when the South Florida Railroad Company began laying tracks a few miles west of the settlement. This provided a connection from Osceola both to Orlando to the south, a sprawling urban development dating back to 1838, and

to Sanford to the north, a port city at the intersection of Lake Monroe and the St. John's River. Since its incorporation in 1877, Sanford had developed in a major hub for shipping agricultural products. Importantly, the railroad transported not only goods but also brought wealthy visitors from the northern U.S. to the area. As early as the 1870s, residents from the northern U.S. seeking refuge from the cold winters visited Florida as tourists to enjoy its mild climate and natural beauty (Harvey 2003, 66; Winter Park Founders 2025).

In 1880, the railroad brought Loring Chase to Central Florida from Chicago. He came to the area to recuperate from lung disease and fell in love with the gently-rolling, hilly and lake-dotted landscape just east of the railbed. With another wealthy New Englander, Oliver E. Chapman, he purchased a large plot of land around Osceola and planned a new town there – Winter Park. Over the next four years, the two men designed the town's layout, opened streets, built a town hall and a store, planted orange trees, and required that all buildings meet stylistic and architectural standards. Next, the two self-proclaimed urban planners advertised Winter Park as home to "snowbirds" from the north, looking for a place to hibernate in the winter (Lanier 1875). In 1885, a group of businessmen formed the Winter Park Company. Chase and Chapman sold the town to the new company. On 21 October 1887, Winter Park was officially incorporated as a town and in 1925 reincorporated as a city (City of Winter Park 2025).

From a surface-driven, horizontal history, Winter Park was the State of Florida's first *planned* European city based on exploiting nature as an empty canvas. Chase and Chapman were among the first land developers to capitalize on the region's mild climate and beautiful landscape. Central Florida with its "sunny beaches, blackwater rivers, clear springs, and (to Europeans) unfamiliar flora and fauna", was "sufficiently exotic and romantic" to become a major tourist attraction (Harvey 2003, 66). At the time, they were unaware that sinkholes had made the lake-filled landscape. By the 1920s, over 1.5 million people were visiting Florida annually, and so many of them stayed that the state's population grew four times faster than that of any other state in the United States (Harvey 2003, 66-7). After a slight decline during the Depression, numbers soared again after World War II. Central Florida, especially the area around Orlando where Winter Park is located, witnessed tremendous population growth. Orange County's population grew from 70,074 in 1940 to 263,540 in 1960 and to 471,660 in 1980 (Marcus, Caviedes 1983, 8).

In their development schemes, land developers and the tourist industry touted the climate, recreation, and ambiance, selling a way of life that often included an escape from the modern world. Much of what was built in Florida contained utopian elements and had a fanciful quality to it: Moorish architecture, Venetian pools,

and a town designed to resemble the mythological Greek city of Heliopolis. "Florida was a blank canvas on which anything could be painted" (Harvey 2003, 67). However, each of these designs came with an ecological cost. In 1981, the principles of urban planning that disregarded Florida's geological limitations and catered to human desire and imagination spelled catastrophe in Winter Park.

4 Water Wars between Settlers and Underground

Water is a unique feature of the Florida peninsula. Because of the abundance of water stored in its limestone aquifers, Florida is one of the few subtropical peninsulas that is not a desert (Belleville 1982). Maps from the mid-seventeenth century referred to the Florida peninsula as an island territory. Covered with sinkhole lakes fed by groundwater, crisscrossed by approximately 41,700 kilometers of rivers and marked by a river of grass – the Everglades – Florida represented "a place where land and water interweaves" (Florida Department of Environmental Protection 2018). Yet in response to European visions of land development, many of those islands, lakes, and wetlands disappeared or were transformed by the twentieth century. Instead, water wars had begun between settlers and underground as Florida was increasingly running dry above and below ground (Belleville 1982).

Unlike the indigenous population, the American colonizers viewed the watery terrain as an obstacle to their development plans for Florida's 'empty canvas.' From the second half of the nineteenth century onward, land developers and politicians alike pushed for large-scale amelioration projects and supported plans to reclaim the land by building canals across the peninsula. At the center of their imagination was the wetland landscape south of Orlando where after 1858 the few remaining bands of Seminoles resided, the Everglades. Already in 1881 – when Loring Chase envisioned Winter Park – industrialist Hamilton Disston purchased four million acres of land in the South. He spent more than ten years engaged in land development, canal dredging, and establishing sugar plantations. Ultimately, Disston failed, but this gave the watery landscape, which stretched from Orlando to the southern tip of Florida via the Kissimmee River and Lake Okeechobee overflow, only a short reprieve. Extensive landscape modifications in the twentieth century, such as the construction of the Hoover Dike around Lake Okeechobee and the channelization of the Kissimmee River reduced the Everglades to half their historical size (University of Florida Library 2015; Ritter 2016).

Proponents of amelioration believed that the muck and mud found in the wetlands would make a superior soil for agricultural purposes.

Consequently, with the draining of the land came the in-migration of agriculture and industries, including high water-intensive forms such as sugar farming, cigar manufacturing, phosphate mining, sponge harvesting, and large-scale commercial agriculture which then targeted Florida's groundwater (Museum of Florida History 2025, 8).

The Florida aquifer underlies approximately 100,000 square miles, including all of Florida, southern Georgia, western Alabama, and southern South Carolina. This aquifer is one of the most extensive and widely used sources of groundwater in the United States. Particularly in the winter months, when citrus fruits and vegetables ripened and foliage crops were grown, agriculture and industry consumed excessive amounts of water (Tibbals 1990, E4; Marcus, Caviedes 1983, 8). Urban centers also emerged and drew water. Starting in 1887, the city of Savannah, Georgia, began supplementing its surface water withdrawals from the Savannah River with groundwater from the Florida aquifer. Around 1900, an estimated 200 to 300 wells in southern Georgia pumped water from the groundwater source, too. By 1910, the aquifer system was being pumped along the east and west coasts of Florida. By the 1950s, the Floridan aquifer system supplied all of Orlando's municipal, domestic, and industrial water, as well as about half of its agricultural water. By 1990, more than 3 billion gallons of water were being pumped daily from the aquifer system (Tibbals 1990, E4; US Geological Survey undated; Marella, Berndt 2005; Miller 1986).

As early as the 1960s, scientists began measuring a gradual decline in groundwater levels that they could not attribute to deficient rainfall. Instead, they connected it to an increase in groundwater pumping year after year, which coincided with a surge in population growth, particularly in the Orlando-Winter Park area of Central Florida (Tibbals 1990, E72). A water demand study from the early 1970s also considered population growth. The study calculated that the daily water requirement for every 10,000 new settlers – not including the 35 million annual visitors to Florida – would be 4.9 million liters (Marcus, Caviedes 1983, 8). The study was more than timely.

A new strain on groundwater sources emerged in 1971 with the opening of Disney World, a 11,000-hectare amusement park only 30 kilometers from Winter Park. Searching for an East Coast equivalent to his successful Disneyland amusement park, Walt Disney had settled on Central Florida. The land was inexpensive and abundant, the weather was sunny and stable, and the area was easily accessible by highways. At the time, most Floridian tourists still travelled by car rather than by plane (Mittermeier 2020, 59). Built on drained land with thousands of tons of concrete poured into sinkholes to fill and stabilize the ground, Disney World overwrote the characteristics of Central Florida's karst landscape. Additionally, the amusement park relied heavily on groundwater. Disney World created

an artificial watery landscape with 3,000 kilometers of water pipes, 65,000 sprinklers, an 18-kilometer canal system, 30-kilometer dikes, and 30 automatic sluices. At EPCOT, the Experimental Prototype Community of Tomorrow, there is a 17-hectare lake whose water level is constantly kept at the same level with the help of pumps. From the beginning, Disney's water usage was immense. In response, groundwater levels around the amusement park sank by roughly 2.5 meters between 1968 and 1973. By 1985, the daily water usage was at 37 million liters (Mauch 2022, 178; Marcus, Caviedes 1983, 8).

The massive extraction of water – both above and below ground – has had a significant impact on Florda's karst landscape, accelerating changes at an alarming rate since the 1970s **[fig. 2]**. Key to these changes were the ever-new sinkholes. As early as 1968, geologists Lichtler, Anderson, and Joyer had established a link between droughts and sinkhole formation. On the one hand, declining groundwater levels resulted in the withdrawal of support from the surficial materials overlying and filling cavities in the carbonate aquifer. On the other hand, the excessive pumping out of the aquifer created a suction effect, causing surficial sand and clay to collapse into solution cavities in the underlying carbonate rocks. Both processes contributed to the formation of sinkholes (Lichtler et al. 1968). A 1980 US Geological Survey study of 4,000 sinkholes in Alabama since 1900, found that 3,800 of the sinkholes were triggered by excessive groundwater pumping (US Geological Survey 1980, 128).

Figure 2 Sinkholes in West-Central Florida. Freeze Event of 2010. Washington D.C., US Geological Survey, Dover (FL). Photo by A. Tihansky. Public domain

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Scientists only began researching sinkholes in Florida systematically after the Winter Park incident. Yet, in hindsight, they concluded that Central Florida had it coming. The engineers who examined the sinkhole in Winter Park reported that it had been forming for decades as the overlying sand eroded into subsurface voids. They also stated that the sinkhole's formation was accentuated over the last 50 years due to the steady drawdown of the Floridan aquifer, which shifted from +20 meters in the 1930s to +14 meters in the early 1980s (Jammal 1984, 363-9). Already in 1972, Henry Swanson, an agricultural agent and local expert on Central Florida water had sounded the alarm. He had warned all Orange County mayors that if local governments continued to allow "too much water to be drawn from the ground and to cover the land with buildings and parking lots, they [could] expect sinkholes, especially in the west Winter Park area" (Robison 1987). The months prior to Winter Park's sinkhole incident in 1981, were one of the state's worst droughts in a decade. Normally, the area around Winter Park received an average of 1280 mm of precipitation per year in the 1970s. From January 1980 to April 1981, the sixteen months before the Winter Park sinkhole, there was a precipitation deficit of around 270 mm, with seventy precipitation-free days immediately before the event. The ground was extremely dry, and in response to below-average rainfall and extensive well pumping Florida's aquifer had dropped to a record low of 12,2 meter (40 feet) below normal (Marcus, Caviedes, 1983 5; Kirchheimer 1981; Robison 1987).

5 Earth with an Appetite

"From the sky", Florida's sinkholes look like "huge pockmarks dotting the Florida landscape", wrote Rocky Moretti of the *Tampa Times* in May 1981. Most of the *old* sinkholes are no problem, he continued, "if anything, they make nice fishing ponds or swimming holes". The problem was rather the hundreds and hundreds of *new* sinkholes that occurred annually, reducing property values, damaging structures, and creating headaches for property owners (Moretti 1981). Winter Park's 1981 sinkhole was one of those new sinkholes that from below ground fundamentally impacted Florida's social and economic stratification above ground while triggering people's imaginations. "There is something eerie", wrote *Orlando Sentinel* journalist Michael McLeod, "in the very idea of the earth opening up to gobble great mouthfuls of its own surface". Perhaps, he continued, "sinkclone" should be coined "to suggest the Dante-esque weirdness of the phenomenon" (McLeod 1986).

From the moment it first appeared on 11 May 1981, people began to treat Winter Park's sinkhole as if it were a living creature satiating

its appetite. The growth of the hole was framed as an elaborate meal that began with the sycamore tree as a light appetizer. Mae Rose Owen's three-bedroom home was the first course. The second course was five luxury cars, followed by seven additional trees, a shed, and large sections of the local pool and Denning Drive. While the hole was enjoying a fancy dinner, local authorities could only stand-by and watch natural forces unfold. "We have to let Mother Nature take its course", said Winter Park Fire Captain Gus LaGarde. Hour by hour, the hole expanded a couple of meters here and there, while the authorities remained unsure of its trajectory. "There is a couple good-sized baseball fields nearby", LaGarde said. "We wish it would go in that direction" (Associated Press 1981a). But the anthropomorphized sinkhole was not only "going places", it was also "taking bites" and "gulping down". By Sunday, "the monster [with] a voracious appetite" as the *Associated Press* described it, did not stop eating until it had swallowed an arena the size of a football field (Associated Press 1981c).

The spectacle of the living, monstrous underground – a traditional, historical image of the world below – soon drew hundreds of onlookers to Winter Park. At times, crowds of more than 500 people gathered around the hole; perhaps adding in another stop along their tour to Disney World. Fairbanks Avenue, another road leading past the hole, eventually had to be closed due to the increasing number of rear-end collisions. People were more preoccupied with gawking than driving (Carrasco 1982; Marcus, Caviedes 1983, 2). Entertainment and enterprise soon followed. Some "enterprising spectators" set up a lemonade stand, while others sold T-shirts bearing the slogan "Winter Park Sinkhole" (Associated Press 1981c). As the sinkhole persisted, Winter Park resident Lou Montesi became the "king of souvenirs". For months, he sold Frisbees, sinkhole T-shirts, and sinkhole photographs. On some days he made as much as U.S.$ 900. He even built an observation platform for those wanting to get a better view (Roen 1982; Colarossi 2002). Among them were busloads of geologists who were enthusiastically venturing into the new disciplinary subfield of sinkhole science that emerged in the incident's aftermath. In 1982, the Florida Sinkhole Research Institute was established at the University of Central Florida in Orlando with the aim to create a sinkhole database (Griffin 1987). In the years following, whenever geology conferences were hosted in Orlando, the most consistently sold-out side trip was the bus tour of the Winter Park sinkhole (McLeod 1986).

Jeff Briggs, Winter Park's city planer had sympathy for the crowds: "Where else do you see a house swallowed up" or "Porsches in a Sinkhole?" **[fig. 3]**. Public curiosity about the sinkhole was not about fatalities – anyways a rarity when it came to sinkholes in Florida. At the time, the only confirmed account of a sinkhole causing a fatality

in Florida dated back to 1959, when a man drilling for water was buried in a sinkhole collapse. A nearby geologist was buried up to his neck but managed to escape uninjured (McLeod 1986). People's guilty pleasure was their focus on property damage. However, as Mae Rose Owens house sat next to German luxury cars, it showed how the sinkhole took no note of social difference and how people had different resources to deal with the catastrophe.

The part of Winter Park where the sinkhole collapsed, about a mile southwest of downtown, symbolized America's ambivalence towards its cities. Though generally a low-income area, it was marked by stand-alone family homes and vast green spaces. Fairbanks Avenue, the town's main thoroughfare was a busy shopping street; Denning Drive was an important access road leading, among other places, to Disney World (Marcus, Caviedes 1983, 8; UPU 1981). And yet, the small 3-bedroom home of Mae Rose Owens stood next to a car dealership that sold high-end Porsches manufactured in Germany. When both the African American woman's home and five Porsches toppled into the hole, a discussion erupted over what to save.

Figure 3 Navoy, A.S. Winter Park Florida Sinkhole of 1981. Image 5 out of 15. 1981. Washington D.C., US Geological Survey, Winterpark. Public Domain

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Real estate agent Bob Govern was home when he received the message that his US$ 40,000 Porsche sports car, which had been at the dealership for repairs, had toppled into an earthly crater. Together with two other Porsche owners, Govern considered a helicopter rescue of the cars, which, at the time, were still upright and virtually intact, hanging in there about 15 meters (50 feet) down the side of the sinkhole. Initially, city officials vetoed the idea due to the danger of further cave-ins (Associated Press 1981c). The following Monday, county officials similarly rejected Govern's second idea to lift the car out with a crane. On Thursday, finally, they approved the mission after the Reliance Insurance Company of Orlando, the car's insurer, pledged a US $5 million liability policy to cover possible damages for city and county governments (Kilsheimer, Carrasco 1981).

On the day of the luxury car rescue, about 100 people from Winter Park attended a meeting with geologists and city and county officials to learn more about sinkholes in general and the current situation. Mae Rose Owen was the focus of attention. She had lost everything to the sinkhole, from pictures of her five children and antique furniture that her mother had given her to a small box containing about US $100 that she had won on a trip to Las Vegas and had planned to give to her grandchildren (McLeod 1986). However, the *Orlando Sentinel* portrayed her as a stoic woman who did not understand what a geotechnical engineer said about how sinkholes are formed, nor why homeowners who lived at the edge of the sinkhole "had to pay to stabilize the slope to prevent further erosion". She seemed like the perfect victim in a narrative that saw the sinkhole as cause of the catastrophe, but not urbanization or water extraction. Ultimately, the news outlet quoted Owen as saying, "I don't think it's fair, but someone has to bear the brunt" (Kilsheimer, Carrasco 1981).

The trouble was that 'someone' was an African American woman at the lower end of the social and economic strata in an otherwise wealthy state of the US, or in other words: Mae Rose Owen. Since the properties at the edges of the sinkhole were private, the city of Winter Park was prohibited by law from spending public money on them (Kilsheimer, Carrasco 1987). As with the Porsche rescue mission, insurance institutions played a significant role also in the story of Mae Rose Owen's home. Yet, while the Porsche insurance company put down US$ 5 million to cover potential damage from the rescue mission for the luxury cars, Mae Rose Owen did not come out on top. Her insurance covered the loss of her home, but not her property. Taking note of the inequality and injustice wound up in the sinkhole case, associates of Winter Park sinkhole expert Jim Jammal ultimately raised money to buy Owen a plot of land on which to rebuild her home (Griffin 1987).

6 Conclusion

It took several weeks for the sinkhole in Winter Park to stabilize after it formed. Initially, a great deal of debris was sucked into the subsurface, including Mae Rose Owen's house and large sections of the city pool, but not the cars, which had escaped a similar fate through a spectacular rescue mission. Eventually, the sinkhole naturally plugged and filled with water. However, before the residents of Winter Park could relax, the sinkhole suddenly drained twice, indicating that the plug had been breached, and that water could flow freely into the subsurface aquifer again. Months passed before the sinkhole plugged permanently and its hydrology stabilized. The ground had finished its destruction, and Winter Park residents could again relate to the seemingly unchanging natural environment based on a stable underground (Jammal, Associates 1982).

Over the course of the following years, the city redeveloped the urban landscape, stabilizing the edges near businesses and converting the former pool into a ball field. The sinkhole was renamed Lake Rose in honor of the woman whose home the earth had swallowed (Brinkmann 2013, 108). Still, little active memory culture remained; perhaps also because there exist just too many sinkholes in Florida. Funding for the Florida Sinkhole Research Institute founded in 1982 was discontinued in the late 1990s, and its sinkhole database was transferred to the Florida Geological Survey (Griffin 1987). Today, residents view Winter Park's sinkhole as an urban recreational lake rather than a local catastrophe, which begs the question: "If a sinkhole forms in the woods, does anyone hear it drop?" (Brinkmann 2013, preface).

Ultimately, Winter Park's 1981 sinkhole is emblematic of the evolving relationship between humans and the environment in the Anthropocene era with all its difference and necessary differentiation. The sinkhole was a key turning point in the live of some and, with the help of the right insurance, solely a drop in the ocean of history in others. Although the forces of the sinkhole from below ground overpowered the logic from above ground in one bold strike, they ultimately did not distort social inequality. Additionally, Winter Park's sinkhole symbolizes the human tendency to avoid close examination, even when standing on shaky ground. Although the sinkhole gave rise to sinkhole science and underground studies, the results did not lead to changes in urbanization patterns or groundwater extraction. Instead, insurance companies became the primary employers of

geologists and their sinkhole data as people seek to maintain the established order above ground through insurance.[3]

Such refusal to respond to the necessary and unchangeable exchanges of flows between above and below ground in a karst landscape represents as much an ecological, economic, and political problem as a conceptual and historical one. It demonstrates the persistence of what Eyal Weizman has called a geopolitical discourse "that tends to look across rather than cut through landscapes" (Weizman 2002). The volumetric perspective as proposed in this special issue, and in this contribution, offers a way to reframe this discourse and to show the strong entanglements of above and below ground logics and logistics.

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3 However, the role of insurance as an institution that enforces the established above-ground logic of property law was challenged early in the new millennium. In the early 2000s, Florida's insurance policies offered generous sinkhole coverage. Even minor issues, such as small cracks in driveways or walls, were paid for. This invited unscrupulous individuals to file sinkhole claims for cosmetic damage that was often unrelated to actual sinkhole activity. This created a snowball effect, with insurance companies increasing inspections while fraudulent claims continued. Both eventually led to premiums spiking for everyone and the housing market going into a sinkhole panic. By 2011, lawmakers passed stricter regulations to curb the panic ("Sinkhole Frenzy: How Florida's Real Estate Was Rocked in the 2000s", article available at `https://graystoneig.com/articles/sinkhole-frenzy-how-floridas-real-estate-was-rocked-in-the-2000s`).

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