Lubricating Water Metabolism: How Mountain Offerings Contribute to Water Sustainability in the Peruvian Andes

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**ABSTRACT** This article examines how water's transformative quality shapes Andean offering rituals and how these in turn perform the hydrological cycle as a metabolic process that involves humans as well as superhuman beings. It enquires into the offering practices of an Andean community providing an ethnographic account of its water management and the tributes it pays to the mountain and the springs that supply it with water. Building on the concept of water metabolism, the article interrogates the offerings as a replica of the metabolic process that produces water. The argument is that by triggering a “change of matter” of the offering items the ritual transforms these into a gift to the deities that control the water. Moreover, invoking Roy Rappaport's study of rituals as regulators of humans' interaction with the environment, the article suggests that by enacting water metabolism, Andean offerings not only lubricate the hydrological cycle, but they also offer Andean people a window on their own agency and its bearings for their water resources. Reviewing the recent development in a neighbouring settlement and ongoing changes in the community's own water supply, the article concludes that the holistic calibration of the hydrological cycle as a metabolic process which engages both humans and non-humans makes Andean offerings emblematic of the effort to achieve water sustainability anywhere and therefore resilient to change.

**Keywords:** water, mountain offerings, Andes, Peru, metabolism, sustainability, hydrological cycle

**Introduction**

In chemical terms, ice, water, and vapour are the same substance. Nonetheless, their different appearances make us perceive them as distinct elements. In the liquid form, water is subject to the law of gravity that makes it flow downhill wherever it exists. In effect, water is untamable unless it is exposed to heat, which transforms it into vapour and makes it disappear in the air. Ice (and snow) on the other hand, is water in a solid state that has texture and appears both fixed and stable, that is, until it melts and becomes water or vapour. Ice's stability, however, varies in different parts of the world depending on the latitude and the temperature. In the Arctic, ice is permanent and covers both the land and the sea most of the year. By contrast, in the tropics ice is a rare phenomenon only found at high altitudes and out of human reach, which lends it an image of not just aesthetic beauty but also infinity and mystery. The appearance of ice (and snow) as a substance that is inaccessible and that belongs to another physical realm makes it a compelling motive for cultural creativity and religious adoration (Gagné et al. 2014). The imaginary power of ice is particularly salient when it appears in the form of glaciers which are huge mobile ice formations that grow on the top and melt in the bottom at one and the same time and that constitute the source of some of the world's biggest
rivers and vital deposits of freshwater in regions suffering from irregular precipitation and water scarcity (Orlove et al. 2008). Not surprisingly, the capacity to reproduce themselves while yielding a constant flow of clean water makes glaciers the object of not only political craftsmanship and social empowerment but also cosmological ingenuity and ritual activity, which the Andes is evidence of (Bolin 2009; Paerregaard 2018a).

Aim and Scope

The article discusses how anthropology contributes to the understanding of water’s materiality and its capacity to change physical appearance and chemical composition. The aim is to inquire into the cultural ideas that water’s transformative quality gives rise to and the ritual practices which humans create in their effort to control its circulation, domesticate its physical power, and contain its flow. The article speaks to the growing number of anthropologists who are focusing on water as the topic of their research (Ballestero 2019; Hastrup and Hastrup 2015; Orlove and Caton 2010; Strang 2015). Departing from Strang’s proposition that to study human/material relations we must examine how “the formal qualities and characteristics of the object – whatever it is …” shape people’s construction of meaning (Strang 2005: 97) it pays special attention to her suggestion that “the importance of the characteristics of material things are particularly evident in relation to water” (Strang 2009: 30). The article takes up this proposal by exploring on the one hand, how water’s materiality shapes the way Andean people represent it symbolically and on the other, how the idea of water as metabolic product fashions the offerings they make to the superhuman forces that control the water flow as per their beliefs. More specifically, it investigates offerings as a replica of the metabolic process by which material objects change chemical composition and physical form and as a result, produce water, energy, and life. The argument is that by studying the burning, consumption, and disposal of offering items as a representation of the hydrological cycle we get a better understanding of not only how the Andean people construe water metabolism but also how their offerings contribute to a sustainable use of water (Paerregaard 2020a; Strang 2016).

The article builds on the notion of water metabolism which is centered on water’s role in the biophysical changes that humans’ interaction with their natural environment entails. Borrowing from Roy Rappaport’s study of rituals as a tool to regulate humans’ interaction with the environment, it suggests that offerings play an essential role in Andean water management and the creation of symbiotic human-environment relation. My claim finds support in ethnographic studies that document how Andean communities use the mountains’ meltwater for irrigation (Gelles 2000; Guillet 1992; Travick 2003) and how water users conduct offerings to the mountain deities to ensure a smooth flow of water (Paerregaard 2013b; 2013c; Stensrud 2016a). The general message of this scholarship is that Andean people view offerings to these non-human forces as critical to ensure a stable and abundant water flow (Brandshaug 2019; Paerregaard 2019). Hence, the questions guiding my research are: How, where, and when are the offerings performed and to whom are they addressed? What is the physical nature of the items that are offered and how are they transformed into an offering gift? How do the offerings shape Andean people’s interaction with the water, the environment, and the non-human forces that control the water flow according to them? And finally, how do changes in the water supply affect the offerings and how do Andean people recalibrate these to adapt to the changing world?
The article reviews data from fieldwork in Tapay, an Andean community where I have worked in the past 35 years. The field material includes official census material; surveys on landholdings, crops, irrigation, livestock, and commerce; formal and informal interviews on agricultural practices, household activities, inter-household cooperation, water governance, and community organisation; and participatory observation in key events related to agriculture, irrigation, and offerings. Long-term fieldwork has provided me with detailed insights into Tapay's development in the past decades and allowed me to observe ongoing changes in not only agriculture and irrigation but also ritual practice and the cosmology. My data are particularly useful to document the offering's resilience to changes in Tapay's water supply and the water stress that climate change causes. While the ethnographic description of the offering's annual calendar, ritual performance, and material ingredients draws on my first fieldwork in 1986, the discussion of how the villagers have changed perception of its meaning and importance for Tapay's water metabolism reviews data from visits and stays in the community in 1990s, 2000s and 2010s.

The article is divided into five sections. In the first, I develop the article's conceptual framework. Inspired by critical debates of the notion of the hydrological cycle, I introduce the concept of water metabolism to examine the cultural import of Andean water offerings. I also borrow from Roy Rappaport's classical work on Kaiko, which I suggest is helpful to inspect the human-nature relation underpinning the offering ritual. In the second section, I introduce Tapay's community organisation and water management and in the third section I ethnographically scrutinise how the villagers conduct the offering ritual. In the fourth section, I review the analytical implications of my data with special attention to the offerings' role as regulator of Tapay's water use. I also discuss recent developments in Tapay and its neighbouring community which shed light on the offering ritual's more universal aspects and its resilience to change. In the fifth and final section, I conclude by returning to the article's opening questions and reflect on the relevance of metabolism to apprehend offerings' bearings for water sustainability.

Water Metabolism

A widely held doctrine among physical geographers and other scientists studying water is that the world’s water supply and water's movement on, below and above the surface of the Earth follow the so-called the hydrological cycle. Implicit in this model of how water circulates, its volume remains constant even though the water takes different forms (ice, fresh water, saline water, and atmospheric water) according to climatic variables. Influenced by political ecology and other theoretical trends within geography, environmental social studies, and cognate disciplines, water scholars have recently questioned the hydrological cycle as a neutral scientific concept arguing that it is a social construct that has emerged in a specific historical context and in response to economic and political needs. Drawing our attention to the relationship between water and society and the way socio-economic and political forces modify the hydrological cycle, the scholars argue that this must be understood as more than a mere natural process. To capture this hybrid of natural and social forces, Linton and Budds introduce the concept of the hydrosocial cycle which they define as “a socio-natural process by which water and society make and remake each other over space and time” (Linton and Budds 2014: 170). As Boelens puts it, “hydrosocial cycles are
simultaneously natural and social constructs – as chains of human and non-human elements constructed by the human mind and by human interventions” (Boelens 2014: 245). Rather than viewing water as a mere chemical matter, we must ask how this substance is embedded in “an assemblage of historical, hydrological, political and technological circumstances that produce a given instance of water” (Linton and Budds 2014: 2017).

To unpack this assemblage of hydrological, social, and technological circumstances another group of water scholars suggests that we view the hydrologic cycle as a metabolic process produced of not only physical changes and chemical reactions, as modern science claims, but also the social and political relations that manipulate the natural water flow and make water accessible as a resource for human use (Paerregaard et al. 2016, 2020). Unlike the term metabolic water which refers to water created inside a living organism through its metabolism, water metabolism stands for the entire process through which water is made and remade both as a natural substance (from liquid to ice and vapor and back again) and as an object of human control (from appropriation to transportation, allocation, consumption, eventually, disposal). The concept has been conceived by the same critical thinking as the hydrosocial cycle: that society shapes and is shaped by water, materially as well as discursively, and that water flows are embedded in all institutional and political processes that both coexist with them and affect them (Swyngedouw 2009). However, water metabolism adds analytical value to the notion of the hydrosocial cycle by highlighting the social practices humans engage in and the relations they create with their biophysical surroundings when appropriating water and transforming it into H₂O. As Beltrán and Velásquez (2017) point out, rather than understand water as a mere resource flow, as a factor of production only disaggregated from its environmental, institutional, technological, and social context, it should be viewed as an integral element of a metabolic process organised around humans’ appropriation and exploitation of nature.

Water metabolism taps into the notion of social metabolism (González de Molina and Toledo 2014; Madrid-López and Giampietro 2015) which has a long history in social theory going back to Karl Marx (Martínez-Alier 2004; Pauliuk and Hertwich 2015). As a politically engaged intellectual, Marx pointedly drew the attention to social inequality and environmental pollution, which he claimed was caused by capitalist production. Just as the workers live under the yoke of economic profit, so has nature become the slave of humans, he contended. In his praxis theory, Marx fleshed out the inconsistencies of capitalist production reminding us that nature and society are inextricably linked together and that human beings, like society, are an integral, yet particular and radically distinct, part of nature (Swyngedouw 2006: 108). Employing the notion of metabolism, he scrutinised nature as the material in which human labour realises itself. Marx’s understanding of metabolism was closely linked to the term’s German meaning, “change of matter” (stoffwechsel), which implies a continuous process of transforming and re-assembling of material elements (Swyngedouw 2006: 108). Thus, in Marx’s view, through the mediation of labour, society emerges from nature, resulting in the production of a ‘second nature’, that is the re-assemblage of human-material objects resulting from human labour. Marx’s definition of the nature-society nexus as a metabolic relation led him to assert that “the workers can create nothing without nature, without the sensuous external world” (Marx 1992: 325) and to conclude that “Nature is man’s inorganic body, that is to say nature in so far as it is not the human body” (Marx 1992: 328). As labourers, then, humans can only bring the wrongdoings of capitalism and their own self-alienation to a stop by engaging with the second nature as their external body.
Marx’s writings have gained renewed interest in a time of global climate change that is transforming the planet into an anthropogenic world and that lends humans a feeling of double alienation: first their separation from the ‘first nature’ they ruthlessly have exploited and then their separation from their self-produced, unrecognizable ‘second nature’ that now is turning against them (Escobar 1999). Marx’s concepts of metabolism and alienation have particular bearings for anthropologists because they help us understand the human-nature nexus. But even though Marx’s theory continues to inspire modern anthropologists, anthropology also challenges it by showing that humans’ engagement with nature covers a complex relationship that historicizes the landscape and extracts specific places out of undifferentiated space. Moreover, in many places nature constitutes not only the ‘sensuous external world’ and ‘inorganic body’ of their members in their daily struggle to satisfy the physical needs but the central point of reference of their worldview providing humans with a sense of place and locality and a feeling of belonging. To anthropology, therefore, Marx’s metabolism refers to a biological and socio-political as well as a cosmological and metaphorical relation of exchange; similarly, his concept of alienation can be read as at once a critique of capitalism and modern consumer society and a lens to explore humans’ relation to nature and their position in the physical environment more broadly.

In fact, Marx’s use of metabolism to problematise capitalism’s exploitation of nature resonates with anthropology’s tradition of studying environment-society-culture dynamics. In the history of environmental anthropology one work stands out as particularly relevant to modern anthropologists: Roy Rappaport’s ethnographic account of the Kaiko ritual and its role in regulating both intra-human and extra-human relations among the Maring people of New Guinea (Rappaport 1968). Borrowing from systems theory, cybernetics, and nutritional science Rappaport showed how Kaiko and the slaughtering of pigs it involved marked both the time of warfare with neighbouring groups and a shift in horticultural production, which is essential for the management of the ecosystem. His argument that Kaiko enabled Guinea people to restore the human-pig ration and create environmental sustainability was groundbreaking at his time insofar as it demonstrated that culture plays an active role in managing humans’ interaction with their physical surroundings. And even though Rappaport’s study was constrained by his view of culture as a self-producing and self-contained system, it deserves renewed attention because it exemplifies how anthropology can contribute to ongoing debates on human/non-human relations at a moment of global climate change. Paradoxically, at a later stage in his writings Rappaport’s functionalistic understanding of culture and reductive notion of human agency led him to a fatalistic view of cultural adaptation which he argued could result in ‘maladaptation’ and a breakdown of the ecosystem. Similar to Marx who coined the term ‘metabolic rift’ to draw attention to humans’ overexploitation of the soil and the commercial use of non-human manure to meet the growing demand for food products, Rappaport thus anticipated the possibility of an ecological crisis even though he had no way of predicting the scope of climatic and environmental problems humans would face 50 years after his writing.

But how can Marx’s and Rappaport’s ideas of metabolism and ritual adaptation help us understand the meaning of Andean offerings and their impact on the water supply and the environment in the Andes? To answer this question, I move to Peru and offer an ethnographic account of water management, ritual practice, and environmental change in the community of Tapay.
Water Management in Tapay

Tapay is a rural community located in the Colca valley of Peru’s southern highland (Fig. 1). Unlike the populations of other Colca communities that are concentrated in one major settlement and a few smaller hamlets, the villagers of Tapay live scattered in a number of settlements. The bulk of the population is spread in nine hamlets located below 4,000 m. called Tapay (the community’s administrative center), Puquio, Chuccho, Cosñihuar, Malata, Paclla, Llatica, Fure, and Tocallo while a small group of people live in dispersed clusters of houses on the puna – tundra-like short-grassland above 4,000 m. At a community level, the population is divided into moieties: Hanansaya that apart from the main settlement comprises three settlements and the puna-population and Urinsaya that includes the rest of the settlements. In the valley the principal livelihood is agriculture that yields corn, potatoes, beans, and other crops and that provides the villagers with their basic foodstuff and fruit cultivation (apples, pears, peaches, figs, etc.) which they exchange for other produces and items on the regional barter market (Paerregaard 1992). Another important product is cochineal, a louse that lives on a cactus known by the same name and that when dried is used as dye in cosmetics and food. The global demand for natural dye has several times lead to a boom in the trade of cochineal in Peru providing the villagers with a substantial cash income (Paerregard 1997). On the puna, the herders raise llamas, alpacas and, to a smaller extent, cattle and make a living selling fresh and dried meet or exchanging it for other products. Today, most villagers acquire their food or other basic items in the shops of the neighbouring community of Cabanaconde and the provincial capital of Chivay rather than on the bartering market. Yet even though almost all the villagers are linked to the national economy, many still prefer to exchange services and products with other villagers without the use of money.

Fig. 1. The community of Tapay. Photo: Karsten Paerregaard in 2011.
Except from cochineal, all crops and fruits in Tapay depend on irrigation. In most Colca communities this is supplied by a few main water sources – rivers, streams, canals or water springs. Tapay’s water supply, by reverse, comprises 53 water sources of which 21 are puquios (springs) and 32 are tomas (offtakes) from six rivers and streams that carry the melted ice and snow from the surrounding mountain peaks to the Colca river (Paerregaard 1994). A total of 21 reservoirs in the community’s many settlements allow the water users to store the melt water over night. The dispersed nature of Tapay’s water supply is reflected in the organisation of the community’s irrigation system which is divided into clusters delimited by the rivers, offtakes, or springs that supply them with water as well as the reservoirs that store this and the canals that lead it to the fields (Guillet 1992). To maintain the water infrastructure and to manage the water, the users are organised in two ways: irrigation committees that are recognised by Peru’s Ministry of Agriculture and water groups that are informal, autonomous associations.

Tapay has four water committees which are in charge of managing the water that comes from the community’s three principal rivers (Seprigina, Molloco, and Tampoña) and its biggest spring (Oqta). They also operate and maintain the reservoirs and the canals. Tapay’s informal user groups, on the other hand, manage the rest of the community’s many water springs. Each committee or water group appoints two regidores (Spanish: water allocators): a hatun regidor (big water allocated), who allocates water during the dry season from July and December, and a huch’uy regidor (little water allocator), who allocates water during the wet season from January to April. Hatun regidor is one of the most demanding public offices in Tapay. It is a mandatory duty that goes on turn among the water users and shunning it may lead to the loss of one’s water right. The regidor’s responsibility comprises two tasks. The first task is to lead the water through the irrigation cluster by opening and closing the offtakes, reservoirs, and canals (Fig. 2). Water allocators may employ two methods to direct water to the fields. One is corte which means allocating uphill from the lowest to the highest located fields. The other is brinco which implies that the individual water users call on the regidor to allocate water to all his/her fields in a single round. The second task is to allocate water to the individual water user, which the regidor does by blocking the water flow in the canal and digging a hole in the canal called boquerón (big mouth) to direct the water into his or her field. Once the water enters the field it is the owner’s own responsibility to irrigate it.

To ensure an efficient and fair water management the irrigation committee (or the water group) oversees the regidor’s work, deals with cases of water thefts, and resolves water disputes that mostly occur because the users arrive late to their turn to receive water. During the months of irrigation, the water users’ major challenge is the timing of their presence.

![Fig. 2. A regidor allocating water in Tapay. Photo: Karsten Paerregaard in 2011.](image)
at their fields to receive water. Many villagers report that they often spend hours waiting to irrigate because others arrive late and therefore hold up the regidor. To prevent such delays, rules concerning water distribution are strict. Water users who are absent when the regidor appears may miss their turn. Depending on the crop and the irrigation cluster, such a sanction can have serious consequences as it implies to wait for the next irrigation round. To save themselves the trouble of hurrying between different irrigation clusters and, even worse, running the risk of missing one of the irrigation rounds and thus endanger the crop, some water users offer the water allocators cash to irrigate their fields. And as it has become increasingly common that regidores outsource their work by contracting villagers in need of money to do it, such offers are often accepted.

Replicating Metabolism

Shunning the job of allocating water does not relieve the regidor from other duties. At the end of his/her term, the regidor is expected to arrange the yarqa aspiy (ditch cleaning), a mandatory workday when the water users come together to clean the canals and the reservoirs and to celebrate the outgoing water allocator (Fig. 3). It is the regidor’s obligation to provide the participants with food and drinks and hire a band to entertain them while they work (Fig. 4). Another duty associated with the office as regidor is to organise an annual offering called pago or t’inka to the spring, the offtake or the reservoir that supplies the irrigation cluster with water. The ritual derives from a cosmology that connects the water flow to not only the sea and the hydrological cycle that transforms salt water to freshwater and vice versa but also to superhuman forces that are believed to control Tapay’s water supply and that demand offering gifts to release it (Paerregaard 2013c). An example of such superhuman beings are the apus who are deities living in the mountains and who are believed to possess the power to regulate their flow of meltwater; the other are the gentiles who are Andean peoples’ mythical ancestors from pre-Inca times who resurrect as skeletons and

Fig. 3. Water users participating in Tapay’s yarqa aspiy. Photo: Karsten Paerregaard in 1986.

Fig. 4. A regidor celebrating the end of his term at Tapay’s yarqa aspiy. Photo: Karsten Paerregaard in 1986.
human bones and hide behind rocks and sacred graves. Many believe that *gentiles* control Tapay’s many springs and that they release the water by urinating. Both *apus* and *gentiles* are feared because of their power to cause harm and punish humans who fail to reciprocate their favours among which the most important is to release water.

All of Tapay’s water allocators are expected to organise offerings to the springs, offtakes, and reservoirs that feed their irrigation cluster. The *regidor* of the community’s main settlement, however, has a special responsibility. On November 1, s/he is expected to arrange Tapay’s most important offering ritual at Mount Seprigina (5,400 m), its highest mountain considered to be the source of all other water sources in the community (Fig. 5). In the following segment, I discuss two important and interrelated aspects of the *pago* which illustrate how this presents the hydrological cycle as a metabolic relation between humans and deities. One aspect is the *pago’s* temporal and spacial organisation; the other aspect is the materiality of the offering items.

The many offerings to Tapay’s water sources follow a ritual calendar that starts on June 24, in the settlement of Chuccho at 2,300 m. and ends on November 1, on Mt. Seprigina. The offering calendar looks as following:

* June 24: First offering to springs of the hamlets of Pallajua and Huilcasco in Chuccho, Hanansay.
* July 29: First offering to offtakes in the main hamlet of Tapay, Hanansaya.
* August 5: First offering to springs in Puquio, Hanansaya.
* August 8: First offering to springs in Urunja, in the main settlement of Tapay, Hanansaya.
* August 24: First offering to springs and offtakes in Cosñihua and Malata, Urinsaya.
* August 30: First offering to offtakes in Fure, Urinsaya.
* September 8: Second offering to springs in Puquio and Chuccho, Pallajua, Urunja and Huilcasco, Hanansaya.
* September 10: First offering to offtakes in Llatica, Urinsaya.
* September 20: First offering to offtakes in Tocallo, Hanansaya.
* October 4: Second offering to offtakes in the main settlement of Tapay, Hanansaya.
* November 1: Second offering to springs in Cosñihua and Malata, Urinsaya, and third offering to Mt. Seprigina that supplies water to offtakes in the central settlement, the two settlements in Urinsaya and all springs in Hanansaya.

In the calendar a number of offerings in Tapay’s moieties coincide when repeated either for the second or third time. Time and place vary for all first offerings, while the second
offerings partially coincide in time even though they take place at the same locations as the first. In the third offering, place and time merge in a single event: November 1 on Mt. Seprigina considered the most important of \textit{pago} of the year when the water users act as one community paying respect to a single power believed to control Tapay's many water sources. The model shown below (Fig. 6) illustrates the \textit{pagos}' merge of place and time. It reveals that even though Tapay’s irrigation system is geographically fragmented and managed locally by the community’s many water user groups, these vision their water sources as interconnected and controlled by a single power. While the water users make \textit{pagos} to the springs, offtakes, and reservoirs that supply their irrigation clusters independent of each other, their offerings gradually overlap as these move up the mountain and approach November 1, when all water users join the last \textit{pago} of the year to Mt. Seprigina. The model suggests that the water users not only believe their water sources are controlled by the same power but they also imagine the water flow that links these to the mountain as a hydrological cycle which constantly renews Tapay’s water supply. This is a notion that resonates with a more general Andean perception of the world as floating on a great sea which connects the freshwater of rivers, springs, and lakes with the saltwater of the oceans (Bastien 1985; Urton 1981). However, unlike the hydrological cycle which modern science claims constitutes a self-contained water flow, the Andean hydrological cycle is driven by a metabolic process which is controlled by the mountain deities and other spiritual powers and which humans mediate by making offerings. But how exactly do humans do this?

To arrange the \textit{pago} the \textit{regidor} contracts a \textit{paqu}, an offering specialist who knows to prepare and conduct the offering and who is accompanied by an assistant. The \textit{pago} consists of a collection of elements called \textit{iranta}: seeds and leaves of the coca plant, \textit{konuqa} (a herb from the \textit{puna}), \textit{qorilibro} and \textit{qolqelibro} (small objects of gold and silver), an alpaca foetus and \textit{pichuhuira} (fat from the breast of llama), maize of three different colours, \textit{qochayuyo} (seaweed) and starfish. Some of the objects are burnt at the spring, the offtake, the reservoir or at the foot of Mt. Seprigina. Additionally, several items are consumed during the offerings,
for instance *agua* (beer prepared as a thick brew of corn of three different colours), wine, and seawater. Three of the *iranta’s* components – seaweed, starfish, and seawater – have a common origin, which underpins the idea that Tapays’ water supply is connected to the ocean and that saltwater and freshwater flow in the same hydrological cycle. Other items represent the Andean plant (coca seeds and leaves, and *konuqa*), metal (gold and silver) and animal (alpaca foetus and llama fat) which associate the *pago* with the some of the most appreciated elements in Tapay’s physical surroundings. Lastly, the *iranta* includes *agua* that plays a central role in its Andean ceremonial activities and wine, a drink of spiritual importance in its Catholic traditions.

As an assemblance of the key elements of Tapay’s material environment (on as well as under the ground) and ceremonial/spiritual universe (Andean as well as Catholic) the *iranta* embodies the world which Andean people inhabit, and which encircle their water supply. And by putting fire to the *iranta*, sprinkling seawater and other liquids, chewing coca leaves, drinking spirits and corn beer, and smoking cigarettes the ritual’s participants set in motion a ’change of matter’ of not only the offering items’ physical form and chemical composition, as these are burned, consumed, and disposed but also of their symbolic value as their material transformation recalibrates them as offering gifts (Fig. 7). Even though the mountains’ melt water is not itself metabolised in the ritual, the offering items include liquids – spirits and different classes of corn beer – that also undergo a ’change of matter’, as they are consumed by the participants and become bodily liquids; or as they are poured in honour of the deity, they are dropped to the ground, or left (in bottles or other containers) at the offering site where they eventually dissolve and are absorbed by other materials. Whether liquid or solid the offering items are critical to the metabolic process as it is their ’change of matter’ that produces the gift, an idea that also imbues other Andean rituals such as offerings to *Pachamama* (Mother Earth) to yield a good harvest or *gentiles* to cure people who fall ill.
The organisation of Tapay’s *pagos* as not only a temporal sequence of offerings starting on June 24 and ending on November 1, but also a geographical hierarchy of offerings starting at the bottom and ending on the top of Mt. Seprigina shows that, in the eyes of the water users, Tapay’s springs, rivers, offtakes, canals, and reservoirs constitute one cohesive water body. Moreover, the *iranta*’s assemblage of key elements from the physical and metaphysical world that encircles Tapay’s water flow indicates that this body is conceived as an integral part of the hydrological cycle. Lastly, the *pago*’s performance and the destruction, consumption, or disposal of the *iranta* it involves, suggest that the offering is imagined as a metabolic transformation of the offering items’ chemical composition and physical structure into a gift. Thus, the offering is not completed before corn, plants, seeds, leaves, fat, foetus, fish, weed, and metal pieces have burnt and turned into smoke; the seawater, the *aqura* and the wine have been dropped to the ground and absorbed by the earth; and the spirits have been drunk or spat into the air. Only by transforming the *iranta* into air, dirt or body liquid has the offering accomplished its goal which is to deliver the gift the deities require to release the water.

**Metabolic Challenges**

In contrast to the classical literature on sacrifices that highlights on their symbolic aspects and argue that they serve as a means to communicate with the sacred (Hubert and Mauss 1964), I have centered my analysis of Andean offerings on their materiality suggesting that the offering items represent the physical world that encircles the water flow. By highlighting the metabolic process that the offerings trigger my study evokes another of the discipline’s classic: Rappaport’s study of the Kaiko ritual and his suggestion that it contributes to environmental sustainability. Similar to Kaiko, Andean offerings present the society-nature nexus as a relationship of exchange between humans and superhuman forces that demand the formers’ respect in return for their use of natural resources such as pigs and water. But even though Kaiko and Andean offerings both serve as regulators of humans’ interaction with the environment, their social dynamics are very different. In Rappaport’s account, the ritual constitutes a self-contained cultural institution that ensures humans’ need for meat without jeopardising the environment. In his later writings Rappaport reflected on the limitation of such self-regulating practices warning that if they fail to adjust to the changing world, they may become maladaptive and create an environmental crisis.

Offerings can also lose importance as a regulating mechanism. But the ritual is more than a mere instrument to safeguard the environment. It is a vehicle for human agency and self-reflection. As a replica of water metabolism, the ritual offers a window on water metabolism and humans’ engagement with the material environment as well as with the superhuman beings who control water and other natural resources. If Kaiko is a thermostat to restore the human-pig ration (Dwyer 1985), offerings are a thermometer that humans use to read their impact on the water flow. Missing some of the offering items or neglecting the offering ritual all together may disrupt water metabolism; conversely, providing more offering gifts may smooth it. The offerings’ visualisation of humans’ role in the hydrological cycle also allows room for different interpretations of the bearings of human agency. Some water users explain the offerings as an act of exchange with the mountain deities who provide water in return for gifts. To others the offering ritual is a way to appease the deities,
who they fear because of their power to punish humans. Hence, while the ritual follows a well-described script for the offerings’ performance, the motives that drive the villagers to take part of them differ, just as their explications of their effect vary. Some say droughts and irregular precipitation are signs of the deities’ dissatisfaction with the offering gifts; others read them as proof that the deities no longer listen to their call for help (Paerregaard 2020b). And while some attribute water shortage to the deities’ anger and wish to punish humans, others claim it occurs because the deities no longer hold the power to control the water, which has led some to abandon Tapay’s offering practices all together.

Despite, or precisely because, Andean offerings are open for different readings and interpretations they have proven resilient to change, which is evident in Cabanaconde, Tapay’s neighbouring community. Until recently the villagers of Cabanaconde paid annual tributes to its main water source: the nearby mountain of Hualca Hualca (6,025 m). Senior villagers recall how the entire community used to walk up to the summit to make collective offerings to Mt. Hualca Hualca in the hope that it would yield more water (Gelles 2000). They also recount that the villagers believed the community descended from Mt. Hualca Hualca providing it with an ethnic identity distinct from other communities in the region. However, after the Peruvian state built a channel that transports water from a watershed above the Colca valley to the coastal desert and that supplies the communities on the Colca river’s west bank with water (Paerregaard et al. 2020; Stensrud 2016b; Ullberg 2019), Cabanaconde stopped making offerings to Mt. Hualca Hualca (Paerregaard 2013b, c).

In the aftermath of the channel’s construction in 1983, Cabanaconde also changed its water management adopting a model promoted by the Peruvian state. Previously, the task of water allocator was a mandatory, unpaid duty similar to Tapay’s water management. Today Cabanaconde’s water is organised by a number of irrigation committees that contract remunerated water allocators to do the job. But even though Cabanaconde has adopted a professional water management model, the presidents of its irrigation committees continue to conduct annual offerings to the five valves that the community uses to take water from the channel (Paerregaard 2019). The rituals are organised in a temporal and spacial order resembling Tapay’s offerings. Cabanaconde’s offerings to the channel also follow the same ceremonial repertoire as Tapay, assembling items from the ocean, the underground, the fields, the animal kingdom, and the spiritual world that are burnt, sprinkled or left at the offering site. Instead of paying tribute to Mt. Hualca Hualca, Cabanaconde now does it to the channel suggesting that the change of water supplier has had little impact on the community’s perception of offerings as a means to lubricate the water flow.

Tapay’s ideas of water metabolism and the hydrological cycle are also being challenged. In recent years, the community’s water supply has diminished due to climate change and the melting of Mt. Seprigina’s ice and snow cap which has made some villagers question the deities’ power (Paerregaard 2018b). A recent event has added fuel to their doubts. In 2016, a goldmine opened in Tapay which has created concerns among many villagers who fear it may cause water shortage in the community and contaminate its water supply. In response, Tapay organised several marches to the mine, which is situated above its main settlement at 4,800 m, not far from Mt. Seprigina. To support the villagers’ protests and to affirm their concern for Tapay’s environment, migrants from Tapay have arranged similar events in the city of Arequipa. The company, on the other hand, has tried to gain Tapay’s support by offering employment to several hundred villagers and migrants and financing the construction of
public works in the community such as schools and roads. Finally, it has agreed to construct a channel to direct water to Tapay from a nearby river, a project that currently is in progress and that promises to enhance the community’s water discharge significantly. The mine’s investments in Tapay’s infrastructure and, not the least, the employment of its migrants as workers has changed the image that particularly young villagers hold of its interests and activities. The mine’s presence, however, has also left Tapay’s population’s divided and, even though the prospect of a new channel creates hopes for a better future, it had done little to mitigate many senior villagers’ fear for the mine’s environmental impact. The following years will show whether Tapay adapts its offerings to the new water supplier by paying tribute to the channel instead of Mt. Seprigina. But even if Tapay does so, the development in Cabanaconde suggests that this will have little effect on the offering practice and the community’s water perception.

Conclusion

My data show that the Andean offerings recalibrate the hydrological cycle by ascribing superhuman forces a critical role in the circulation of water. From my study of offerings, it is also evident that humans try to lubricate the hydrological cycle by setting in motion a ‘change of matter’ of items that represent the many kingdoms and realms which encircle water’s transformative flow. Finally, my data suggest that it is the metabolisation of the offering items that produces the gift which the superhuman forces demand to release the water flow. At the heart of this replica of water metabolism is a holistic worldview which perceives water as a substance that is enmeshed in relations with humans as well as non-human beings and therefore of vital importance for all forms of existence. By enacting the very process that reproduces life, offerings and their configuration of the hydrological cycle as a human-nature relationship are iconic for the effort to preserve fresh water supplies anywhere in the world.

Similar to Rappaport’s idea my argument is that rituals play a critical role in regulating humans’ access to natural resources, and offerings contribute to the creation of water sustainability by highlighting humans’ role in water metabolism. Reviewing an example from a neighbouring community of how hydraulic infrastructural projects can instigate water users to change offering practices, I also suggest that these are resilient to changes in the water supply chain. Even when Andean communities change water supplier and even when this implies turning the back to the mountain deities and recognising external agents such as the state (and perhaps also mining companies) as their new supplier, they still believe offerings are instrumental to produce water. Water metabolism needs grease!

References


