Bulked gold, riverine trade, hiking trails, and WorldView2 satellite remote sensing in Northwestern Luzon: the Angaqui network

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Abstract

This paper is based on a case study of the Angaqui gold trade network in Northwestern Luzon during the Early Historical to Historical Period (10th to early 20th c). Multiple data sources including GIS predictive modelling and remote sensing through high-resolution and multispectral WorldView2 satellite imagery, written primary historical and secondary historical sources, indigenous peoples oral tradition, and results of systematic archaeological survey and excavation were integrated in the research to come close to a wholistic view. Availability of the satellite imagery facilitates a more regional and multi-scalar approach to archaeology of the region. Remote sensing has revealed segments of old trails within the network. The written and oral tradition both complement each other when correlated with available archaeological data. Availability of historical visual documentation also provide a means to reconstructing the gold evanescent market encounter in Northwestern Luzon.

Introduction

This is the fourth case study that looks at the gold evanescent market encounter for gold in Northwestern Luzon (see Canilao 2017a, 2017b, 2017c) (Fig 1). This article will deal with
Network 3 (Fig 2), which encompasses areas within coastal and upland Ilocos Sur and the Mountain Province. Ethnographically and archaeologically documented settlements within this network will be presented in a section below but first to provide historical context, we will look at primary and secondary accounts that talk about how the Ilocos coast is a source of gold in the Early Historical to Historical periods (10th to early 20th c) including its multiscalar trade connections. This section will also explore the products that were exchanged, and actions undertaken by the small-scale gold producers to up the stakes in the gold exchange.

**Trade with China and beyond**

The Philippines has been argued to participate in a regional maritime exchange network during the protohistoric Period (or Early Historical period) (Dizon 2003: 1,20) with the Ilocanos of Luzon eventually adapting their own maritime trade vessel called Biray (sometimes spelled Virei). Historian Grace Mateo argues that Ilocano involvement with this trade network may have extended to Melaka, India and China (2004:42-43), and in terms of China,

[The] Ilocos trade network was not confined to the Island of Luzon. International trade was a significant component of the Ilocano economy during this time [pre 16th c]. A 1574 estimate claims that thirty to forty Chinese [Birays] came to the country annually and during prosperous years even as many as fifty. (2004:41)

Ilocano Birays also crossed the seas to trade with China as will be shown below. According to Berthold Laufer, a curator of Asian anthropology, the Chinese-Philippine trade can be pushed back to the latter part of the 12th c (1908: 154). But, H. Otley Beyer the father of Philippine anthropology pushes this even further back to 890 AD up to the 12th c with the Arab traders pioneering these early exchanges using the Islands as intermediaries, after they were ousted.
directly out of China (1979: 115). When relations began to improve between the Arabs and the Chinese in the middle of 10th c the direct trade with South China, Chuangchow and Canton was re-established and now the vessels regularly passed through Bornean and Philippines Islands rather than the Indo-China coast (ibid). One of the early historical accounts of such Arab ships unloading products from Mindoro at Canton was from 982 AD (ibid). This Arab ship as well as other trading vessels would have passed through Northwestern Luzon as its last stop just before crossing the Batanes channel, hopping to Formosa (Taiwan).

Albert Chan argues that Philippine gold actually ended up in smithies of Canton in Southern China (Chan 1978: 52). Jesuit priest Alonso Sanchez who ministered in the Philippines observed a great amount of gold from the Philippines being cast in the form of small boats, weighing half a pound each when he went to Canton in the 16th c, right at the advent of Spanish colonization of the Philippines (Chan 1978: 52).

Entanglement into this trade was not unidirectional as Ilocanos eventually crossed the seas to coastal Indo-China with their Birays. Structural remains of this vessel type was seen in Pandan, Caoayan, Ilocos Sur during the first season of the Ilocos Sur Archaeology Project of 2011 (Canilao 2015) (Fig. 3). The vessel and the span of its operations also figures in the Northwestern oral tradition of Biag ni Lam-ang,

Dua pay ti sasakayan  
I have two gold tradeships

a balitok a bulawan  
plying between here and the

nga agbubunag ti pinggan  
Chinese country trading in

idiay ili a Kasanglayan,  
porcelain. I have commercial
In this passage we see that gold was exchanged mainly for porcelain. According to archaeologist Laura Junker,

Between the tenth and fourteenth centuries Philippine chiefs in a limited number of polities strategically located along the western littoral [includes Northwest Luzon, Ilocos] dominated a low-volume trade for Chinese porcelains and a wide variety of other foreign luxury goods (glass beads, silks, bronze objects) (1999:19)

By the 15th and 16th c, at contact with the Spaniards, this trade has already intensified (ibid).

Several archaeological excavations in Northwestern Luzon reveal whole pieces and sherds that are provenienced from Dai Viet (Northern Vietnam), Siam, Khmer, and China (i.e., see Canilao
German traveler Hans Meyer also observed stoneware dragon jars in Candon intended to be sold in the upland areas including the Lepanto mines (1975:117). Meyer himself was perplexed when his personal Igorot interpreter spent all of his month’s earnings just to purchase a single jar from Candon (ibid). But at this juncture let us expound more on how gold ended up in coastal communities when the mother lode is located several kilometers upland in the fastnesses of the Cordillera Mountains of Luzon, with alluvial gold drained along the rivers.

“**Ilocos Gold**”

In her dissertation work on the Ilocos, Grace Mateo talks about how gold ended up with the Ilocanos,

Gold and forest products were not obtained in the lowland, but through trade with the Igorots. The Ilocanos served as middlemen, buying gold from the Igorots and selling it to foreign traders. For the gold and the forest products of the Igorots, the Ilocanos bartered rice, cotton, livestock and salt. There are no figures to indicate the volume of trade between these two groups, but their commercial relations appear to be significant since trade became the focal point of Ilocano- Igorot relations (2004:45)

Anthropologist Evelyn Caballero (1996:29), concludes that the antiquity of this trade [and the prosperity it brought about in Ilocos] is evident based on a reading of ethnohistorian Felix Keesing statement that “the province had extensive pueblos and many people[, containing] mines of gold, which Japanese and Chinese merchants came to exploit” (1962:97). An unsigned Relacion (1586) alludes to the direct relation between the Ilocanos and the upland miners in the following passage,
They [Ilocos people] are husbandmen and possess very large fields. Consequently, it is a land abounding in rice and cotton. There is also considerable gold, for the chief mines of these islands are situated in the mountains of that province. These people [Ilocos people] enjoy it for they have more communication with the miners than anyone else. (unsigned 1586: 382)

Ilocos gold is also the most sought after in Luzon and probably the whole archipelago, according to Spanish Governor General Francisco de Sande,

In this island there is much gold among the natives in jewelry, and they trade it. There are a great many reports of gold mines, and because they say that the best are in the province of Ilocos (Sande 1576: 88)

Cordillera historian Willian Henry Scott (1970: 700) highlights the fact that in Antonio de Morga’s Sucesos de las Islas Filipinas (1609: 183), the Igorots mined the gold but it were the Ilocanos who refined and distributed it. In another work, he argues that the Igorot gold fields that were regularly referred to in 16th c Spanish accounts as the wealthiest in the archipelago must have suffered the general post-Conquest decline in gold production, which reached its nadir about 1600 (Scott: 1974: 13).

At this juncture it should be mentioned that Mateo in her dissertation (2004) comprehensively traces the transformation of the relationship between the Ilocanos and Igorots from trading partners to enemies due to Spanish colonization in the region. Scott; on the other hand, generalizes that 320 years of lowland commercial cooperation between lowland Pangasinan and Ilocos with the Igorots was not interrupted during the Spanish Period.
Lowland merchants travelled around buying up carnelian beads to sell them at a peso a piece; Igorot G-strings were woven on Ilocano looms in the eighteenth century as in the twentieth; Igorot miners could refresh themselves with lowland basi [rice wine] and molasses cakes; and a slave trade in both directions continued into the American regime (Scott 1970:713).

The slave trade will be discussed shortly, but changes did occur based on historical evidences provided by Scott (1971), specifically indicating that there is a propensity for the upland miners to deceive their newly converted trade partners in the coasts. By the 18th c the Igorots themselves were melting (refining) the gold into cakes because “ordinarily they sell it in sheets or ingots so there is opportunity for deception and alloying it with silver or red copper” (Antolin 1789, translated by Scott 1971: 123). Scott, in citing Guillaume La Gentile (1779-1781) states that this illicit and deceptive trade for gold was carried out this time around with lowland coastal friars and alcaldes in exchange for silver dollars (Scott 1974: 141). The Spaniards themselves became involved in the illicit precious metals trade with the Igorots citing an instance in 1855 wherein 117,000 pesos worth of Igorot copper was sold to Manila and the fact that the Governor of Pangasinan had involvement with Igorot debtors [owed gold payments] in the 18th c, which caused complications in launching punitive expeditions against the Igorots (1970:713).

At this juncture, we investigate further another offshoot of the Spanish period illicit trade for gold alluded to by Scott- the increase in slave- taking and head- hunting with upland groups allegedly preying on hispanized lowland settlements.

**Slave-for-Gold and Strategic Trade Alliances**
Oral tradition accounts of slave trading was recorded by Bagamaspad and Hamada-Pawid (1985),

Slave trade introduced the baga-en into Ibaloy society. Literally meaning “one who is sent”, the baga-en concept is closely associated with that of Busul or enemy. For while earliest remembered slaves were spoils of inter-tribal warfare or purchases from head takers who were potential allies or enemies, slave trading soon became a part of the gold trade (130).

They cite Kabayan municipal history in terms of the barter value of slaves,

[slaves were] exchanged for gold, coins, animals and ceremonial blankets. A slave would be worth a kolebao, death blanket; a pig, molmol; or a piece of gold. These people would be most commonly between the ages of 6 to 16 years (p137).

Interestingly, they argue that at the height of the slave-for-gold trade in the 1800s there were a maximum of five slaves for a family (ibid).

At this juncture, we also explore another interesting aspect in the exchange. Although the upland gold miners/ producers are traditionally assumed to be an exploited group and literally peripheral, or in some, marginal to controlling the trade (i.e., see world systems theory WST literature: Frank 1999, Algaze, 1993, Hall 1986, Hall 1989), there are strategic maneuverings on the part of the miners/ producers themselves to ensure that their stakes in the trade are optimized vis a vis the coastal settlements and even the foreign merchants. The creation of inter-village alliances appeared to be very common in Northwestern Luzon in order to facilitate the smooth flow of products through the trading networks. Bagamaspad and Hamada-Pawid (1985) explain,
The trade routes brought the trader from Banget-Pico to Sabdang, present-day Sablan, also earlier called Disdis, to Galiano into Aringay then San Fernando or from Betdi, Tublay to Pico into Kafagway to Chuyo and down to Agoo through portions of present day Marcos Highway. The practice of trade lasted days and developed still another dimension to the practice of arranged marriages, kaising where a trader maintained more than one family over a dispersed area. Such a relationship was both a formation of a nuclear family as well as the establishment of an alliance between the trader and his kin and the kin and his neighbors of is wife in settlements along the trade routes. (p. 77)(emphasis mine)

The advantage of this form of social networking is more vividly illustrated when Bagamaspad and Hamada-Pawid argue that the gold miners and panners from more interior settlements became more dependent on the new rich baknang’s (elite class also called Kadangyan’s) amongst them in the highlands, whose wealth is built upon control of lowland trade items sourced from their well-placed kin on the lowlands and cattle grazing in their upland “estancias” (1985:138). More importantly, towards the end of the Spanish colonial period, by the 1880s, these Baknangs or Kadangyans either control or own the Cordillera iron, copper, and gold mines according to Hans Meyer (1975: 126). The items they brought in from the lowlands in exchange for gold fueled a consumption economy among the Igorot gold producers (1985:138).

**Overland, Riverine and Maritime trade routes**

In this section we explore the transport of gold within this trading network. As will be demonstrated below, the historical record shows that the trade was carried out through overland trails, river rafts and finally ocean-crossing birays (see Azurin 1991, Mateo 2004). Indeed, the
Grand Abra River is characterized as broad and open (Meyer 1975: 108) sharply differing from the Aringay, Naguilian, and Amburayan Rivers of Networks 1, 2A and 2B, and the Agno River that drains into Lingayen Gulf. This has great implications in terms of riverine transport networks. Mateo for instance, explains the Igorot- Ilocano linkage through the river,

Despite their contrasting geographical terrains, Ilocos and the Cordillera are geographically and ecologically linked. The three largest and most important rivers in the Ilocos region- the Amburayan, Abra, and Laoag Rivers- serve as a vital link between the lowland Ilocos and the upland Igorots since these rivers criss-cross the Cordillera and Ilocos[…] but it is the Abra River which has traditionally been the **major highway** linking Ilocos Sur and Cordillera. It boasts an overall length of fifty- five miles from Lepanto on the thickly forested western slope of the Cordillera to the coast. From Lepanto it flows along a Northerly course via Agnet River near Lagangilang then moves to a southerly direction. Numerous tributaries flow into the Abra so that by the time it reaches the Abra valley, which is the only wide and fertile flatland in the province it becomes a river of notable size. It eventually empties into the South China Sea through the Banaoan gap, a V- shaped gorge near Santa, Ilocos Sur. (2004: 46) (**emphasis mine**).

An integral transportation mode is the raft,

During the rainy season, the Igorots loaded their cargoes on rafts or boats and went down to Abra and Amburayan Rivers to trade with the Ilocanos... Of the three rivers, the **Abra River appears to be the most traversed route** by the Igorots judging from the amount of references to it. It could also be because Abra River descends to Vigan, the capital of Ilocos. It appears to be the chief avenue of trade and communication prior to the
construction of the Abra- Ilocos Sur highway in the twentieth century. Despite being narrow and rapid-flowing, it could apparently accommodate freightage by bamboo rafts as far as **forty eight kilometers between coast and the interior** (2004: 48-49) (emphasis mine).

The 48 kilometer estimate may be an understatement since the River could accommodate wider bamboo rafts up to the middle Abra section. Two types of bamboo raft that service the three different elevation zones of the Abra River. The lower and middle Abra is probably serviced by a longer and wider bamboo raft (Fig. 4). The fast- moving upper Abra, which directly drains the gold rich areas of Northern Benguet, Upland Ilocos, and Western Mountain Province (within the gold trade Network 3) would probably be more accessible using a smaller version of this bamboo raft (Fig. 5). It should be stated that though navigability for any kind of river vessel generally improves with the rivers depth, the unique advantage of these bamboo rafts is that they have shallow drafts, laying literally flat on the river surface. Mateo also elaborates on the schedule of raft travel using the 1819 account of Francisco Alban OP as a basis,

At certain points, the raft had to be dragged upstream by the locals with ropes while walking along the banks of the river, wading through shallow water and clinging to rocks or swimming and pushing the raft. It took fourteen hours to go upstream from Vigan to the Abra Valley, but only five hours going down river. (2004:49)

She also argues that multiple modes of transportation are needed to complete the upland-lowland travel, with foot trails linking Tineg to the Northeast and the Binongan, Malanas, Ba-ay, Bucloc, and Ikmin to the east and southeast while horse trails connected Eastern Abra with Lepanto, Kalinga and Apayao (2004:49). She further explains,
Besides the Abra River, trails crossed westward from the Abra Valley to the Narvacan coast and the coastal points. Similarly, trails descended from the north Abra into Ilocos Norte. Rivers and trails were the routes used by Igorot traders in carrying their goods to Ilocos (2004:49).

The Narvacan route became an alternative to using the Abra River route that was controlled by the Vigan-Caoayan settlements. It should be noted that horses are quite ubiquitous in the Abra Valley (Fig. 6). An interesting historical account about traversing such trails on a horse is given by Roy Barton in his chapter *Hightrails in headhunterdom* coming from Cervantes settlement of the upper Abra River.

We expected to reach Bontok that night. The rain grew heavier. The trail was deep with mud at places- dangerous. There was danger that our ponies, struggling, would flounder off the side of the trail, in which case, several seconds might be required to reach the earth again. (1930:24)

The use of horses would have hastened the formation of troughs within the trading trails. What is interesting about the treatment of the trail in the passage above is that the trail is exoticized more for headhunting rather than the trade it facilitated. Several archival photo plates from the Dean Worcester collection show some of these turn-of-the-century trails somewhere in the Angaqui network (Fig. 7, Fig. 8) with one showing a trail near Bontok, which shows the trail switch back in the background (Fig. 9).
We now proceed to identifying the relevant settlements and trails articulated within the Angaqui network. As stated above it appears that the organization of coastal settlements in Ilocos has astounded the first Spaniards who entered the area in the 16th c. In general, when talking about the Southern Ilocos area which include Purao, Tagudin, and Dumaquaque, Keesing argues, It seems fair to assume from the 1591 and 1612 figures that the people along this section of the coast, later to be called Southern Ilocanos, number around the latter part of the sixteenth century about 15,000. By demographic perspective this number is unusually high density of settlement, and the Augustinians established more centers to serve it than was done in any other parts of Ilocos comparable in size (1962: 99).

The better lay out of the towns in Northwestern Luzon specifically the La-Union- Ilocos coastline is alluded to in the following passage by Ortega that talks about Salcedo’s conquest through Luzon when he attempted to circumnavigate Luzon,

They reported that the population there was large and that there were many good settlements close to one another and that they were better governed than in the other parts. (Ortega 1572: 257)

As for the interior settlements, one particular military expedition targeting Lepanto mines provides the settlements in between the coast and the mines,

On February 3, 1850 an expeditionary force of 70 troops and 250 cargadores led by an engineer Don Antonio Hernandez, together with Commander Manuel Coballes, left Manila for the Ilocos coast. From Candon, Ilocos Sur they passed through Salcedo,
Concepcion, Angaqui, and Cervantes and reached Mankayan on the 24th (Bagamaspad Hamada-Pawid 1985: 172)

It is in 1869 that proposals to finally establish missions in Tiagan, Angaqui, Cayan, and Mankayan were put forward as an offshoot of the establishment of the Cantabro-Filipina of Mankayan (Bagamaspad and Hamada-Pawid 1985: 174).

Coastal Settlements of Candon, Dumaquaque and Santa Maria

Two Spanish period maps available in the National Archives (NA) in Manila indicate that the settlements of Angaqui (Quirino) and Cervantes were crucial bulking villages in the historical period (Fig. 10, Fig. 11). A map by Don Esteban Pennarubia (1869) in Archivo Museo Naval, Organo de Historia y Cultura Naval in Madrid, Spain also shows the area as of the late 19th c (Fig. 12). The maps though out of scale are useful in looking at the connections between settlements. As explained in the methods section, some GIS functions are available to warp these historical maps to improve its accuracy to scale. The most notable feature is the centrality of Angaqui in this network, which appears to be serving the Minlaoi to Candon and Dumaquaque network but also the Lepanto to Abra de Vigan network.

Thus we have Dumaquaque and Candon as the main coastal settlements but it should be noted that in the two NA maps, Santa Maria is also shown as a critical settlement. Santa Maria; however, belongs to Network 4 (see networks figure in Canilao 2017c: 365) further north because like Narvacan, these coastal settlements were destinations of traders who chose the overland route from the Bangued area rather than the raft route which brings them to Vigan-Caoayan during the Early Historical period (pre- 16th c). According to Perez the (Historical Period, Spanish Period) growth of Santa Maria was seen as contemporaneous with the older
village of Candon when the Commandancia Politico Militar (CPM) district of Lepanto was created in 1852 thus “Santa Maria and Candon acquired great importance as points of departure for the interior of the mountains” (Perez 1988: 23). Keesing argues that by the 19th c Candon was recognized not only as a major trading center but also a base for mission work (Keesing 1962: 108). Mateo also states that,


candon was another Igorot frequented town, but its location, halfway between Narvacan and Tagudin, and its distance from the Abra and Amburayan, would appear to have disincentives for traders. But Candon, which was created in 1591 [hispanized], had a long history of intimate ties with the Igorots of Bontoc (in present-day Mountain Province), that were established by the intermarriage of a scion of its most prominent Babaknang family, the Abayas, with the daughter of the founder of Tetepan, a village in Western Bontoc (2004:217). (emphasis mine)

Santa Lucia was formerly known as Dumangquaque based on more recent historical researches (Newson 2009:181, Mateo 2004: 43. 67) although in the earlier work of Keesing (1962: 98) he identifies this as Tagudin, which was included in the case study of Network IIB—Lepanto gold district (Canilao 2017b). Reyes argues that the settlement had gold which was exploited by merchant ships from China and Japan (1890 trans 2014: 140). Keesing (1962: 107) states that Manuel Buzeta’s 1850-51 census shows that gold nuggets were panned in waterways of Santa Lucia. This waterway way is the Buaya River located south of the village. Buaya River has its headwaters on Mount Monserat, Mount Ampayao, and Mount Tila/ Tirad (Mount Estileta) the natural barrier that separates the Abra basin from the coast.
Based on the accounts of the Conquest of Juan de Salcedo in 1572, he captured a village chief called Silata who he used as an emissary to forge reconciliation with the rest of the villagers in Dumaquaque. Silata was able to bring a delegation to meet Salcedo and to offer around 100 ounces or 2,834.95 grams (2.8 kilos or 6.25 pounds) of gold (Reyes 1890 trans 2014: 141). In terms of population, Keesing cites a 1591 Account of Encomiendas stating that Dumaquaque and Candon coastal settlements each individually had a population of 3600 with 900 tributes in gold (1962:98). Newson’s data, which is based on Martin de Goiti’s second expedition to Ilocos in 1572-1573 shows that from Dumaquaque, 385 tahels of gold was exacted; whereas, from Candon it was 120.5 tahels (2009: 180). One tahel of gold is equivalent to 39.537 grams of gold (Peralta- Imson annotation in Reyes 2007: 57). Therefore, Dumaquaque village gave a tribute of 15,221.745 grams or 15.2 kilos or 33.5 pounds of gold and Candon a tribute of 4,764.209 grams or 4.7 kilos or 10.3 pounds of gold. In terms of the source of this gold, the mines closest to these coastal trading settlements are in Patiacan and further south and upriver of Abra, the Lepanto gold district at the headwaters.

Patiacan/ Minlaoi in Mount Quinali

Patiacan has a secondary burial tradition which was recorded during the second season of the Ilocos Sur Archaeology Project (Fig. 13) with some as old as 200 years and as late as 100 years based on the fact that present day residents can recall the people interred as ancestors two to three generations back in time (Canilao 2015). Patiacan which came to be the name of the whole Barangay means “place for viewing/sighting.” Indeed a GIS viewshed analysis from the Minlaoi hilltop nearby with watch tower vestiges has some interesting results presented below. Back in 1911 community histories were systematically recorded and interestingly the
contemporary day settlers in Patiacan believe that “the ancestors of Patiacung barrio trace back to 1793, when they went to a place called Balaoa, west of Santa Lucia in Ilocos Sur” but were forced to migrate further inland because of the Christians in that town (Keesing 1962:113). Balaoa may have been Buwaya, mentioned above which is the river south of Santa Lucia that is panned for gold. It is possible that this inland push may have been part of the remontados that chronically fluctuate.
Figure 1 Case studies of gold trade networks in Northwestern Luzon (ASTER GDEM is a product of METI and NASA).
Figure 2 Settlements in Network 3, the Angaqui network (Using WV2 mining combination) (DigitalGlobe Foundation)
Figure 3 From Ilocos Sur Archaeology Project season one (ISAP-1) files. Main photo: Biray remains
(Sampan) at Pandan, Ilocos Sur (Photo by author). Inset: the beached Biray circa 1980s (Photo courtesy of Hon. Germelina Singson-Goulart)
Figure 4 Larger bamboo raft in the lower Abra River, turn of the 20th c (© The Field Museum, CSA 28583. Photographer: Fay-Cooper Cole)
Figure 5 Smaller bamboo rafts somewhere along the Abra River, turn of the 20th c (© The Field Museum, CSA 33909. Photographer: Fay-Cooper Cole)
Figure 6 Horses grazing in Abra River Valley near Angaqui (Quirino) (Photo by Ilocos Sur Archaeology Project team member Kathleen Tantuico 2012)
Figure 7 Guard structure along the trail somewhere in the Angaqui network with Bontok warriors, turn of the 20th c (© The Field Museum, CSA 18562. Photographer: Dean C. Worcester)
Figure 8 Trellis along the trail somewhere in the Angaqui network with Bulol posts, turn of the 20th c (© The Field Museum, CSA 18525. Photographer: Dean C. Worcester)
Figure 9 Guard structure along the trail approaching Bontok settlement in the Angaqui network with Bontok warriors, turn of the 20th c (© The Field Museum, CSA 22186. Photographer: Dean C. Worcester)
Figure 10 Unknown (Cartographer). (1794). Ydea Aproximada del Teritorio entre Cagayan e Ylocos. Courtesy of the National Archives of the Philippines.

Figure 11 Tauguaz, Rafael (Cartographer). (1891). Croquis del Distrito Politico Militar de Tiagan y Rancherias de Ilocos Sur. Courtesy of the National Archives of the Philippines.
Figure 13 Artist illustration of the Patiacan secondary burial coffin tradition (Illustrated by Eduardo Bersamira 2012-Ilocos Sur Archaeology Project II)
based on proselytizing efforts in the lowlands as well as the prospect of small-scale mining in Minlaoi at Mount Quinali.

Contiguous to the settlement of Patiacan is the abandoned settlement of Minlaoi. During the second season of the Ilocos Sur Archaeological Project (ISAP) in 2012 both test pit excavations and surface surveys were carried out at the archaeological site. Several earthenware sherds were recovered together with some tradeware sherds on the surface, and within crevices of huge limestone boulders towards the West of the site (Fig. 14). Bigger and more complete sherds of fluted earthenware vessels were encountered in test pit excavations (Fig. 15).

Foundation stones of watchtowers were also observed at the top of the hill, overlooking Abra River valley (Fig. 16) There are also traces of ancient mountain terraces evident on the slopes (Fig. 17). Within the vicinity of Minloai site are lode mining slides associated to both small scale and more industrial scale mining (Fig. 18).

Interestingly, Minlaoi and the greater Patiacan settlements are parts of Mount Quinali, which means “dugged-up,” perhaps alluding to mining of gold. In some accounts, the settlement itself is not called Minlaoi but Quinali (Perez 1902:105). The Pennarubia map of 1868 also marks Quinali at the banks of Balasian River (Rio Quinali) in the area of Patiacan- Minlaoi (Fig. 19), northeast of Angaqui. In fact, Perez argues that the location has been moving all the time because of war with the Bontocs (ibid).

Angaqui was renamed Quirino in 1964 (Republic Act 4035) and historical sources indicate that this bulking station has direct trading relations with the coastal settlements of Santa Lucia and Candon. It is fortunate that Father Angel Perez gave a succinct account of this
settlement. Overall, Perez work on the Igorots has been praised as one of the more important ethnographic works on Cordillera (Prill- Brett 1978: 48). Fray Perez was an Augustinian priest assigned in Kayan from 1886 until the close of the Spanish period in the Philippines (Prill- Brett 1978: 48). Perez provides an interesting account on a portion of the trail, a rest stop, that has a picturesque view of Angaqui on the East and the coastal towns (Dumaquaque/ Santa Lucia, Candon, Santa Maria, Narvacan) to the West. The trail passes through either Tila Pass/ Tirad or through Tobalina,

[…] from those elevated ridges two beautiful, enchanting and magnificent panoramas are to be seen, both most delightful. The first is the great precipice that frightens those not accustomed to hiking in such heights and causes vertigo, a precipice which it is necessary to descend to the village of Angaqui. After resting, the inexperienced traveler contemplates the picturesque villages scattered along the ridges of the Cordillera spurs; and in the bottom of the valley, the wide Abra bathing various little islands [river islands] and there in the distance a labyrinth of higher and higher ridges and ranges sometimes covered with undulating clouds [.] Behind us we have left the other panorama which offers a more delightful view, if you like, for from there the wide tempestuous China Sea is spread- out, washing the beaches of both Ilocos and La Union, so far is the view from those eminent heights on clear days. (1902:87).

Hans Meyer in his trip in the 1880s also describes this rest stop at the trail at Tila peak adding that this towers behind (west of) Angaqui and was at that time the only direct route from Ilocos Sur to Lepanto…
There the whole coastal province of Ilocos Sur was spread out below us. Beyond the nearest low mountain range, the green plain laying gleaning with the China Sea shimmering beyond it. Thalatta, thalatta! To the north the eye had an unobstructed view all the way to the Province of Abra, and to the south, Cape Namacpagan was darkening in the twilight. A fresh wind was blowing up from the sea. We rested, the porters cooked their meal of rice, and we started the descent with new vigor. In three hours we were down in Lingey. (1975: 76)

Remote sensing through WorldView2 satellite imagery was carried out on the trail at Tila and indeed segments of the old trail stand out particularly because of its troughs and associated vegetation. This will be presented below. Perez (1902) talks about the central location of Angaqui, Angaqui is the capital of the group and the mission and is located in a pleasant and agreeable place on the slopes or first approaches to Tila and Tobalina…Its many creeks and cascades water spacious fields in the district, from which not only is palay harvested for the citizens, but a surplus, and they export it to towns of Santa Maria and Candon in exchange for the clothe which the Ilocanos bring up to sell from the towns mentioned (p.89) (emphasis mine)

The location of Angaqui was digitized in Legleg as it appears in the 1:50000 National Mapping and Resource Information Agency topographic map (1989), the present-day location of the Poblacion. Interestingly Legleg is a term that pertains to river sludge/silt/clay or slime that may have gold particles...
Oral accounts from Mankayan tell that there once was a woman in Panat who went to the river to take a bath. She used Legleg, a type of clay to soap her hair. After bathing she discovered particles of gold clinging to her hair. The woman went home to tell her neighbors about her discovery. The neighbors, hearing this, went to find the source of the gold ingrained in the clay. Thus started the knowledge of gold and its subsequent mining through the labon (Bagamaspad and Hamada-Pawid 1985: 67)

In a redrafted map published in Bagamaspad and Hamada-Pawid (1985: 9) based on 1899 map of the 8th Army Corps of Engineers and a 1890 map of Comandancia Politiko Militar (CPM) Amburayan, Angaqui also appears due East of Gregorio del Pillar or Concepcion, with Quinali or Patiacan located East, South East (1985: 9). When overlain on the NAMRIA topographic map this location is indeed at LegLeg, Quirino.

Cervantes stands out in the Benguet oral tradition accounts as part of the string of pre-generational settlements (predates earliest ancestors in genealogies) which was occupied in the North to South movement,

Ampontoc, Dec-can, Panat and Bagongan were the early settlement areas. Due to an early epidemic, the people in these early settlements moved out from Panat to Lap-angan, Palasa-an, Payen, Esmay and Bakun; from Deccan to Sesecan and Baguyos; from Ampontoc to Comillas, Cervantes and Comay. Others returned to Namiligan
Cervantes is also frequently mentioned as a trading center dating to as early as the 1600s based on oral traditions, a conduit to Mankayan and its gold (Bagamaspad and Hamada Pawid 1985: 76, 77, 78, 83). A legend of Suyoc gold recorded by prospector Laurence Wilson 1932, 

The gold in Suyoc, as in other districts, first stood in the shape of a great high tree which reached the heavens. When it fell it was buried and some of the branches (veins) have been found and much gold taken from them. The main trunk has not been found and remain buried very deep[...] Gold was first discovered many generations ago at Suyoc by a band of boys from near Cervantes who were out on a fishing trip. (p. 29).

Cervantes became the capital of the newly combined Commandancia Politiko Militar (CPM) of Tiagan and Lepanto (Keesing 1962: 110). According to Perez this town is strategic and central to other settlements in Northwestern Luzon,

The main road leaves the town from Angaqui in a northerly direction; that which heads for the district of Benguet takes a southerly route via Mancayan; that for Bontoc goes east; finally, that of Amburayan to the west (1902:108)

Because of this strategic location Perez describes the populations as heterogenous, a melting pot of not only Ilocanos, Abrenos, and Igorots but even Chinese (p.109). Bagamaspad and Hamada-Pawid also state that Cervantes was central between Lepanto, Mankayan and Candon (1985: 76). Later in the 18th c Cervantes became an intensive center for cattle trade. Hans Meyer writing in the 1880s describes the trail connecting Angaqui with Cervantes as

[...] heavily travelled. Igorots who had purchased cattle and provisions from the market in the coastal province of Ilocos Sur moving homeward, Chinese taking caravans of trade
goods into the mountains, and mail runners and patrols of the Guardia Civil, all were
encountered there often (1975:75).

Cervantes formerly Mantamang also became more prominent as a Christian town by 1870
because of the operations of the Cantabro-Filipina Mankayan to its South (Bagamaspad and
Hamada-Pawid 1985 174, 177).

Above we have data coming from written and oral ethnohistorical sources in tandem with
archaeological data. At this juncture we take a look at GIS and remote sensing methods and its
contribution to the research.

Methods

Image enhancement was implemented on archived WorldView2 satellite imagery
courtesy of the DigitalGlobe Foundation. The WorldView2 satellite image came in both 2 meters
multispectral and 0.5-meter panchromatic form. The scenes were first converted from .tiff to
.img format using ERDAS Imagine 2016 (Hexagon Geospatial- Madison AL, USA). The
multispectral scene was subset into layer 1 alone and layers 2 to 6 stacked and layers 7 and 8
stacked. Both layer 1 and layer 7 and 8 stacked were resampled to 0.50 cm following the affine
option and using the bilinear method. The 0.5 meter panchromatic image was then resolution
merged with the 2 meter resolution bands 2 to 6 using the Brovey transform method (Panchal
and Thakker 2015). The resulting pansharpened image was then layer stacked back to the
resampled layer 1 and the layer 7 and 8. Topographic maps both 1:250000 and 1:500000 were
acquired from the NAMRIA and were also georeferenced and mosaicked using ArcMap 10.5
(ESRI- Redlands CA, USA) (Fig. 20, Fig. 21). This in turn was used as a base map in geo-
referencing Spanish historical maps. The trails in the georeferenced historical maps were then
digitized into polylines. Trail predictive models were also simulated using ASTER GDEM data. These trail models start from mines to bulking villages then to the coastal settlements. These predictive and ethnohistorical trail polylines were then projected over the image enhanced Wordview2 satellite imagery using different band combinations to remote sense archaeological features. Because of the evidence for watchtowers in Minlaoi, a viewshed analysis was also carried out from that location. A second viewshed analysis was also undertaken at Tila which appears to be a rest stop along the trails drafted in historical maps. Both Tila and the Minalaoi areas had some interesting archaeological features identified through remote sensing.

Discussion

In consonance to the steps undertaken in previous case studies, the gold evanescent market encounter was modelled using GIS. The Viewshed analysis shows that Minlaoi (Quinali) has a very good visibility of Angaqui in the banks of the Grand Abra River (Fig. 22). Indeed remnants of a watch tower was found in the area during the second season of the Ilocos Sur Archaeological Project in 2012 (Fig. 16). Interestingly, there is a turn-of-the-century example documented in this network by D.C. Worcester (Fig. 23). The location of the watchtower offered the advantage of spotting movements in the Angaqui settlement.

It is argued that Angaqui would have been an ideal location for berthing the longer and wider Abra rafts (Fig. 4), which are easy to spot from the watch tower in Minlaoi. Indeed, the lower and middle Abra River (approx. 88 kilometers) averages 70 to 80 meters across with one of the narrower passages of the middle Abra near Luba measuring 25 meters across as seen through Googleearth TM imagery (2016) using the ruler function. Upon reaching Angaqui (or even Cervantes on high water), cargo can then be transshipped using the smaller rafts (Fig. 5). In
addition to the raft-spotting utility of the watch tower it may also have functioned as a defensive
outpost based on the accounts of chronic inter village warfare mentioned above. In fact, when
strategically distributed in the landscape in tandem with the trail guard posts (Fig. 7, Fig. 8, Fig.
9), these structures would have formed a robust defense network.

Arguably, Angaqui was a major bulking station given its strategic location along the
grand Abra River wherein heavier loads can be transshipped by bigger rafts. The location of
Angaqui is also strategic because in terms of Euclidean distance, it is the closest to the Tila peak
trail, which may have served as a satellite and rest stop for ship- spotting on the coastal
settlements of Candon and Dumaquaque. This feature was described by Frey Antolin Perez
during his hike through the Tila trail in the late 19th c as well as Hans Meyer around the same
time. Viewshed analysis was implemented in Tila and indeed both the Candon and Dumaquaque
settlements on the coast were visible (Fig. 24).

Predictive modelling of trails connecting the mining settlements with the bulking stations and
eventually the coastal settlements was also implemented (Fig. 25, Fig. 26). These trails were
compared to digitized trails based on historical maps from the 18th and 19th c and indeed parts
of the predictive model coincides with ethnohistorical trails in several segments. One particular
case shows both the historical trail and the GIS predictive model passing through Bitong in
Galimuyod. This location is arguably a waypoint location in the Candon to Angaqui trail (Fig.
27). True enough, according to M.L.I. Ingel, Bitong is a “pre-Spanish contact settlement in a
remote, upland part of the town, where people from different villages met and converged before
proceeding to, or going out of, the neighboring villages” (2015: 2). Residential burial was also
encountered in the area (Ingel 2015), typically associated with Early Historical to Historical
mortuary practices of the Itneg and “proto T/I” in Ilocos (for a more extensive discussion of residential burial see Canilao 2016).

The most notable would be the segment that goes over the Tila ridge between Angaqui towards the coastal settlements (Fig. 28). Remote sensing analysis in the area shows several old trail segments. According to Ferguson, Berlin and Kuwanwisiwma (2009) ancient trails will show discontinuous segments of the trail that will remain visible in the present as a form of fragmented preservation (p.27). Three discontinuous trail segments stand out using the vegetation combination of WorldView 2 satellite. What is interesting (similar to the case study in Tonglo, Network 1) is that grasses and low-lying patches of shrubs has grown to delineate the trail and this particular vegetation has a unique spectral profile highlighting the trail itself (Fig. 29, Fig. 30). This pattern was also observed in a remote sensed trail segment in Network 1, which show secondary growth vegetation that grow in a uniform pattern (Canilao 2017c: 375).

The trail segments also exhibit heavy and long-term trampling and troughing, wherein trails form depressed surfaces (Ferguson, Berlin and Kuwanwisiwma 2009: 28, also Sheets and Sever 1991: 69). This is especially seen in 51Q 248500mE 1897000mN (Fig. 31) exhibiting “an abrupt dog-leg turn rather than a broad sweeping turn,” which is another criteria for ancient pedestrian trails (Ferguson, Berlin and Kuwanwisiwma 2009: 30-31). This turn is a very sharp considering that it is at a 15 degree angle. For comparison, a turn of the century trail photo with switch back at the back is seen from Worcester collection taken near Bontoc on the eastern flank of the network (Fig. 10).

A segment of the historical trail based on the 1794 map also appears to pass through the area of Patiacan- Minlaoi in Mount Quinali. Alongside the digitized historical trail is an actual
trail that is seen snaking back and forth as it scales the slopes of Mount Quinali (Fig. 32). This is probably the same trail traversed by Richard von Drasche during his trip in the 1870s travelling from Besao to Angaqui (1975: 44). For comparison two turn of the century trail photos show the supposed headhunterdom trails (coined by Barton) taken along the trails in this network specifically east of the Abra River (Figs. 8, 9, 10). Remote sensing using image enhanced Worldview 2 imagery of the environs of Minlaoi, reveal an old trail parallel to the newer and wider road (Fig. 33). The image enhanced soils and construction combination also shows the various archaeological features noted at the site during the second season of the Ilocos Sur Archaeological Project 2012 (Fig. 34).

Conclusion

Overall, gold mining groups in the interiors appear to have had access to more than one coastal market to export their gold but the crucial factor would have been the midway bulking stations, and who controls these settlements. The Tonglo and Gasweling bulking stations appear to be primarily a diaspora of the mining groups whereas the Danac and Apaya may have been a blending of both the mining groups and coastal groups who have migrated to the interior. The Angaqui bulking station stands unique in that it seems to have absorbed more diasporas of coastal peoples who specialized in riverine navigation at the end of the Early Historical Period 16th c. During the Historical period the reach of the riverine network was extended further upriver up to the village of Cervantes, also a melting pot like Angaqui (or more). The decision of where and when to participate would be based on several factors some of the important considerations include the diaspora of the middlepersons or traders who reside on the bulking stations of Tonglo, Gasweling, Danac, Apaya, etc…, the choice between low or high bulk
604 exchanges, at which point transshipment via the major rivers becomes important. In the case of
605 the Tonglo network they had an option of either hiking down to Agoo or Aringay. In the case of
606 the Gasweling network they had the agency to decide whether to hike down to Bauang, Baratao
607 or Calincamasan. In the case of the Lepanto network they were given the options of Tagudin or
608 Purao.

609 What is distinct about the Angaqui network that was analyzed in this paper, compared to
610 the three other networks to its South is that the scale of movement of bulked goods is higher as
611 afforded by the Abra riverine transport system. This was also partially seen with the Danac and
612 Apaya bulking station *vis a vis* the Amburayan River in the second case study. The geographic
613 and topographic advantage of this network; however, is the proximity of the mines to the
614 bamboo raft- navigable Abra River. In fact, the Quinali mines themselves are barely 3 kilometer
615 from Abra River (Euclidean distance). At this juncture it is also important to note that the Abra
616 River itself drains the gold rich Mankayan area where in Lepanto is located (the upper Abra
617 River). It is also plausible that gold mined from the area instead of being transported completely
618 overland through the Apaya conduit and partially on the Amburayan River using the Danac
619 conduit (see Canilao 2017b) may have been fully transported through the Abra River. This
620 movement may be related to the rise of Cervantes as a bulking station between the Mankayan
621 mines and the Minlaoi mines. The rise of Cervantes as a bulking station may have been late
622 compared to the rise of Angaqui.

623 The positioning of the settlements therefore indicates that lower bulk exchanges with
624 Dumaquaque and Candon are possible using the old trails passing through Tila but bigger bulk
625 exchanges with coastal settlements of Vigan- Narvacan-Santa Maria would have been facilitated
by the Abra River. Just like the case of the Danac bulking village, as markets became more regular and semi-permanent rather than evanescent and triggered by ship arrivals, trips became more regular between mines and coasts and the bulking villages in between (Canilao 2017b: 631-632). This is probably the reason why Vigan and Narvacan had the higher population at contact in the 16th c based on conquistador Martin de Goiti’s account (Newson 2009: 182). Narvacan is more accessible for those travelling by land from the Abra River bend at the Tayum- Bangued area. Vigan; on the other hand, is more accessible via riverine travel (rafts). Indeed, Hans Meyer mentions that he traversed a horse trail from Narvacan to San Quentin, and Bangued in the 1880s on his way to visit the Guinaang tribe (1975:78). Mateo (2004) also talks about these horse trails above.
Figure 14 various sherds found in crevices of limestone boulders south of Minlaoi hill (Photo by ISAP team member Kathleen Tantuico 2012)
Figure 15 earthenware vessels buried East Southeast of Minlaoi Hill (Photo by ISAP team member Kathleen Tantuico 2012)
Figure 16 Watch tower foundation stones on the crest of Minlaoi Hill (Photo by ISAP team member Kathleen Tantuico 2012)
Figure 17 ancient terracing evident on the surrounding hills of Minlaoi archaeological site (Photo by ISAP team member Kathleen Tantuico 2012)
Figure 18 Lode mining slides south of Minlaoi archaeological site (Using WV2 mining combination) (DigitalGlobe Foundation)
Figure 20 note control points used to georeference 1891 historical map using NAMRIA 1:50000 topographic maps as a basemap.

Touguaz, Rafael (Cartographer). (1891). Croquis del Distrito Politico Militar de Tiagan y Rancherias de Ilocos Sur. Courtesy of the National Archives of the Philippines
Figure 21 note control points used to georeference 1794 historical map using NAMRIA 1:50000 topographic maps as a basemap.

Unknown (Cartographer). (1794). Ydea Aproximada del Teritorio entre Cagayan e Ylocos. Courtesy of the National Archives of the Philippines.
Figure 22 Yellow areas are visible from Minlaoi site (Using WV2 mining combination) (DigitalGlobe Foundation)
Figure 23 Watch tower somewhere in the Angaqui network, turn of the 20th c (© The Field Museum, CSA 22186. Photographer: Dean C. Worcester)
Figure 24  Yellow areas are visible from Tila (Using WV2 mining combination) (DigitalGlobe Foundation)
https://doi.org/10.1016/j.jasrep.2017.12.026. © <2018>. This manuscript version is made available under the CC-BY-NC-ND 4.0 license http://creativecommons.org/licenses/by-nc-nd/4.0/
Figure 25  Area east of Angoqui; yellow (1891) and red (1794) lines are digitized polylines of historical map trails; black, white, blue, purple, and violet lines are drawn to enhance the 30m GIS generated predictive models (Using WV2 mining combination) (DigitalGlobe Foundation)
Figure 26  Area South of Angaqui; yellow (1891) and red (1794) lines are digitized polylines of historical map trails; black, white, blue, purple, and violet lines are drawn to enhance the 30m GIS generated predictive models (Using WV2 mining combination) (DigitalGlobe Foundation)
**Figure 27** Historical trails including yellow from 1891 map and red from 1794 map passing through Bitong site. Least cost path predictive model from Angaqui to Candon, plotted as blue line (Using WV2 mining combination) (DigitalGlobe Foundation)
Figure 28 note red and yellow historical map trails closely resembles GIS generated trail predictive models from Tila to Candon (pink) and Tila to Dumaquaque (white), Tila to Anagoqui (grey) (Using WV2 mining combination and WV2 vegetation combination) (DigitalGlobe Foundation)
Figure 29 note the spectral signature of the vegetation associated with this trail segment (Using WV2 vegetation combination) (DigitalGlobe Foundation)
Figure 30: Note the spectral signature of the vegetation associated with this trail segment (Using WV2 vegetation combination) (DigitalGlobe Foundation)
Figure 31 note trough and 15 degree dog-leg turn in this trail segment (Using WV2 vegetation combination) (DigitalGlobe Foundation)
Figure 32 digitized trail based on historical map showing part of the Angaqui-Patiacan-Besao trail (Using WV2 mining combination) (DigitalGlobe Foundation)
Figure 33  old trail alongside contemporary road north of Minlaoi site (Using WV2 vegetation combination) (DigitalGlobe Foundation)
According to Newson, towns in Ilocos numbered between 200 to 400 but Vigan alone had 800 houses with 3,000 houses nearby (Bantay, Caoayan, Santa) (2009:179). Using both datasets it is apparent that the location of Angaqui is strategic on both historical market scenarios- evanescent market and semi-permanent market. What is interesting to note however is that this location is more advantageous as a bulking point for gold that is shipped via the Abra river. There is no visibility of the Ilocos coast from Angaqui. This settlement is more strategic for bulking more goods that will be shipped through bamboo rafts downriver. It is probable that the current Angaqui location is reflective of a more complex gold trading network emerging in the area and this is also in tandem with the emergence of Cervantes. Angaqui is older than Cervantes; however, because the Angaqui- Minlaoi network would predate the later Lepanto-Cervantes- Angaqui network which is wholly shipped via the Abra river. An earlier Lepanto-Apaya and Danac may have also coincided with the Minlaoi- Angaqui before operations became fully riverine.

It is probable that Vigan in tandem with the emergence of other bulk breaking points along the Abra River would have eclipsed other peer settlements like Dumaquaque and Candon. Again, the high density of settlers in the 16th c was shown in Newson’s work (2009). When Vigan emerged as the center it was no longer important to have visibility of the coast what mattered was to establish bulking stations that are along the river and at the same time able to offer services and support (i.e., repairs and supplies) to rafts traversing upriver and downriver.

Future Directions
There is prospect of undertaking research in the lower to middle Abra River, within the
provinces of Ilocos Sur and Abra. The researcher was able to conduct preliminary work on Pandan, Caoayan during the lead-in to the first season of the Ilocos Sur Archaeological Project but the next step is to expand upriver, towards the East, South East, then South along the river---the middle Abra section.

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