Network Centrality Analysis of Kayalıpınar (Samuha) In Late Bronze Age Anatolia: Determinants of An Alternative Capital

by

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ABSTRACT

Network Centrality Analysis of Kayalıpınar (Samuha) In Late Bronze Age Anatolia: Determinants of An Alternative Capital

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This study aims to explore the main advantage of Kayalıpınar (Samuha) in the Old Assyrian and Hittite period) located 55 km west of Sivas, in its emergence as one of the foremost centers of Hittite Anatolia (ca. 1650-1200 BC) across the spheres of administration, religion, military, and trade: One of the most important nodes of the Assyrian Trade Colony network according to its history of holding first a *wabartum* status (small port) and then developing into a *karum* (major port) during the Colony Period, Kayalıpınar (Samuha) became the capital of a major province of the Hittite State, the Upper Land located on the Eastern sections of Central Anatolia. The great king Hattusili III gained power in Kayalıpınar (Samuha) until his victory over king Urhi-Teshup in this very city, followed by his reign over the Hittite throne. The city was associated with the great goddess Shaushga of the Hittite Pantheon, being home to a great temple of the deity acting as a religious education center for the Hittite royal youth. As Anatolian geography is weaved with rivers, mountain ranges, and other smaller geographical obstacles that act as natural boundaries; geography dominated the expansion of power throughout history. Considering the challenges posed by the Anatolian landscape, the research seeks to identify the logistical and geopolitical advantages that drived Kayalıpınar's (Samuha) prominence: The analysis employs calculations of Least Cost Path and the Gravity Model as the foundational elements of network data. Accessibility is approximated through walking distances, while settlement size is represented by archaeological site surface area. Utilizing these datasets, gravity calculations are applied to ascertain the flow between cities. Subsequently, a social network model is constructed based on the gravity values, and four distinct centrality measures (degree, closeness, betweenness, Eigenvector) are computed for the entire network. Through comparative analysis of Kayalıpınar's (Samuha) different centrality values, it has been shown that Kayalıpınar's (Samuha) main advantage was rooted in its betweenness centrality, and the city served as a bridge node.

ÖZETÇE

Geç Tunç Çağı Anadolusunda Kayalıpınar (Samuha)'nın Ağ Merkeziyeti Analizi: Alternatif Bir Başkentin Belirleyicileri

Hanife Nurbahar Kurtlu

Arkeoloji ve Sanat Tarihi, Yüksek Lisans

28 Haziran 2024

Bu tez çalışması, Eski Asur ve Hitit dönemlerinde Samuha olarak bilinen ve Sivas'ın 55 km batısında yer alan Kayalıpınar'ın, idari, dini, askeri ve ticaret alanlarında Hitit Anadolu'sunun önde gelen merkezlerinden biri haline gelmesindeki temel avantajını keşfetmeyi amaçlar: Kayalıpınar (Samuha), Asur Ticaret Kolonileri ağı içindeki en önemli noktalardan biri olarak küçük bir liman olan *wabartum* statüsünden başlayarak büyük liman *karum*a gelişmiştir. Ardından Geç Tunç Çağı'nda Hitit Devleti'nin önemli bir eyaleti olan ve Orta Anadolu'nun Doğu kesimlerinde bulunan Yukarı Ülke'nin başkenti haline gelmiştir. Büyük kral III. Hattuşili, Kayalıpınar'da (Samuha) güç kazanmış ve burada kral Urhi-Teshup'a karşı zafer kazanmış, ardından Hitit tahtında hüküm sürmüştür. Şehir, Hitit Pantheonu'nun büyük tanrıçası Şauşga'ya adanmış olan büyük bir tapınağa ev sahipliği yapmasıyla Hitit kraliyet gençliği için dini bir eğitim merkezi olmuştur. Anadolu'nun coğrafi yapısını belirleyen ve dönemin siyasi güçleri için de doğal sınırlar olarak görülen nehirler, sıradağlar gibi unsurlar göz önünde bulundurularak, araştırma Kayalıpınar'ın (Samuha) önemini sağlayan lojistik ve jeopolitik avantajları belirlemeyi amaçlamaktadır. Analizde, temel veriler olarak En Düşük Maliyetli Yol ve Çekim Modeli hesaplamaları kullanılmıştır. Yürüme mesafeleriyle erişilebilirlik yaklaşık olarak hesaplanırken, yerleşim büyüklüğü ise arkeolojik alanların yüzey alanı ile temsil edilmiştir. Bu veriler kullanılarak, şehirler arasındaki akış çekim hesaplamalarıyla belirlenmiştir. Ardından, çekim değerlerine dayalı bir sosyal ağ modeli oluşturulmuş ve şehirler ağının tamamı için dört farklı merkezlik ölçütü (derece, yakınlık, aradalık, özvektör) hesaplanmıştır. Kayalıpınar'ın (Samuha) farklı merkezilik değerlerinin karşılaştırmalı analizi sonucunda, şehrin asıl avantajının ara durum merkezliğinde yattığı ve şehrin bir köprü noktası olarak önem kazandığı gösterilmiştir.

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ABBREVIATIONS

LCP	Least Cost Path
LBA	Late Bronze Age
SNA	Social Network Analyis

Chapter I:

INTRODUCTION: RESEARCH QUESTION, HYPOTHESIS, METHODOLOGY AND LITERATURE GAP

1.1 Research Question

The city of Samuha has been known from the Hittite and Assyrian tablets long before its localization in 2014. In the Late Bronze Age (1650-1200 BC) it was the city of Goddess Shaushka, Hurrian equivalent of Ishtar, with an important temple for the deity. It served as the administrative center of the Hittite province of Upper Land, even served as the Hittie King's main base during the years Hattusha was under conquest. In the Middle Bronze Age (2000-1650 BC), Samuha was part of the Assyrian Trade Colonies network with first a small port and later a major port. History and significance of Samuha is explained further in Chapter 2. The majority of the literature on the city has been published before its localization, therefore focused on localizing the city. The historical significance of the has been established early in its study (Garstang 1942; Alp 1956; Lebrun 1976; Yiğit 1997).

In this thesis, a Social Network Analysis (SNA henceforth) based on the landscape and the location and size of archaeological sites have been applied to the LBA city of Samuha, localized to Kayalıpınar in Türkiye. Kayalıpınar is an archaeological site located in Sivas in North Central Anatolia, exhibiting dominantly Late Bronze Age (LBA henceforth) although the site has earlier and later findings such as Palaeolithic stone tools and the Byzantine necropolis (Maner 2023). The large size of the mound with 281,242 square meters points to the significance of the settlement even at first glance. The archaeological evidence and geophysical studies support Kayalıpınar's importance with the monumental administrative and religious structures in the earlier years of excavation after the start in 2005 (Müller-Karpe 2007). Localization of Samuha to Kayalıpınar in 2014 allowed better understanding of its structure and significance. The archaeological excavations are yet to illuminate the historical events mentioned in these texts. Based on the textual evidence, it appears that Kayalıpınar (Samuha) was among the most important centers of the LBA Anatolia. Being localized 10 years ago,

the information at hand on the city itself overpowers the information acquired by its localization and excavation. This thesis is an attempt to use the landscape data and location of Kayalıpınar (Samuha) as sources of archaeological data in accordance with the information at hand on the city of Samuha.

Kayalıpınar's (Samuha) significance is understood at the intersection of four different spheres: administrative, economic, religious and military. It is considered to be the capital of the Hittite province of Upper Land and was used as a temporary capital after the conquest of Hattusa by the Kaska groups on the North as discussed later in the thesis. It was among the most important nodes of the LBA Anatolian network. The underlying factors of its long-lasting significance and centrality are presumed to be the logistical advantage and geo-political location. Through this perspective, the main questions of the methodological application are: What was the key advantage of this city compared to the other LBA Anatolian cities? What type of a center it was? What was the most important factor of its centrality?

1.2 Hypothesis

In order to answer these questions, a social network model of LBA Anatolia is constructed. Through this model, the four main types of centrality measures are calculated for Kayalıpınar (Samuha) and compared in standardized value. Each of these four centrality measures (betweenness, closeness, Eigenvector and degree centrality) are based on different advantages in a network which are explained further in chapter four. By a comparative analysis of the standardized centrality values of Kayalıpınar (Samuha) in the network, the aim is to identify the most prominent advantage of this city that made it such a significant center.

Based on what is known by textual evidence, the hypothesis is that the betweenness centrality would be the highest one among four. Higher betweenness centrality indicates that the node functions as a bridge between different clusters in the network. A bridge node receives flow from different and independent sources and has access to variety of flows compared to the rest of the network. Similarly, Kayalıpınar (Samuha) was located between and interacted with different provinces of the Hittite State (Upper Land, Land of Hatti, Lower Land), the Kaska and Azzi-Hayasa lands. The city is also located on the natural routes from North to South and East to West (Fig 1). Based on the logistical

advantages and disadvantages inferred from the textual evidence on Kayalıpınar (Samuha), and the location of Kayalıpınar, the hypothesis is: The betweenness centrality of Kayalıpınar (Samuha) was its foremost advantage, and the city had the characteristics of being a bridge node.

1.3 Methodology

In this thesis, an SNA methodology based on the landscape and the location and size of archaeological sites have been applied to the LBA city of Samuha, localized to Kayalıpınar in Türkiye. Through bringing together SNA and gravity model, a network model of LBA Anatolia has been built and evaluated in comparison to the archaeological evidence together with an application to the specific research question in order to see the potential of the methodology in testing hypothesis and reliability of the results. This methodology has been developed to overcome the limitations in Hittite archaeology such as the proportion of cuneiform tablets yet to be translated, the lack of uniform data from different excavations, lack of open-access data sets, the delays in publications, the uncertainty of Hittite city localizations as well as the high number of sites without Hittite names and cities without matching sites. The significant role of Anatolian landscape in the Hittite governance structure as known from textual evidence is another factor for the choice of methodology.

The overarching limitations of archaeology have been considered, similarly. The fragmented and incomplete nature of archaeological data poses the greatest challenge, one specific case is the high number of archaeological sites in Türkiye which are yet to be excavated. The proposed methodology is aimed to be applied to the vast survey data in the future. Similarly, any relevant site explored can be easily integrated into the model, the methodology allows for quick update in parallel to archaeological emergences.

1.4 Literature Gap

There are only a few examples of SNA applications on Anatolia in the LBA and the Middle Bronze Age which covers the more prominent periods of Kayalıpınar (Samuha). Barjamovic et al. constructed a network model of Assyrian Trade Colonies in 2019 on the Assyrian textual evidence through use of consecutive mentioning of cities as a

relationship index. Although the methodology was strong, the weaknesses of the model were the limited localization of the cities known from tablets and the number of tablets that have been translated. A recent application of SNA to Hittite archaeology is a master's thesis by M. Ali Akman in 2023 where he uses co-occurrence of the toponyms in Hittite cuneiform tablets in order to model and understand Hittite historical geography.

Especially in Hittite archaeology, there has been a tardiness in integration of quantitative and digital approaches. Big data sets which cover the Hittite world are necessary in order to study and understand this first unifying power in Anatolia. Yet it is a challenge to construct these data sets because of the limitations in archaeological evidence and publications as well as the lack of accessibility of archaeological data. Either caused by the foundational limitations in archaeological evidence or the academic culture in Hittite archaeology and slower adaptation to the advances in archaeological method, Hittite historical geography has been studied through a more qualitative approach so far. The main problem of the Hittite historical geography is localization of the cities, rivers, mountains, *huwasi* stones and other features mentioned in the cuneiform tablets. In the future, quantification of the historical geographical data, especially with integration of AI technologies in the next decades, is hoped to resolve these problems in Hittite archaeology and make it possible to model the Hittite world with higher accuracy. This thesis is only a starting point for a network model of the inter-city relations in the Hittite Anatolia and aimed to be improved in the future. Still, another desire of the thesis is to inspire the younger Hittitology and archaeology students to learn more on Social Network Analysis and overcome the fragmented nature of Hittite archaeology in the future through repeated attempts in all-including models.

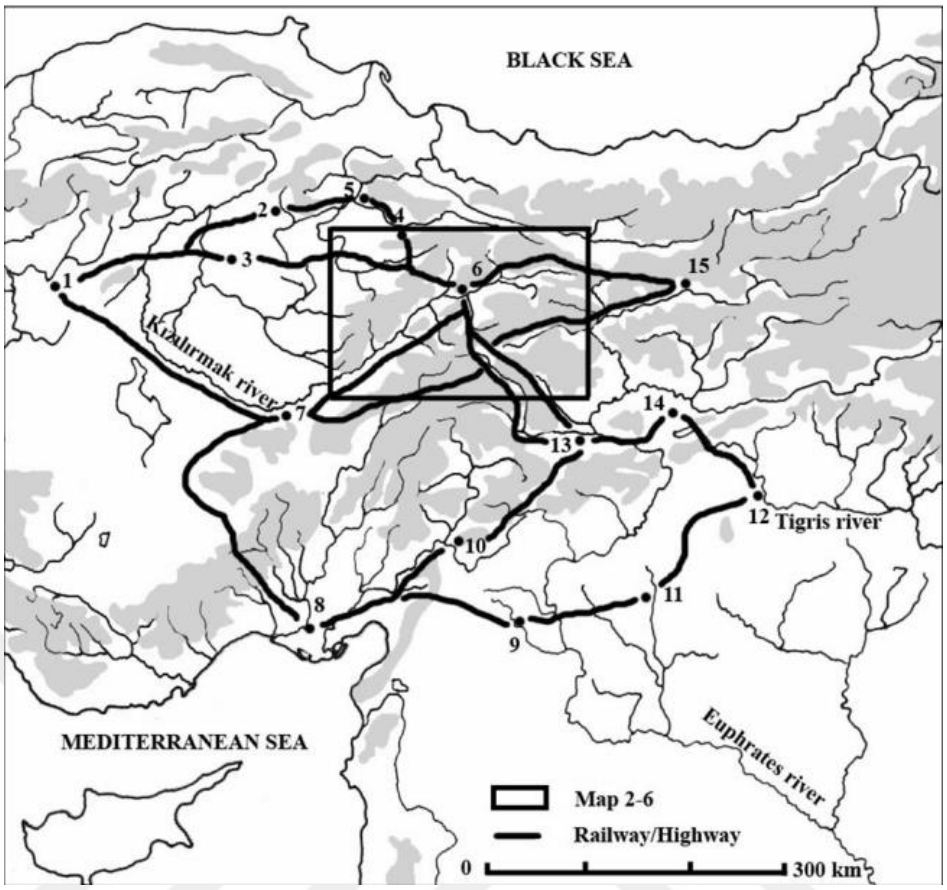

Figure 1: Mountain routes in Central Anatolia, Location of the survey area. 1: Ankara; 2: Çorum; 3: Yozgat; 4: Tokat; 5: Amasya; 6: Sivas; 7: Kayseri; 8: Adana; 9: Gaziantep; 10: Kahramanmaraş; 11: Şanlıurfa; 12: Diyarbakır; 13: Malatya; 14: Elazığ; 15: Erzincan. (Ökse 2007).

Chapter 2:

KAYALIPINAR (SAMUHA): A REGIONAL CAPITAL ON THE RIVER KIZILIRMAK-MARASSANTA

2.1 References to Samuha in Primary Texts

Samuha is a Hittite city among the important cities of the LBA Anatolia. Although the archaeological site is rich and valuable, a great proportion of the academic work on the city was published before its localization in 2014 or even the start of the excavations in 2005. The earliest academic works on Samuha focused on the localization of this important Middle and Late Bronze Age Anatolian city. These publications present a coherent and detailed evaluation of the Assyrian and Hittite cuneiform texts mentioning the city of Samuha. The case of Samuha also presents a good example to compare the textual evidence and archaeological evidence because of this situation. In this section, mentions of Samuha in the Assyrian and Hittite cuneiform texts will be presented and evaluated.

The name Samuha appears earliest in the Middle Bronze Age in the texts from the Assyrian Colony Period. The cuneiform texts mention Samuha first with a *wabartum* and later a *karum* which indicates its significance in the Colony Period and give a basis for its importance in LBA in addition to its logistical advantage (Goetze 1940).

The earliest mention of Samuha in the Hittite cuneiform tablets is in the Telipinu Edict which is the only record of the city during the Old Kingdom Period (Yiğit 1997).

In KBo VI 28 I 11-12, written during the reign of Hattusili III and possibly mentioning the events of the reign of Tudhaliya III, Samuha is mentioned in relation to Azzi attacks. The country is being attack by enemies from all directions. The Azzian enemy conquers many cities of the Upper Land and makes Samuha its border (Goetze, 1940, 21).

In KUB XXXII 133, written during the reign of Mursili II and again mentioning the events of the reign of king Tudhaliya III, Samuha is mentioned with a religious significance. King Tudhaliya III brings the Black Goddess from Kizzuwatna to Samuha and builds a temple there. This event is interpreted as an attempt to protect the goddess from an expected enemy attack to Kizzuwatna during the time (Goetze, 1940, 24).

In KBo XXVI 84 II 8-10, written during the reign of Mursili II and mentioning the works of Suppiluliuma I, we learn that Tudhalia III sent his son prince Suppiluliuma I from Samuha to the land of Hatti which was destroyed by the Kaskan enemy at the time (Güterbock, 1956, 41).

In KBo XIX 11 I 2-18, another text written during the reign of Mursili II, it is told that king Suppiluliuma moves from Samuha to fight the Hayasa and Kaska enemies and brings the prisoners of war back to Samuha (Güterbock, 1956, 62).

Samuha gains further importance during the life of Hattusili III. In KUB I 1 I 24-27, one of the texts that are considered to be the autobiography of Hattusili III, it is told that Hattusili became the commander of the Upper Land during his brother Muwatalli's reign. Hattusili III tells that Arma-Tarhunta, the previous ruler of the Upper Land, revolts against him and fills Samuha with magic. From this text we understand that Hattusili III was in Samuha as the ruler of the Upper Land, which indicates the significance of the city for the province (Güterbock, 1956, 63).

In KUB I 1 III 54-IV 6, another text from the autobiography of Hattusili III, we learn that Samuha played an important role in the fight for the throne between Urhi-Teshup -son of Muwatalli- and Hattusili III. Urhi-Teshup moves from Marassantiya to the Upper Land. In a parallel text Samuha is used instead of Upper Land (Otten, 1981, 19).

Rest of the events is found in KBo VI 29 II 32-35 and KUB I 1 IV 7-40. In these texts it is told that the Goddess Ishtar captures Urhi-Teshup like a pig or a fish. Hattusili lays siege to Samuha while Urhi-Teshup is in the city. With help from the goddess, city walls fall down and Hattusili captures young king Urhi-Teshup in Samuha and sends him to exile (Goetze, 1940, 50). Although this list gives weight to a political and military focus so far, the majority of the cuneiform texts about Samuha has a religious theme.

As mentioned before, a large section of the scholarly work on Samuha so far focused on the localization of this important Hittite city. There are couple of aspects that have considered for this purpose. A starting point is the Upper Land. In two cuneiform texts on the biography of Hattusili III, the expressions Samuha and Upper Land are used interchangeably (Yiğit, 1997, 282).

One of the most important Hittite texts on Samuha's location and significance is a letter which unfortunately cannot be securely associated with a king. In KUB XXXI

79, Samuha is mentioned together with two other cities. Samuha is connected to Pittiyarig and Arziya through a river, yet the river's name is not given in the text. The text tells the transportation of provisions through the river from Pittiyarik to Samuha for soldiers and prisoners of war. It is also mentioned that the water levels are insufficient for the transportation and rearrangements had to be made (Cornelius, 1958, 373). The text also suggests that transportation through this river was not an ongoing practice but rather the solution to an extraordinary situation.

The same text also includes other information on the location of Samuha. A series of attacks from all sides are described. Among these attacks it is written that the Azzian enemy made Samuha its border after conquering the Upper Land. The Azzi are located roughly to the North-Eastern Anatolia. Since the Upper Land stands between the core of the Hittite state, the Land Hatti, and the Azzi lands it could also be suggested that Samuha is on the closer end of the Upper Land to the Land of Hatti. Following these Hittite accounts, it is suggested that Samuha was the capital, or the main center, of the Upper Land.

A letter from the Assyrian Colony Period, the TC 10, includes a road description mentioning Samuha. In the letter it is written to go to Tilimra in case the journey is not towards Kussara and Samuha. Bilgiç infers from this text that Samuha's location should not be far from Boğazköy and it should be towards the east of Boğazköy region and the city of Kussara (Bilgiç, 1946, 393).

It has already been mentioned that the Black Goddess was moved from Kizzuwatna to Samuha in order to protect the deity from the Armanata attacks on Kizzuwatna. From this text we understand that Samuha must be at a safe distance from Kizzuwatna. And considering that Kizzuwatna is located on the south parts of Anatolia.it would be possible for Samuha to be on the northern parts Anatolia. Another suggestion made by Yiğit is that Samuha should be distant but also connected to Kizzuwatna (Yiğit, 1997, 284).

During Tudhaliya III's reign after Arnuwanda, the northern parts were again under attack but this time by both the Kaska and the Azzians. The Azzians conquered the Upper Land and made Samuha their border. (Collins 2007, 45). This was especially a difficult period for the Hittite kingdom and as a result the capital Hattuşa was left for a safer location, which might be Samuha. From Samuha Tudhaliya III and his son Suppiluliuma conquered Anatolia again. They pushed back the Kaska and the Azzi-

Hayasa in the north and north-east. Although many cities were re-captured, fortified and re-settled, Tudhaliya III spent the rest of his reign in Samuha until his death. (Collins 2007, 46)

In KBo VI 28 it is told that Azzians attacked the Upper Land and made Samuha their border during the reign of Tudhaliya III (1360–1344 BC) (Goetze, 1940, 21). Based on this statement it is concluded that Upper Land was between Azzi-Hayasa and Hatti lands. Similarly, since Suppiluliuma I brought the war booties from Azzi-Hayasa and Kaska to Samuha, it is suggested that Samuha was a base for military campaigns on these groups in the north and north-east (Murat 1998, 176).

Another source of information on the localization of Hittite cities are the city lists. In these city lists it is accepted that the names are listed based on a geographical order. One specific list of this kind shows Samuha right after the name of Sarissa. Although the exact context of this letter is not known, Yiğit suggests that these two places could be geographically close (Yiğit, 1997, 284). Considering the fact that Sarissa has been identified as the site of Kuşaklı in Sivas, it would be plausible to expect Samuha to be in the Sivas region.

Considering all the evidence, scholars who studied and discussed localization Samuha mainly focused on two areas: upper Kızılırmak (ancient Halys), and upper Euphrates. Yiğit concludes in favour of the upper Kızılırmak area (Yiğit, 1997, 287).

2.3 Samuha as a Center

Based on the information that have been provided above, it is suggested that Samuha was a four-fold center in the spheres of military, administration, religion and economy.

Military Center: As the capital of the Upper Land, Samuha played a pivotal role as a garrison of the crucial buffer zone between the Hittite core territory and northern enemies like the Kaska, as well as eastern enemies such as the Azzi-Hayasa. Military campaigns towards East and North were launched from Samuha. Hence, the city served as a strategic starting point and logistical hub for expeditions against these enemies. Soldiers from throughout the Upper Land gathered in Samuha to form armies that marched south to engage in various fronts. We also know that Hattusili III used his power as the commander of the Upper Land and the ruler of the city of Samuha to make

a coup d'etat on his nephew. When the young king came to the city to defeat Hattusili III he failed which illustrates the power of the city's defenses. This strategic positioning and military function underscores Samuha's importance in defending the Hittite power and expanding its influence through military conquests.

Economic Center: Samuha emerged as a significant economic center during the Assyrian Trade Colonies period, initially as a *wabartum* and later evolving into a *karum*. Its strategic location facilitated extensive trade networks that connected Anatolia with Mesopotamia and beyond. The city's economic significance persisted into the LBA, supported by archaeological findings and textual evidence revealing trade agreements between Hittite rulers and neighboring tribes like the Kaska, which ensured access to Samuha's markets. This economic role contributed to the city's prosperity and importance in regional commerce.

Administrative Center: As the administrative capital of the Upper Land, Samuha played a crucial role in governance and bureaucracy. The city housed government officials who administered laws and maintained written records, including royal decrees and administrative documents. The rich archive of bullae and tablets is in accordance with the monumental administrative building that have been discovered in the excavations. The city's administrative functions were integral to the Hittite Empire's governance structure, demonstrating its organizational importance within the broader political framework.

Religious Center: Religiously, Samuha was associated with the goddess Shaushga (Ishtar), as evidenced in cuneiform texts and mentions of a great temple dedicated to her worship. The city served as a significant religious center where important festivals were held, and it was included in the annual pilgrimage routes of Hittite kings and queens. Additionally, Samuha played a role in the education and training of Hittite royal heirs, emphasizing its cultural and religious importance in shaping dynastic succession and religious practices within the Hittite realm. Hattusili III's role as a priest of this goddess of war and love played a significant role throughout his career.

Logistical Advantage: Samuha's centrality in military, economic, administrative, and religious domains underscore its overall logistical advantage in LBA Anatolia. Its strategic location facilitated trade and military expeditions, while its administrative functions ensured efficient governance. Additionally, Samuha's religious significance

added cultural richness, influencing both religious practices and royal traditions. The city's multifaceted role highlights its importance as a junction of activity and influence in the ancient Anatolian landscape, contributing significantly to the broader dynamics of the Hittite Empire's expansion and governance strategies.

2.2 Archaeological Excavations at Kayalıpınar (Samuha)

The ancient city of Samuha has been located as the archaeological site of Kayalıpınar in Yıldızeli, Sivas in Turkey. Kayalıpınar is situated 1.8 km east of Kayalıpınar village in Yıldızeli district, Sivas province, and 420 m north of the Kızılırmak river (Figure 2). This settlement, formed on a natural elevation, has been repeatedly inhabited from the Epi-paleolithic Period (ca. 20.000-9.000 BC) to the Seljuk Period (11-14th centuries AD), as evidenced by findings on the surface and during excavations. The settlement area covers about 40 hectares. Kayalıpınar was officially registered as the Kayalıpınar Ruins Site (Ören Yeri) by the Kayseri Cultural and Natural Heritage Preservation Regional Board on December 22, 1990. In early publications, it was referred to simply as Kayalıpınar, a name that has since been consistently used (Maner 2023).

The first excavations on the site began in 2005. The excavations were directed by Dr. Vuslat Müller-Karpe and funded by Marburg Philipps University until 2020. Over the fifteen years from the beginning to the end of this excavation series many significant findings have been made one of which is the Hittite cuneiform tablet that provided the evidence for localization of Samuha to Kayalıpınar in 2014 (Maner 2023).

Figure 2: Kayalıpınar archaeological site and Kızılırmak (Marassanta) (retrieved from Google Earth on 06/17/2024 17:00).

Kayalıpınar's significance as a major center around the 2nd millennium BC was recognized through the "Sivas Province Surface Survey" conducted in the 1990s. The initial excavation campaigns took place between 2005 and 2009 under the supervision of Sivas Museum Directorate and Dr. Vuslat Müller-Karpe from Marburg University. In 2013, excavations were resumed by Sivas Museum Directorate and Assoc. Prof. Dr. Bora Uysal from Cumhuriyet University. The third phase of excavations occurred from 2014-15 to 2017-2019 under the leadership of Dr. Vuslat Müller-Karpe from Marburg University. The fourth phase of excavations began in 2021 under the direction of Assoc. Prof. Dr. Çiğdem Maner from Koç University, Department of Archaeology and Art History (Maner 2023).

Due to the expropriation of two parcels within the 1st degree conservation area, excavation activities have been limited to these two parcels, located on the southern side of the settlement. Previous excavations by amateur archaeologists uncovered graves from the Hellenistic, Roman, and Late Antique periods, administrative structures from the Hittite period, and buildings from the Old Assyrian Trading Colony period (Maner 2023).

During the 2014 and 2015 excavation seasons, cuneiform tablet fragments were discovered, confirming Kayalıpınar's identification with Šamuha mentioned in Old Assyrian and Hittite sources. These tablets refer to the dispatch of cult inventories for three deities of Šamuha (Rieken 2019). Associating Kayalıpınar with Šamuha not only confirms its presence in the Old Assyrian Trading Colony period tablets found at Kültepe but also highlights its significance beyond the Hittite period. It served as a trade and religious center during the Old Assyrian Trading Colony period and as one of the capitals and major religious centers of the Upper Land during the Hittite period (Maner 2023).

There are few archaeological excavations on the Hittite Upper Land. Kuşaklı (Sarissa) and Kayalıpınar (Samuha) are two of them. Andreas Müller-Karpe, the head of excavation in Kuşaklı and assistant to the head of excavation in Kayalıpınar, gives a detailed summary of the archaeological research in Kayalıpınar starting from 2005 in his article “Recent Research on Hittite Archaeology in the Upper Land”. The geophysical survey illustrated that the site has many levels and structures from different periods. On the surface sherds from Chalcolithic and EBA were found. During the excavations on the southeastern hill, two public buildings from the Hittite Kingdom and

a domestic structure from Early Hittite period between them were found. The Early Hittite periods correspond to layers 5 and 6. The domestic architectural remains and pottery from the level 5 are very similar to the ones in Kültepe (Kanesh) (Müller-Karpe 2009, 109).

Level 4 and 3 also indicate destruction. At level 3 in building B, there are clay bullae with seal impressions and cuneiform tablets from the Middle Hittite period. There are also examples of big pithoi similar to the ones in the big temple of Boğazköy. Their sizes and the marks on them indicate that they were used to collect goods on a public level to be redistributed later. These findings show consistency with the central role of Kayalıpınar (Samuha) as an administrative and religious center for the Upper Land as discussed above (Müller-Karpe 2009, 111). The thirteen seal impressions on bullae from level 3 are discussed in detail. Nine of them have Anatolian hieroglyphic writing while the rest has cuneiform writing. One of them is a biographic seal impression. The name Kantuzzili and the title "Commander of the Royal Bodyguard" are readable on it (Müller-Karpe 2009, 112).

Considering the various Kantuzzilis in Hittite history, Müller-Karpe concludes that this individual must be either uncle or brother of Suppiluliuma I and dates it to between 1390 BC and 1344 BC. This is the "concentric invasion" when many lands were lost to various enemies from all sides, during the reign of Tudhaliya II/III. The Azzian attack to Upper Land and capture of Kayalıpınar (Samuha) in this period has already been discussed above. The burning and destruction in level 3 corresponds with these historical events. The cuneiform seal impressions belong to Tawanannas. Especially one them has the word twice which was interpreted as Queen Tawananna, the third wife of Suppiluliuma I, by Thomas Beran and Bin-Nun. On the other hand, other examples of the similar case have been found in Kayalıpınar and it is possible that these seals were anonymous in general. They only indicated the royal office rather than individuals. (Müller-Karpe 2009, 113).

Kayalıpınar-Šamuha, due to its location on the northern bank of the Kızılırmak (Maraššanta/Halys) river about 45km southwest of modern Sivas, developed uniquely. The area's wide, fertile plain made it ideal for agriculture and easy transport, attracting settlers since around 5000 BC. The heart of the Hittite city formed around an ancient mound called the South-Eastern Hill, where artifacts from ancient times have been found. During the Middle Bronze Age, the city expanded north and east, showing well-

planned, rectangular architecture. Excavations have uncovered evidence of active trade, including Assyrian documents mentioning Anatolian merchants and various clay sealings. This highlights Kayalıpınar-Šamuha's role in the Assyrian trading network, evolving from a minor outpost to a significant trading center, as noted in texts from Kültepe (Müller-Karpe 2017).

Unlike Kültepe and Acemhöyük, which were abandoned after being sacked, Kayalıpınar continued to thrive during the early Old Hittite Kingdom. The district of South-Eastern Hill underwent a significant change: Early Hittite houses were replaced by a palace complex consisting of at least three interconnected buildings (A–C) during level 4. Building A, strategically positioned overlooking the river valley, featured massive walls and a grand staircase, indicating its importance. Sculpted limestone blocks adorned the entrance, depicting a seated goddess and possibly the Great King. Buildings B and C served more practical purposes, likely including a royal seal house and estate buildings (Müller-Karpe 2017).

During the Middle Hittite Period, the palace complex was destroyed by fire, possibly due to an earthquake. Despite this disaster, urban development continued, and the palace was promptly rebuilt with minor changes. This reconstructed phase (level 3) ended in another fire following systematic looting, likely due to hostile conquest during the reign of Tuthalija II/III. This period witnessed the invasion of Azzian enemies, leading to the destruction of Šamuha and nearby Šarišša (Müller-Karpe 2017).

Despite these setbacks, Šamuha was quickly rebuilt and briefly served as a royal residence. A new palace (Building D, level 2) was erected next to the old complex. However, like many Hittite cities, Šamuha met its final end around the end of the 13th or beginning of the 12th century BC (Müller-Karpe 2017).

Unlike Kayalıpınar, other Hittite cities in the region have not been extensively excavated. Limited explorations in modern-day Sivas at Topraktepe and surveys elsewhere suggest that sites like Kalkankaya and Gökdin Kale may be comparable or larger than Šamuha, with Gökdin Kale potentially identified as Pitiyarik, closely linked to Šamuha in historical texts (Müller-Karpe 2017).

Chapter 3:

LATE BRONZE AGE ANATOLIA: THE HITTITE HISTORICAL GEOGRAPHY

The Hittite archives, comprising about 30,000 cuneiform tablets spanning roughly 500 years from 1650 BCE to the mid-12th century BCE, offer abundant geographical insights. These records originate from the Hittite heartland near the Kızılırmak River and extend across their vast empire in Anatolia, Syria, and Mesopotamia. They include numerous place names, descriptions of landscapes, and other geographical details, making historical geography a central focus in Hittite studies (Gerçek 2018).

Scholars have worked to match Hittite place names with archaeological sites and later classical references to locate towns and regions accurately (Figure 3). Recent research has introduced new methods from fields like political geography and landscape studies. However, there's still much to learn about how Hittite elites perceived their world, homeland, and foreign lands, and how they gathered and conveyed geographical knowledge. The archives primarily reflect the perspectives of the ruling class, and these perspectives likely evolved over the centuries covered by the documents. Despite challenges in analyzing diverse and scattered evidence, ongoing studies aim to deepen our understanding of Hittite geographical concepts and practices (Gerçek 2018).

3.1 The Land of Hatti

The "Land of Hatti" constituted the heartland of the Hittite Empire, centered around their capital Hattusa in central Anatolia. Although its exact borders were not precisely defined in Hittite sources, it generally encompassed the region surrounding the Kızılırmak River basin. This territory, known to the Hittites and their contemporaries as the Land of Hatti, was distinguished from neighboring regions such as the Upper Land, Kaska, Lukka, and Arzawa in Hittite administrative and religious texts (Gerçek 2018).

The Hittites revered their boundaries and roads as sacred, considering them part of the domain of their chief deity, the Storm-God. Any encroachment on these boundaries was viewed as a serious offense, requiring rituals to appease the gods. Safeguarding these frontiers was a fundamental duty of the Hittite kings, underscoring

the importance of maintaining territorial integrity. Despite these idealized views, the actual boundaries of the Land of Hatti were fluid, especially in peripheral areas where Hittite control was less stable. This led to political fragmentation and pockets of autonomy beyond direct Hittite rule. Religious beliefs also shaped the Hittites' perception of their homeland, considering it the sacred domain of their gods where rituals and offerings were conducted exclusively. This connection to their land is reflected in archaeological findings showing extensive settlements and religious activities throughout the core territory of the Hittite Empire, highlighting its central role in shaping their identity and governance (Gerçek 2018).

3.2 The Upper Land

Hittite Upper Land, like the Lower Land, is a peripheral region of the Hittite Empire which was constructed as buffer zone and gained importance through time. As war was the usual state for the political entities of Anatolia in the LBA, Upper Land had its share of attacks and military campaigns. The city of Samuha, the administrative center of the unit, acted as the main capital for a period of time. People risked their lives in order to be the governor of the Upper Land. Hattusili proved that the region was so important that having power over it could make one the great king. In this section, the literature on the Upper Land will be presented and examined from different perspectives such as political history, textual evidence, archaeological research, and geography and localization.

One of the most important groups of people on the Northern Anatolia were the Kaska people. Information on Upper Land in Hittite texts is usually linked to references to the Kaska people. Kaska people were not a state in political unity but a group of tribes that lived in the mountainous Pontic region. The first appearance of Kaska people in the texts is during Hantili II's reign. The text mentions that the king extended Hattusa's Lower City's fortification in an attempt to prevent Kaska attacks (Collins 2007, 42).

According to the Maşat letters, during the reign of Tudhaliya II the Kaska attacked the northern borders when the king was in Arzawa lands. Tudhaliya II was able to answer the attacks and push the Kaska out of Hittite territories (Collins 2007, 43).

After Tudhaliya II, during the reign of his son-in-law Arnuwanda, Kaska were again threatening northern the borders. They attacked many holy cities and took many of their people such as the gardeners and the priests. This was a serious damage to the cultic centers and activities in those lands. Arnuwanda's response included diplomacy, and he made a treaty with them (Collins 2007, 44). A result of this treaty was permission to trade with the Hittite cities to the tribes who were in the treaty (Hoffner 2002 ,5).

After Suppiluliuma, during the reign of Mursili II, Kaska tribes were organized under Pihhuniya and once again, the north was under attack. Azzi-Hayasa conquered the Upper Land again (Collins 2007, 51). Even though it was not a final resolution with the Kaska, in his later years Mursili II managed to take Nerik back after 200 hundred years of Kaska rule (Collins 2007, 52).

The city of Samuha was an administrative center with a royal storehouse as well as a cult center with many sanctuaries dedicated to Shaushga, storm god, mountain and river gods and other deities (Collins 2007, 46). Later, Muwatalli applied a new strategy to protect the northern parts. Kaska was being defeated but none of these victories were final. Muwatalli's brother Hattusili had governed and protected the Upper Land already. So, Muwatalli assigned him as the king in Hakpis and all the northern parts of the kingdom was given to him while he was in Tarhuntassa in the south, to go to war with Ramesses II. Hattusa was given to another trustee of Muwatalli, one of his officials Mittannamuwa. Although there were conflicts between Hattusili and Mittannamuwa, Hattusili managed to rule over and protect the whole north with the help of his patron deity Shaushka of Samuha (Collins 2007, 54).

The previous governor of the Upper Land, Arma-Tahunda, was unhappy with the situation and organized a revolt against Hattusili when he was Aba for a battle. Arma-Tahunda brought charges, Hattusili was judged by the "divine wheel" and by Muwatalli. In the end Hattusili stayed and Arma-Tahunda was exiled to Cyprus. Later, Muwatalli's son Urhi-Teshup became the king and used the name Mursili III. Hattusili was too powerful and took the throne from his nephew in a few years with a civil war (Collins 2007, 56). The fight took place in the Upper Land. Arma-Tahunda's son supported Mursili III with his troops. Hattusili on the other hand used the Kaska tribes he had connections with. Mursili III retreated to Samuha and Hattusili sieged it. In the end Hattusili became the great king of Hittites (Collins 2007, 59).

Even when the Hittite state ended Kaska were active in the destruction of Hittite cities withing the Halys basin such as Alaca, Alişar, Maşat, Kuşakli and Karaoğlan (Collins 2007, 80). In this period they were finally able to move into the Central Anatolia.

In her work, Leyla Murat examines the mentions of Upper Land in detail. She refers to very names such as Goetze, Garstang-Gurney, Alp and Forlanini who are very important names for Hititology. One of the most important texts to learn about Hittite Upper Land is the Maşat letters. We learn that soldiers were requested from the Upper Land along with a list of other place names such as Sakaddunuwa, Sanahuitta, Tupazziya, Lawazantiya, Isuwa and İshupita. This list indicates that all of these places were separate units of administration. Tudhalia III mentions the Upper Land and Ishupita separately; but biography of Hattusili III later indicates that the latter was part of the former (Murat 1998, 175).

In Mursili's annals it is told that the Kaska cities of Ishupita and Durmitta were being problems. Similarly, Tipiya was being an enemy and Mursili beats the Tipiya by going to the Upper Land. A few years later Pihhuniya, king of Tipiya, attacks and captures the Upper Land including the city of Zazzisa (Murat 1998, 177). Pihhuniya has already been mentioned above. He was also a Kaskean who united the Kaska people and expanded the borders of the Kaska state.

In KBo VI 28 it is told that Azzians attacked the Upper Land and made Samuha their border during the reign of Tudhaliya III. Based on this statement it is concluded that Upper Land was between Azzi-Hayasa and Hatti lands. Similarly, since Suppiluliuma I brought the war booties from Azzi-Hayasa and Kaska to Samuha, it is suggested that Samuha was a base for military campaigns on these groups in the north and north-east (Murat 1998, 176).

There also some locations that are "descended to" from the Upper Land. For example, Tudhaliya III descends from the Upper Land to Zithara. Again he goes to Hulana and Kasiya to protect them from Masa and Kammala enemies by "descending" from the Upper Land (Murat 1998, 177). Goetze, Garstang-Gurney and Yakar conclude that İstitina and Zazzisa were part of the Upper Land while Tipiya was on the border (Murat 1998, 178). Again, in Mursili's annals it is told that Azzi-Hayasa attacked the Upper Land via Kanuvara and Istitina. In this description it is not certain if Istitina was part of the Upper Land or on the border of it. There are different opinions on this matter.

Del Monte-Tischler and Forlanini support the first idea while Goetze and Garstang-Gurney support the second one. Still, there is an agreement that Azzi-Hayasa was a border neighbor of the Upper Land (Murat 1998, 178).

The autobiography of Hattusili III is also very important text to understand the Hittite geography. It has been mentioned above that Hattusili was assigned the governor of the Upper Land by king Muwatalli while he was in the Lower Land. Dinçol interprets this as a political division of the state during this period. There is a list of places that Muwatalli assigns to Hattusili III: Ishupita, Marista, Hissahapa, Katapa, Hanhana, Darahna, Hattena, Durmitta, Zippalanda, Pala, Tummana, Kassiya, Sappa, Hulana river, Hakmis and Istahara. Goezte asserts that these places must be parts of the Upper Land (Murat 1998, 179). Lastly in this text Upper Land and Samuha are used interchangeably about the war between Urhi Teshup and Hattusili III. This is evidence of the administrative importance of Samuha for the Upper Land (Murat 1998, 179).

In two cult texts, KUB II 1 and KBo XI 40, it is mentioned that Tudhaliya went on hunting in all mountains and rivers of the Upper Land. Archi interprets that there were a lot mountains and rivers in Upper Land some of which are unknown to us. The rivers Mala, Mammaranta, and Gurmaliya must in the Upper Land (Murat 1998, 180).

The significant text that helped localization of Samuha, KUB XXXI 79, is a letter that tells a delivery of food supplies between from Pittiyarik and Arziya to Samuha via the river (Cornelius, 1958, 373). In the last decade it has been discovered that Samuha was located on the coast of Marassantiya (Kızılırmak) and is at Kayalıpınar in Sivas today. Garstang-Gurney comments that Pittiyarik must be on upper parts of Marassantiya while Arziya is below Samuha between Zara and Sivas (Murat 1998, 181).

The earliest mention of the Upper Land in Hittite texts is in Maşat letters. Maşat was the city of Tapikka in upper Yeşilirmak valley, which played an important role in defence against Kaska attacks during Tudhaliya III's reign. According to a text from Hattusili III's reign, the earliest attacks on Upper Land were also during Tudhaliya III's reign; it was plundered by Azzi-Hayasa. According to texts of Suppiluliuma, he brought war booties from Kaska and Azzi-Hayasa to Samuha which was the administrative center of the Upper Land (Murat 1998, 182). When Mursili was in Kizzuwatna, Upper Land was assigned to Nuwanza temporarily. Azzi-Hayasa attacked again and Nuwanza managed to prevail although difficultly (Murat 1998, 183).

Muwatalli permanently moved the capital to Tarhuntassa for its strategic advance in the campaigns towards south-east. During this period, Muwatalli's brother Hattusili was assigned GAL MESEDI and governed the Upper Land while Hattusa was assigned to the Muwatalli's official Mitannamuwa Murat comments that especially during this period Upper Land was more than a buffer zone for the Kaska and Azzi-Hayasa enemies and it became a significant part of the Hittite Empire. The previous governor of Upper Land was found guilty of puting dark magic on Samuha and Hattusili. This is not the only time Hattusili fought with another member of the royal family; what happened during and after this period has been discussed above (Murat 1998, 184). As Hattusili was successful in his battles with the Kaska and his helps with the Kadesh war, Muwatalli assigned him the king of Hakmiş (Murat 1998, 185). A text from the reign of Hattusili III tells that after him his son Tudhaliya IV was the governor of the Upper Land, Pala and Tummana.

Murat concludes that Upper Land was a buffer zone to protect Hattusa and other cities at the core of the Hittite state. As the attacks from north and north-east got more and more important, the significance of Upper Land increased through time. Finally, Hattusili managed to develop this part of the empire in order to pave his way to be the great king (Murat 1998, 186).

Müller-Karpe covers a wider range of archaeological sites related to the Hittite Upper Land. He discusses rock reliefs, settlements, temples, sanctuaries, fortifications and roads based on material evidence. Unfortunately, Müller-Karpe indicates that the borders of the Upper Land have not been clearly defined geographically; and he does not attempt doing that. Still, all the locations and archaeological evidence he discusses will be represented here (Müller-Karpe 2017).

In addition to Kayalıpınar, Müller-Karpe discusses Kuşaklı (Sarissa) in detail in this article. As for the rural sites, Tepecik, Norşuntepe, Korucutepe are important examples all in Altınova. Sarissa is located on a high valley in Altınyayla plateau. Unlike most Hittite settlements, this city was founded from scratch as an administrative center by the authority in 16th century during the Old Hittite period (Müller-Karpe 2017, 60). It was oriented in northwest/southeast and northeast/southwest directions. The settlement had both domestic and public areas with houses, temples and other administrative buildings. There are several occasions of destruction by earthquake and by enemy attacks. Lastly, around 1200 BC, the city was attacked again in a final way. Most of the people were

killed or left the city. Very few of them spent a couple of decades after this destruction before Sarissa was abandoned completely (Müller-Karpe 2017, 61).

Kayalıpınar and Kuşaklı are the only Hitttie cities in the Upper Land that are excavated. Other known locations are Topraktepe, Kalkanya, Su Tepesi, Kahvepınar and Gökdin Kale, all in Sivas (Müller-Karpe 2017, 62). The three settlements on the Altınova area in Elazığ (Korucutepe, Tepecik and Norşuntepe) indicate a hierarchical relationship with their locations in relation to each other. Müller-Karpe compares this to Altınyayla in Sivas and suggests that Sarissa might be the center of this type of a hierarchy with close settlements (Müller-Karpe 2017, 63).

Hittites built dams to collect water for irrigation needs because of the unstable rainfall conditions in Anatolia. There six dams known near Sarissa. Karakuyu is another example in the Upper Land. It also has an inscription for Tudhaliya IV (Müller-Karpe 2017, 63).

Müller-Karpe touches upon the archaeobotanical findings from Korucutepe and Sarissa, too. Barley and various sorts of wheat, lentils and peas were found in these studies. The wide variety of grain types are interpreted as a caution against crop failure and famine which were not extraordinary for the geography. There are also large silos to collect grains publicly as well as privately. On the archaeozoology part, the common farm animals were sheep with 60%, goat with 10-20% and cattle with 25% (Müller-Karpe 2017, 64).

It is important to highlight that there are two excavated settlements so far: Kayalıpınar and Kuşaklı. Many other sites have been examined during surveys and magnetometry studies. Some sites are fortification walls, some are dams and ponds, and some are sanctuaries. There also many rock carvings that indicate routes and possibly political borders but unfortunately their interpretation in this manner is not reliable yet. The stratigraphies, tablets, seal impressions, pottery and other small findings are very important to piece together the details of the Hittite history which we know from the tablets interpreted so far.

Upper Land's name points to the fact that it covers an area of elevated plateaus and mountains as well as the upper Kızılırmak region. This illustrates how important it is to examine the geographical conditions to understand this part of the Hittite Empire. Many places have been discussed without their specific localization so far. It has been stated

that, especially for administrative areas with liquid borders over time such as the Upper Land, it is not easy to define their place on the map.

One of the most important groups of people for Upper Land is the Azzi-Hayasa People to the North East or East of Upper Land. Serkan Demirel focuses on Azzi-Hayasa in his 2017 paper (Fig. 3). Azzi and Hayasa are written as cities (URU) and countries (KUR URU) on different occasions in the cuneiform tablets. Hittite sources on this country are from especially the 14th century. The first appearance of Azzi-Hayasa in texts is about their capture of the Upper Land, which indicates their importance for this half of the kingdom. One of the most important sources to localize it is Musili II's annals with details of which cities the Azzi and Hayasa attacked. There are varying opinions on the location of the country. Forrer puts it in East Anatolia, Goetze suggests that it is on the north of Isuwa Land, Ünal suggests the southeast of Upper Land, Garstang points at Giresun and Houwink ten Cate suggests between Amasya and Black Sea coast (Demirel 2017, 98). These ideas are examined through the article one by one. In the end this map is proposed:

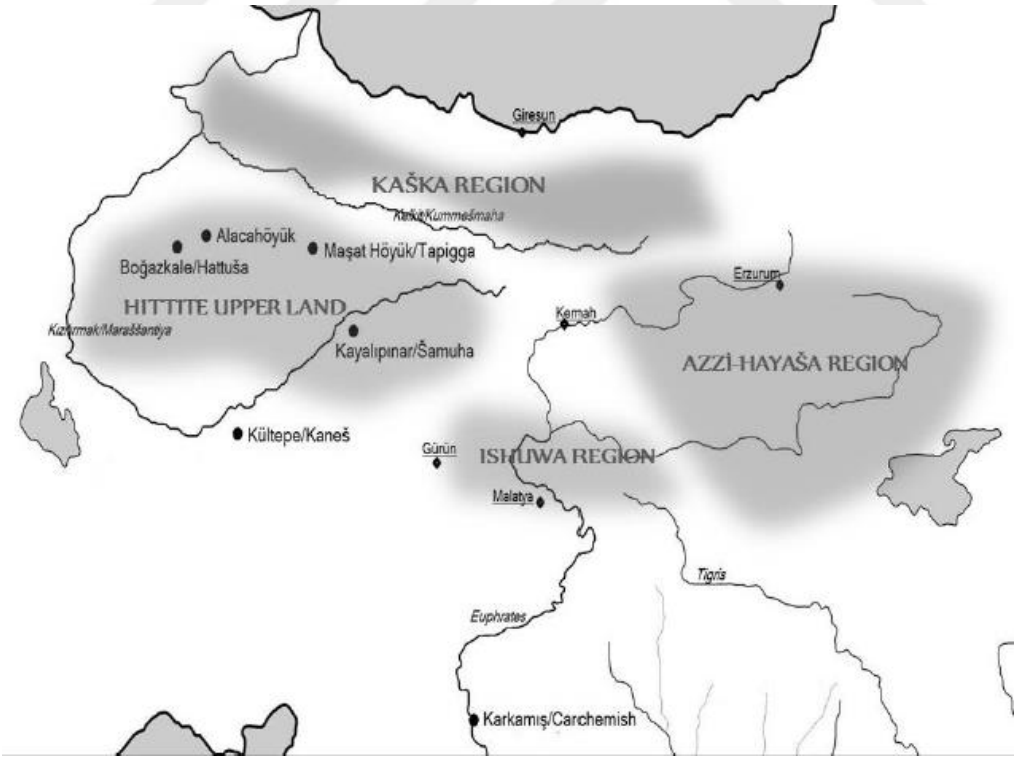

Figure 3: North-Central Anatolia in LBA (Demirel 2017).

Leyla Murat focuses on the Kaska and their localization. Mayer-Garstang and Hrozny located the Kaska between upper Kızılırmak and upper Euphrates. Forrer located them between Yeşilırmak and Çekerek rivers (Murat 1998, 435). On the contrary, Cavaignac suggests that Kaska were in the west between lower Kızılırmak and the Aegean Sea. Goetze's initial idea was similar. He put Kaska between Arzawa and Hatti regions. Later he suggested between Sinop and Ordu on the north, like Garstang-Gurney and Forlanini. Schuler suggests that there were three separate groups of Kaska on three regions: north of Gökırma-Devrez area, between Kızılırmak and Lower Çekerek, and north of Çorum Mecitözü and Kelkit bournes. It is widely accepted that the Kaska had borders with Azzi-Hayasa on the east, Upper Land on the south and Pala-Tummana on the west (Murat 1998, 436). Pala is located between Osmancık and Saraycık, Tummana is located in Kastamonu. (Murat 1998, 440). These suggestions are based on cities, rivers and mountains that have been localized in the past.

There are certain differences between the three maps presented here. Especially, Demirel's map seems to have errors about Kızılırmak and Yeşilırmak. Therefore, it is important to look at these maps in comparison to a recent geographical map with high accuracy. Another important detail is to understand the different landscape that Azz-Hayasa, Upper Land and Kaska are located on.

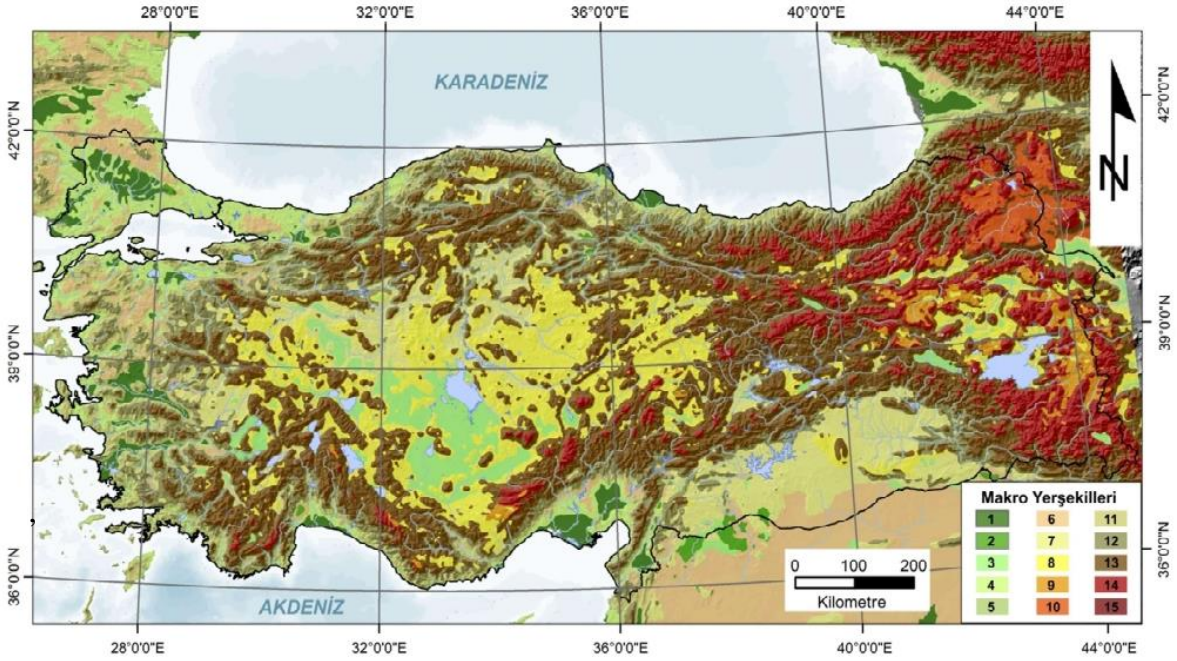

Figure 4: Anatolian topograpy (Cürebal 2020, 55).

As we can see in Figure 4, east and northeast of the Upper Land are strikingly more mountainous than the other regions in discussion. Placing the Azzi-Hayasa and/or Kaska on these regions would imply consequences for economic and political characteristics of these groups.

Was the whole Kızılırmak basin part of the Upper Land? Which mountain lines were the Kaska controlling? There are so many mountains in a small area: Canik Mountains, Köse Mountains, Sakarat and Yaylacık Mountains, Giresun Mountains. Did the Upper Land cover the Upper Seyhan and Ceyhan regions? Overall, all these maps seem to correspond with each other generally. It is no surprise that the people of these three neighbouring regions (Kaska, Azzi-Hayasa and the Upper Land) had conflicts with each other. What is surprising to see is that these enemies are what made the Upper Land itself: exactly because of the Kaska and Azzi-Hayasa attacks Upper Land became so strong and important. Hattusili II should be mention especially in his efforts to defend and improve the Upper Land.

Flora, fauna, geographical formation, climate, underground resources such as stone and metal deposits, natural routes, and other indirect implications of these are crucial to understand the Upper Land fully. An extensive study of the localization and geography of this region, or the administrative unit, of the Hittite lands seems to be essential for future studies regarding the Upper Land and its cities. Without a detailed study of the geography, it would be impossible to study the economy, trade, agriculture, religion and military campaigns of this land in a comprehensive sense.

Overall, the Hittite Upper Land was founded as a buffer zone for the continuous enemy attacks from the north and northeast sides of the Hittite borders. On several occasions these attacks got very serious: Crucial cities including the capital had been occupied. Many state officials and local people were captured, temples were disturbed, cities were destroyed and plundered. Upper Land served as a center to respond to these attacks.

Through time Upper Land's significance increased. At some point Samuha acted as the capital when the king resided there permanently. Upper Land became a rival to the central Hittite power when Urhi-Teshup and Hattusili went to war. And the winner was the Upper Land. As the different perspectives to the historical events can be enlightening; it might be helpful to take Upper Land as a closed entity separate from the rest of the country, in its relationship to the Hittite Empire.

3.3 The Lower Land

During the LBA, specifically during the fourteenth and thirteenth centuries BCE, the Hittite Lower Land, referred to in Hittite texts as KUR ŠAPLĪTI, emerged as a significant political entity in South-Central Anatolia. This region encompassed extensive territories, including large sections of the fertile Konya plain and the foothills of the central Taurus Mountains. While the precise boundaries of the Lower Land are not explicitly given in Hittite records, its geopolitical importance is underscored by its inclusion in the Hittite administrative framework and its strategic role within the empire (Matessi 2018).

The designation "Lower Land" (KUR ŠAPLĪTI) likely stemmed from Hittite administrative terminology, indicating possibly its lower elevation compared to the surrounding areas. This administrative categorization is indicative of the Hittite efforts to manage and control territories through organized governance structures (Matessi 2018).

Before its formal organization into a province during the Hittite Empire period, the Lower Land likely comprised a collection of decentralized town-based administrative centers. These centers operated under the authority of local officials, who managed day-to-day affairs under the overall supervision of the Hittite king. This decentralized administrative setup is suggested by earlier Hittite administrative practices, as reflected in texts such as the "Edict" of King Telipinu from the mid-17th century BCE. According to these documents, governance was organized around town-based districts, each headed by a DUMU.LUGAL (a royal prince or a member of the king's family) (Matessi 2018).

The transition of the Lower Land into a formal province marked a significant shift in the Hittite administrative policy, occurring under rulers like Tuthaliya I and Arnuwanda I, during the fifteenth and fourteenth centuries BCE. This transition involved the consolidation of multiple town-based districts into a coherent administrative unit, governed centrally from the Hittite capital of Hattusa. Such reorganization aimed to enhance administrative efficiency, facilitate resource management, and strengthen territorial control over the region (Matessi 2018).

Key textual sources from the Hittite Empire period provide insights into the political and military activities within the Lower Land. For instance, passages from the

"Deeds" of King Suppiluliuma I and the "Comprehensive Annals" of Mursili II detail military campaigns, governance by appointed officials like Hannutti, and the integration of conquered territories into the Hittite realm. These texts highlight the strategic importance of the Lower Land as a frontier region and a vital component of the Hittite Empire's territorial expansion and consolidation efforts.

The designation of the Lower Land as a province underscores its role as an administrative and military hub within the broader Hittite state. This provincial organization facilitated centralized governance, economic management, and the implementation of imperial policies across diverse landscapes and populations similar to the Upper Land. It also reflects the Hittite Empire's evolution from a regional power into a formidable hegemonic force in the ancient Near East during the LBA (Matessi 2018).

The Lower Land of South-Central Anatolia emerged as a pivotal region during the LBA, undergoing profound political, economic, and cultural transformations that shaped its significance within the broader Hittite Empire. This period, starting around the late fifteenth century BCE, witnessed a shift in territorial governance from decentralized town-based administrations to more centralized provincial structures. This reorganization aimed to consolidate Hittite authority and optimize resource management across a wider geographic scale. Key archaeological sites such as Kilise Tepe and Kınık Höyük highlight this transition. These centers grew in importance as they assumed roles in managing and distributing local resources within their respective regions. Concurrently, other settlements, like Porsuk, diminished in centrality following destruction events (Matessi 2018).

Geopolitically, the Lower Land's strategic location between North-Central Anatolia and the Levantine coast endowed it with critical importance in the Hittite Empire's communication and trade networks. Overland routes, notably through the Göksu valley, linked the region to major hubs like Ugarit on the Levantine coast, facilitating trade and cultural exchange. The port of Ura, situated near modern Silifke, played a pivotal role in these commercial interactions, serving as an intermediary for grain supplies during times of shortage and illustrating the region's economic significance (Matessi 2018).

By the mid-fourteenth century BCE, the Lower Land had become integral to Hittite imperial strategies under King Suppiluliuma I, who expanded Hittite influence

beyond Anatolia into the Levant and Upper Mesopotamia. This period marked a shift from mere military conquest to establishing robust economic and diplomatic ties with neighboring powers like Egypt. The Lower Land's connectivity via both land and sea routes facilitated these exchanges, enhancing its role as a vital conduit in the broader Eastern Mediterranean network (Matessi 2018).

The late thirteenth century BCE witnessed further changes with the Hittite capital briefly relocating to Tarhuntassa in the Lower Land under King Muwatalli II. This move, influenced by strategic and religious factors, aimed to strengthen Hittite control over southern frontiers and secure the administration against external threats, particularly from the Kaska people in the Pontus mountains.

Despite subsequent shifts in political dynamics and the capital's eventual return to Hattusa, the Lower Land continued to play a significant role in Hittite affairs. It became a contested borderland between Hattusa and Tarhuntassa, symbolized by monumental constructions and ideological investments that asserted territorial claims and political legitimacy. This period saw the Lower Land as a nexus of both collaboration and competition, reflecting its complex geopolitical status within the Hittite Empire (Matessi 2018).

In conclusion, the Lower Land of South-Central Anatolia during the LBA exemplifies a region undergoing dynamic changes shaped by imperial ambitions, economic strategies, and cultural interactions. Its strategic position, economic resources, and geopolitical significance made it a linchpin in the Hittite Empire's network of power and influence, influencing both regional dynamics and broader historical developments in the ancient Near East.

3.4 The Arzawa Land

Arzawa is understood as a geographical and sometimes political entity in western Anatolia. According to Hittite sources, Arzawa was often involved in coalitions against the Hittite Empire, particularly during the 13th century BC when it posed a significant threat. Despite periodic alliances and conflicts, Arzawa remained a patchwork of small principalities rather than a cohesive political or cultural unit. The Hittite influence in Arzawa appears limited archaeologically, suggesting that western Anatolian groups maintained considerable independence from the Hittite sphere. The

relationship between the Hittite Empire and Arzawa, a region in western Anatolia during the LBA, was complex and marked by fluctuating dynamics. Arzawa, referred to in Hittite sources both as a geographical area and at times as a political entity, encompassed most of western Anatolia, excluding the Troad and Lycian highlands. It consisted of a patchwork of small principalities and independent polities rather than a unified political unit (Mac Sweeney 2010).

Historically, Arzawa frequently formed coalitions against the Hittites, especially during periods of Hittite expansion or internal instability. The first significant threat emerged in the 13th century BCE when Uhhaziti united many Arzawan groups into a formidable confederacy. This coalition posed a serious challenge to Hittite control, prompting King Mursili II to intervene militarily and eventually impose a peace settlement that divided Arzawa into three smaller kingdoms. Despite these interventions, western Anatolia, including Arzawa, was never fully integrated into the Hittite political or cultural spheres. Hittite administrative systems, elite symbols, and standardized pottery production were notably absent in this region, suggesting a degree of autonomy and independence. Instead of being a cohesive political entity, Arzawa remained a diverse region with its own social, cultural, and linguistic diversity, challenging notions of a unified Arzawan identity (Mac Sweeney 2010).

Recent archaeological and historical studies have underscored the independence of Arzawan groups from Hittite influence, highlighting how some local powers like Mira emerged as significant regional players in their own right. This shift in perspective moves away from viewing Arzawa solely through the lens of its interactions with the Hittites, emphasizing the region's internal dynamics and interactions with other neighboring groups.

In summary, the relationship between the Hittites and Arzawa was characterized by conflict, alliances, and diplomatic maneuvering. Arzawa's fragmented political landscape and its cultural diversity challenge earlier assumptions of a unified entity, illustrating the complex geopolitical realities of western Anatolia during the LBA (Mac Sweeney 2010).

Wilusa, Milawanda and Apasa are also among the significant cities of Western Anatolia for the Hittite state. The coasts of western Anatolia including these cities are overall overwhelmed by the power struggles between the Ahhiyawa and the Hittites. Although the Hittites are focused towards southeast in their conquests, they need the

Aegean region to be safe in order to focus their resources towards Assyria and Ancient Egypt. They follow the strategy of supporting the local smaller kingdoms and city states and making them their vassals rather than gaining direct control of the region (Peker, 2010). The region is crucial to understand the complex web of relationships in the Eastern Mediterranean world of the Late Bronze Age and locate Hittites in this world.

3.5 The Kizzuwatna Land

Kizzuwatna, an ancient region in Anatolia, became part of the Hittite Empire during Tudhaliya I's reign in the mid-15th century BC. Initially under Hurrian control with ties to Syria, Kizzuwatna served as a vital border area facilitating Hittite access to Syria. The exact locations of its cities, such as Kummanni and La(hu)wazantiya, have been debated, with Kummanni likely in southern Cilicia and La(hu)wazantiya in the Elbistan plain. Recent research suggests Kizzuwatna extended northeastward toward the Gezbel pass. Its geopolitical importance lay in connecting the Hittites to Syria and neighboring states, making it a pivotal region in ancient Anatolian history (Hawkins & Weeden 2017).

Kizzuwatna, situated in modern-day southern Turkey, played a pivotal role in the cultural and economic landscape of the eastern Mediterranean during the Bronze and Iron Ages. Positioned strategically between the Anatolian plateau and the Syrian plains, Kizzuwatna thrived as a hub along major trade routes, influencing and being influenced by neighboring civilizations. Archaeological excavations at key sites such as Tatarlı Höyük, identified with the ancient city of Lawazantiya, reveal a prosperous urban center with layers dating back to the Bronze Age. Discoveries here include pottery, seals, and architectural remains that attest to Lawazantiya's prominence within Kizzuwatna. Similarly, Sirkeli Höyük, identified with Kummanni, another major city, has yielded inscriptions and pottery fragments that confirm its significance during the Hittite period (Hawkins & Weeden 2017).

The cultural and religious practices of Kizzuwatna are illuminated by textual evidence like the Hišuwa festival texts, which detail rituals performed at temples dedicated to deities such as the Storm-God and Hebat. These texts provide insights into the religious life and ceremonial practices that were integral to the kingdom's identity. Culturally and religiously, Kizzuwatna shared close ties with the Hittites. The worship

of deities such as the Storm-God, documented in Hittite texts, suggests a shared religious heritage and mutual cultural influences between the two societies. Religious practices and rituals observed in Kizzuwatna influenced Hittite religious beliefs and vice versa, reflecting a syncretic blending of traditions that characterized the broader Anatolian cultural landscape during the Bronze Age.
(Hawkins & Weeden 2017).

Economically, Kizzuwatna benefited from its location along trade routes connecting Anatolia, Mesopotamia, and the Levant. Archaeological finds of imported ceramics, seals, and other artifacts underscore its participation in regional and interregional trade networks, highlighting its role as a commercial center. Economically, Kizzuwatna's strategic location along major trade routes connecting the eastern Mediterranean with Mesopotamia facilitated extensive commercial exchanges. The kingdom's cities, such as Kummanni (modern-day Şar) and Lawazantiya (possibly Tatarlı Höyük), flourished as vital commercial hubs where goods, commodities, and cultural influences circulated between different civilizations. This economic interdependence enriched both Kizzuwatna and the Hittite Empire, fostering prosperity and contributing to the region's overall wealth (Hawkins & Weeden 2017).

From a military perspective, Kizzuwatna's alliances or conflicts with neighboring states often shaped Hittite military strategy and diplomatic relations. The Hittites frequently intervened in Kizzuwatna's affairs to maintain political stability or to assert their dominance in the region. Military campaigns and strategic alliances aimed at securing Kizzuwatna further underscored its significance within the broader framework of Hittite foreign policy and territorial expansion. Defense structures such as city walls and fortifications found at sites like Lawazantiya indicate efforts to protect key urban centers against external threats, reflecting the kingdom's strategic concerns and military preparedness. Textual sources, including Hittite treaties and annals, provide further historical context, detailing Kizzuwatna's political relationships, military campaigns, and interactions with neighboring states. Cultural interactions with neighboring regions influenced Kizzuwatna's art, architecture, and religious practices, as evidenced by artistic motifs, architectural styles, and religious iconography found in excavations. These elements reflect both indigenous traditions and external influences, enriching our understanding of Kizzuwatna's cultural milieu (Hawkins & Weeden 2017).

Geopolitically, Kizzuwatna served as a crucial frontier region for the Hittite Empire between the Hittite heartland in central Anatolia and the southern regions, including Syria and Mesopotamia. It played a pivotal role in shaping Hittite geopolitics, trade networks, and cultural interactions during the LBA. Its control allowed the Hittites to safeguard their southern borders from potential threats posed by powerful southern civilizations, such as the Egyptians and Assyrians. By exerting influence over Kizzuwatna, the Hittites effectively managed and secured their southern frontiers, maintaining stability in the region and preventing incursions into their core territories. In summary, Kizzuwatna's geopolitical, economic, cultural, and military significance for the Hittites was profound. As a buffer zone and pivotal region in Anatolia, Kizzuwatna played a critical role in shaping the Hittite Empire's interactions with neighboring civilizations, contributing to its political influence, economic prosperity, and cultural dynamics during the LBA. The archaeological evidence and textual sources converge to paint a detailed picture of Kizzuwatna as a significant kingdom in ancient Anatolia. Its urban centers, religious practices, trade networks, and defensive structures provide valuable insights into its historical importance and its impact on the broader cultural and political landscape of the eastern Mediterranean region during antiquity. Ongoing archaeological research continues to uncover new facets of Kizzuwatna's history, enhancing our knowledge of this ancient civilization and its enduring legacy (Hawkins & Weeden 2017).

Chapter 4:

METHODOLOGY

4.1 Research Question and Hypothesis

Kayalıpınar's (Samuha)significance in the Hittite world has been demonstrated so far in the thesis. Kayalıpınar (Samuha)has significance in multiple spheres of the Hittite world; it held administrative, religious, economic and military importance. It was the capital of the Upper Land and acted as the royal base for king Tudhaliya II's when the main capital Hattusa was under conquest. It also has a history of significance in the period prior to LBA, the Assyrian Colony Period, inferring from its mention as a city with first a *wabartum* and later a *karum* in the texts from Kültepe.

Which advantage of this city allowed it to be in such a quality? How can a city in Sivas, seemingly distant to the other key cities of the Hittite world, be a critical node in the network? In this thesis, centrality of Kayalıpınar (Samuha) has been explored through SNA, and a comparative analysis of different centrality indexes is employed to inquire the centrality type of Kayalıpınar (Samuha).

The hypothesis is built on different qualities of the city. The first quality is that the city has been invaded/attacked multiple times over the course of the Hittite History. This indicates that it is not the center of a cluster surrounded by nodes that are controlled by it, it is highly accessible and rather alone in its location. Another characteristic is that it is the base of power in king Hattusili III's rise to reign. After commanding the province of Upper Land during his brother's reign as the king, Hattusili the III fought for the Hittite throne after his brother's death. Other than his personal achievements and vision, the power Kayalıpınar (Samuha) holds has been a major factor in this result. Hattusili III's marriage with Pudu-Hepa, a priestess from Kizzuwatna, played a significant role in his career as a ruler. Kayalıpınar's (Samuha) position on the main natural route in Central Anatolia connecting Kizzuwatna and Black Sea region explains how its location afforded flow of power resources. The hypothesis is that Kayalıpınar (Samuha) has a bridge characteristic, and the highest centrality value will be the betweenness centrality compared to the other three.

The methodology followed in order to test the hypothesis and answer the research questions is as follows: A social network model is built based on the Least

Cost Path (LCP henceforth) and gravity calculations among the LBA Anatolian cities with a link to the Hittite state. In the social network model, four centrality values of Kayalıpınar is calculated and compared in standardized form. It is worthwhile to emphasize that although gravity model and social network analysis are established methodologies across disciplines and have been integrated to archaeology for over multiple decades, using gravity model as a solution to the problem of archaeological visibility and limitations of data in social network analysis is an approach that is developed for this thesis and is being applied for the first time, or rather tested.

4.2. Social Network Analysis (SNA) and Applications in Archaeology

SNA is a type of analysis that focuses on the relationships and allows for calculations of connectivity, centrality, clustering, isolated individuals and further analysis (Wasserman & Faust 1994). SNA is an abstract method that models systems through conceptualization of agents in a web of relationships as points (nodes) and the relationships as links between the points (edges). Being based on social structures and relationships, is has been used extensively in sociology literature. Certain concepts from the network theory even entered the daily life such as the strength-of-weak-ties (high number of casual relationships can be more advantageous compared to low number of close relationships) (Granovetter 1973), or the six-degrees-of-separation (any two people on the world can be linked through six steps of connections) (Milgram 1967). Originally developed as part of sociology methodology, SNA gained a more general application through time. The structural relational intuition at the foundation of SNA can be followed back to the 18th century, yet the underlying structure of SNA method as it is used today was built by Jacob Levy Moreno in the 1930s under the term psychological geography. His background in psychiatry provided the psychological and social insights as well as structural intuitions over which he focused on improving the method through integration of probabilistic analysis and statistics (Freeman 2004).

In archaeology, suitable topics for SNA include trade networks, trade routes, alliances, spread of knowledge or diseases, and lastly distribution of specific artifact types. Yet, SNA requires vast data sets with high accuracy and potential for meaningful comparisons and this is not always the case for archaeological evidence. As SNA is a valuable method for economic and sociological studies, there have been a great

accumulation of applications in archaeology (Mills 2017 & Knappett 2013). With a sufficient data set it is possible to use the analysis to examine growth and development of markets, trade links, political relationships between countries in archaeological research as well as interpreting artifact distributions and movement of things. In order to apply SNA it is necessary to define a structured web of relationships which is not always easy to do through archaeological evidence. Another limitation with applications in archaeology is the incomplete nature of the archaeological data. Material remains acquired in archaeological excavations reflect only a proportion of what was there, which is not necessarily a random selection which might have allowed for better use of statistical tools. Examples of SNA applications in archaeology include Assyrian Trade Colonies during the Middle Bronze Age in Anatolia (Barjamovic et al. 2019), Sardinian Obsidian Circulation in the Neolithic period (Freund & Batist 2014), Late Neolithic to Copper Age transition of cert arrowheads in Iberian Peninsula (Jiménez-Puerto 2024), co-occurrence network of Hittite toponyms in cuneiform tablets (Akman 2023). Furthermore, network analysis has been used as an explorative tool to study the entanglements and dependencies among things and people in the fabric of relationships that make up an archaeological site (Hodder & Mol, 2015).

4.3 Centrality Measures in Social Network Analysis

Networks as a concept or metaphor is not new to archaeology. On the other hand, formal network analysis such as SNA has been established as a useful method in archaeological studies in the last decade (Peeples 2019, 452). These formal network analysis methods have two main aspects that usually go together: the graph and the statistical analysis. One of the most common metrics in network analysis is centrality. Centrality is a local value, a value of the nodes rather than the whole network. There are four main types and many subtypes of the centrality measures based on different qualities of the nodes such as betweenness, number of neighbors, shortest paths etc. The four main types of centralities will be calculated and compared for the specific node of Kayalıpınar (Samuha) in the network model of LBA Anatolia.

1. Degree centrality: Degree is the number of nodes a specific node is directly linked to. In other words, it is the number of first-degree neighbors a node has. Degree

centrality indicates how many agents one agent can contact without the need of intermediaries. Its weakness is that it shows a local centrality rather than evaluating the whole network (Das et. Al 2018, 5).

2. Closeness centrality: Closeness is understood in terms of the number of edges or nodes that exists to reach the distant nodes. If two nodes are connected with one edge, they are neighbors. If two nodes are connected with n edges on the shortest route possible, then the shortest path has the length of n. This measure of centrality uses the summation of the shortest paths for the specific node. The bigger the sum is, less closeness centrality the node has. In terms of visual representation this centrality is somewhat visible based on where the node is on the network graph as a whole (Das et. Al 2018, 5).

3. Betweenness centrality: Betweenness is defined by being on the shortest path between two other nodes. If a node is on a lot of shortest paths, it has a higher betweenness value. Betweenness centrality is calculated by the ratio of the number of shortest paths passing through the specific node over the total number of all shortest paths in the network. One specific characteristic of betweenness centrality is that it indicates the bridge nodes. A node with high betweenness and low degree centrality would be a bridge. Bridge is a node that connects different clusters in the network. The advantage of a bridge node is that it receives higher variety of flow compared the other nodes because it receives flow from different clusters. This is especially important for the flow of information (Das et. Al 2018, 6).

4. Eigenvector centrality: This centrality is based on a value termed Eigenvalue. Eigenvalue value indicates how connected a node's neighbors are to the rest of the network and how clustered the neighbors are. Eigenvalue can be conceptualized as the summation of the number of neighbors a node's neighbors have. A real life example could be the number of the powerful people a person is surrounded with. The overall implication of this centrality is authority (Das et. Al 2018, 6).

In the LBA Anatolia network model that is built, Kayalıpınar's (Samuha) centrality is measured based on these four characteristics. The standardized values of these four centralities are compared in order to question the strengths and weaknesses of Kayalıpınar (Samuha) in the network that it is part of. Whether Kayalıpınar (Samuha) has higher centrality compared to the rest of the network would be a different question

and might require a more extensive network with the LBA settlements of smaller scales such as villages and town represented. The LBA Anatolia network that is built in this thesis has a limitation caused by visibility of archaeological data. Therefore, it would be statistically less reliable in terms of the global properties compared to the local properties. To overcome this weakness, the survey data is aimed to be incorporated into the model in the future.

4.4 The Proposed Social Network Model

As has been discussed in previous chapters, the city has acted as a center on different spheres according to the cuneiform tablets. It was a military center as the soldiers of the Upper Land gathered there before marching towards the south and the campaigns against the Kaska and Azzi-Hayasa began and ended at Samuha. It was an economic center as it was already established as a *wabartum* and a *karum* in the Colony Period and limiting access to trade at Samuha was used as soft power against the Kaska groups. It was an administrative center as the capital of the Upper Land. Lastly, it was a religious center as it was the city of the goddess Shaushga, the goddess of love and war, which was visited during religious festivals periodically and members of the royal family were had religious education in the Shaushga Temple in Samuha (Murat 1998). In this thesis, the reasons and factors of Kayalıpınar's (Samuha) significance are being questioned. What was the main advantage of this city in these different spheres simultaneously? The answer is looked for in its centrality values.

In order to build a model that might be helpful in answering this question, there must be some generalizations and assumptions. Firstly, as these different spheres of centrality work with different mechanisms in the real world, it is very important to find their shared characteristics to be able to model the relationships that they consist of. In the scope of this thesis, the value that the edges of the network represent is the flow of people and goods over the LBA in an extensive approach. The flow of people and goods among cities will be calculated through the gravity model.

The temporal and spatial resolution of the model is considered to be among its weaknesses. In order to improve the resolution and build a dynamic model, it is necessary to incorporate different classes of archaeological evidence such as seals, tablets, trade goods, pottery as well as trade routes, paleogeography, the fluctuating

political borders in the LBA Anatolia into the model. At the same, the nature of these classes of evidence is the reason for this limitation of low temporal and spatial resolution. Building a network model of higher resolution would require an in-depth analysis of the archaeological evidence from all settlements as well as the written records mentioning specific historical events and changes in spatial interactions. In addition to the time and effort required to build such a model, the incomplete nature of archaeological data pose great limitations. To overcome the limitations, this model focuses on extensiveness over resolution and covers LBA Anatolian sites that have been excavated. The network model will consist of unimodal nodes and undirected edges.

4.5 The Nodes of The Model

The nodes will be the LBA settlements that have been subject to archaeological excavations and show LBA evidence or its ancient name is mentioned in the Hittite cuneiform tablets. The many landscape monuments that manifest the Hittite power, or the desire for it, on certain routes though Anatolia were considered to be a second group of nodes. These landscape monuments are also related to natural elements such as mountains, fountains and rivers and have religious connotations, as well. The different qualities of these monuments compared to cities would require a bimodal network model with a different tool for flow estimation since size would be meaningless for the landscape monuments, which is aimed explored in the future. On the other hand, excluding the landscape monuments from the network data set offers them as a test for the model. The LCP routes the model suggests can be evaluated in terms of their correspondence to the locations of these monuments. Another candidate for nodes were the cities that are mentioned in the texts but have not been localized yet. Unfortunately, this data set is again unreliable. Kayalıpınar (Samuha) is a good example: Although Samuha was assigned to the Sivas region prior to the finding of the tablet in 2014 localizing it to Kayalıpınar, there were also scholars who suggested Malatya region (Alp 1956). As the interpretation and estimation of location is tricky for the Hittite archaeology, the places that are known from the texts but have not been discovered archaeologically are excluded from the data set. A third group of nodes were considered to be the LBA Anatolian sites discovered in survey studies that are yet to be excavated. Although the survey data has its own strengths, the uncertainties it brings in terms of

settlement size and archaeological evidence, the data set has been excluded. In light of these considerations, model covers the Anatolian LBA sites that have been excavated and displays LBA evidence or is mentioned in the Hittite cuneiform tablets.

4.6 The Edges of The Model

4.6.1 The Gravity Model for Demographic Interactions

The fundamental relationship modelled in this thesis, namely the edges of the network model, is calculated through the gravity model for demographic interactions. The earliest recognition of demographic gravitation is by W. J. Reilly in his 1929 paper in which based on economic and statistical foundations he suggests the trade attraction between any two cities is positively correlated with their sizes and inversely correlated with the distance between. This idea later becomes Reilly's law of retail gravitation after publication of his book *The Law of Retail Gravitation* in 1931.

Starting from this law, John Q. Stewart proposes a model of demographic gravitation in his 1948 paper published in the journal Sociometry. In the paper, Steward builds the foundations of a gravity model for population interactions and movements. Based on the Newtonian gravitation equation and through the analogy of individuals as atoms of a gas, mass is transformed into population mass (number of people) and distance is kept as real distance in miles. His case studies for testing this proposed method focus on higher and lower population areas over the American landscape. Almost a century after these publications, the gravity model is still considered to be a strong spatial interaction model for understanding and estimating movements/forces of population interactions including flows of international trade (Capoani 2023), aggregate tourism demand (Nadal & Gallego 2022), global migration patterns (Khan et al. 2022), econo-political integration (Head & Mayer 2021). This stretch in the area of application shows the model's success is not limited to economic activities although it was the case in its foundation: The gravity model has a strength in understanding flow of aggregate human interactions. Therefore, the gravity model calculations are utilized in this thesis in order to estimate the value of flow among LBA Anatolian settlements.

Gravity model has been accepted as a method in archaeology as early as the 70s although the popularity of the model decreased in the recent decades. An early consideration of gravity model in archaeology is by Renfrew where he discusses the

possibilities and applications of the methodology (Renfrew 1977). The 1986 paper by Chappell is another application of gravity model to examine the alternative sources as a factor of the exchange of goods in an ethnographic example, concluding that the method would be fruitful for the prehistoric exchange systems. Some of the more recent applications are as follows: Wilson used gravity model on Palaeolithic lithic raw material sources in the Vaucluse region in southern France and used the provenance data to understand the attractiveness factors for the lithic sources in the study (Wilson 2007). Another recent application is on the Aegean Bronze Age. In their 2008 paper, Knappett, Evans and Rivers used gravity model as a spatial analysis tool for understanding maritime trade between the islands of the Bronze Age Aegean Sea. Gravity model might be the most suitable for this specific subject since the spatial domain is the Aegean Sea and other than certain winds and currents the landscape would be an isotropic surface. Diachenko and Menotti used the gravity model for Tripolye culture of Chalcolithic Ukraine, specifically the settlement occupation phases and migration activities (Diachenko & Menotti 2012). In the 2019 paper by Barjamovic, Chaney, Coşar and Hortaçsu structural gravity model is applied to the 19th century BCE tablets of the Assyrian merchants to build a model of long distance trade and estimate locations of cities that are yet to be localized. The examples can be extended, but it is significant to note that althought there are few recent examples of gravity model and SNA being brought together in other disciplines (Shang et al. 2021) (Coşkuner et al. 2023), using the gravity model data as the basis of the social network model is an approach that is developed for this thesis and is being tested.

The gravity model consists of three variables: sizes of two entities and the distance in between. In the network model built in this thesis, the gravity values are calculated between the chosen settlements, hence the entities are defined as LBA Anatolian cities within the Hittite world. For the settlement size values a variety of archaeological data has been considered. Demographic estimations for settlement populations can be made based on number and sizes of residential units, size of the cemetery, the mounts of food produced and consumed based on animal remains and agricultural practices, etc. (Zorn 1994). Another option was to use the sizes of administrative and monumental buildings as a reflection of the settlement size. A third option was to use the sizes of tablet and bullae archives in settlements. Yet another type of data could be the numbers of settlement populations mentioned in primary texts.

Unfortunately, in Hittite archaeology there is a discrepancy of data which would make it a challenge for the model to use these classes of data in an extensive and uniform manner. In other words, gathering these data sets for every settlement included in this model would require longer time than it is possible in the scope of this master's thesis. It is one of the ambitions of the network model build in this research to embody these data sets in the future.

Following through accessibility and uniformity of archaeological evidence, the chosen class of data for settlement size is the surface area of archaeological sites in square meters calculated through Google Earth. Although the uncertainty of encroachment areas of mounds and the sites that are lost or underwater today pose a significant weakness to the data set, for the purposes of comparability among all sites and as a baseline for the model to be improved in the future, the surface area data is preferred.

For the analysis, the distance is defined in terms of cost distance. In order to calculate the cost distance LCP calculations are utilized. The main factors of the cost distance in this model are the path length and slope, implying walking human agents. This formulation of distance is expected to reflect up to a degree the affordances of transportation on the Anatolian landscape for the time period of interest. Considering the research question and the propositions behind, feasibility of transportation is employed as a major component of the model.

With the cost distance and the surface areas of settlements as the variables of the gravity equation, the resulting number is expected to be a reliable estimator for the flow of people and goods between the LBA cities in Anatolia. Still, it should be underlined that the value of the flow between cities acquired by the gravity equation will be an ordinal value rather than cardinal. The values will not be in terms of real number of people that moved or days that it took. Rather we will be able to comment on which places were more popular and how easy or difficult it was to go between locations compared to the alternatives. Therefore, the gravity calculations will present a quantification of connectivity among cities in multiple spheres at the same time.

This way, the edges in the network model will present a comparable number representing the flow among the nodes of the network. Although this formulation of an analysis has its own limitations, it gives room for the fluctuations in these relationships over the 450 years that LBA covers (environmental factors such as heavy rains would

have changed the total amount of time that a journey took) and also is flexible enough to incorporate any new sites that is found today between any two centers which would affect the map of connectivity. It would be too complex to try to model all the relevant variables that are found in the real world and their real values - this is the ambition of every model. Rather, in the safer space of this specific network model, the relationships between the cities are of comparative value for the amount of people and goods moving back and forth between the LBA Anatolian settlements.

4.6.2 Least Cost Path Calculation for Cost Distance

In the gravity model the distance is calculated through LCP analysis in order to achieve the cost distance values between chosen settlements. In the simplest sense, LCP analysis is a tool for modelling an agent's movement on a friction surface and creating lower cost routes on the surface. The analysis works with raster data, transforming the friction surface into cells of average cost and calculating the path on these cells. As a geospatial analysis tool, LCP applications in archaeology cover a variety of regions and time periods such as water accessibility in the desserts of Jornada Mogollon Region in Mexico during prehistory, hunter-gatherer procurement zones in Late Upper Paleolithic Spain, paleogeography of Paleoindian sites in Peru (White & Surface-Evans 2012), obsidian circulation in early-holocene Cyprus (Moutsioua & Agapioub 2019), Cycladic maritime interactions in the LBA Aegean (Jarriel 2018) as well as intra-site transportation analysis in Iron Age settlement on Kerkenes Dağ in Türkiye (Branting 2004) etc. One limitation of LCP is the consideration of rivers. Rivers are usually considered to be natural borders and are referenced in Hittite texts as the border between certain regions. On the other hand, it is known that suitable rivers have been used a transportation medium like in the case of Kayalıpınar (Samuha). The question of rivers as a facilitator or an obstacle must be evaluated with care and specific considerations of each major river on Anatolia on the basis of sections available for transportation are needed.

In this thesis, LCP calculations are used to retrieve cost distance data. Unlike the majority of other applications of this analysis where the calculated routes are examined to understand use of space and make estimations of locations, in this thesis only the cumulative costs of paths are used. The calculations are made in Global Mapper

software with the LCP analysis added in the 2024 update using location of sites retrieved from Google Maps locations in latitude and longitude. In the future it is aimed to improve this data set through use of GIS softwares such as ArcGIS and locations retrieved on site with higher accuracy.

Chapter 5:

BUILDING A NETWORK MODEL FOR LATE BRONZE AGE ANATOLIA

5.1 Aim of The Analysis

The aim of research in this thesis is to identify the most significant advantage of Kayalıpınar (Samuha) in becoming one of the foremost centers of the Hittite Anatolia in the four spheres of administration, religion, military and trade. Considering the Anatolian landscape and the challenges it brings, the answer is looked for in the logistical and geopolitical advantage. Following this approach, calculations of LCP and Gravity Model has been used as the basis of the network data. In order to understand the main advantage of this specific location on the landscape, walking distances are used as a proxy of accessibility, and archaeological site surface area as a proxy of settlement size. Using these two classes of data, gravity calculation has been applied and presented as the measure of relationship among cities. Based on the gravity values, a social network model has been built and four different centrality types have been calculated for the whole network. This chapter presents the details of the model and the results of the centrality analysis.

5.2 Nodes of The Model

Nodes of the model have been established as the LBA settlements in Anatolia within the Hittite world. In order to bring this choice in accordance with the archaeological data and its limitations, the nodes of the model have been limited to the archaeological sites that have been excavated and documented Bronze Age material as well as the cities that are mentioned in the Hittite cuneiform tablets. In the future, the model is aimed to be improved through integration of LBA Anatolian sites monitored in surveys, Hittite landscape monuments and LBA sites outside of Anatolia.

A wider network model of the LBA Mediterranean world is among the long-term ambitions of this attempt in proving applicability of SNA coupled with gravity model and applications of centrality analysis for the period. An index of the nodes in alphabetical order is provided below.

Table 1: List of LBA sites included in the network model.

No	Site name	Location	Suggested Localizations
1	Acemhöyük	Aksaray	Burushattum
2	Alacahöyük	Çorum	Arinna
3	Alişar	Yozgat	Ankuwa
4	Arslantepe	Malatya	Meliddu
5	Asarcık Tepesi	Muğla	Wallarima
6	Ayasuluk Tepesi	İzmir	Apasas
7	Bademgediği	İzmir	Puranda
8	Beycesultan	Denizli	
9	Boğazkale	Çorum	Hattusha
10	Büklükale	Kırıkkale	Durhumit/Salatiwar
11	Çadır Höyük	Yozgat	Zippalanda
12	Çine-Tepecik	Aydın	
13	Efes	İzmir	Apasas
14	Eskiyapar	Çorum	Ankuwa
15	Gavurkalesi	Ankara	
16	Gözlükule-Tarsus	Adana	Tarsha
17	Horoztepe	Tokat	
18	Iasos	Muğla	
19	İkiztepe	Samsun	
20	İnandıktepe	Çankırı	Hanhana
21	Kaman Kalehöyük	Kırşehir	
22	Karahöyük	Kahramanmaraş	
23	Karkamış	Gaziantep	Kargamis
24	Kayalıpınar	Sivas	Samuha
25	Kilise Tepe Höyüğü	Mersin	
26	Kinet Höyük	Hatay	Izzia
27	Korucutepe	Elazığ	
28	Kusura Höyük	Afyon	
29	Kuşaklı	Sivas	Sarissa

30	Külhöyük	Ankara	
31	Kültepe	Kayseri	Kanish/Nesha
32	Liman Tepe	İzmir	
33	Maşat Höyük	Tokat	Tapigga
34	Milet	Aydın	Milawanda
35	Norşuntepe	Elazığ	
36	Oluz Höyük	Amasya	
37	Ortakaraviran Höyük	Konya	
38	Ortaköy	Çorum	Sapinuwa
39	Oymaağaç	Samsun	Nerik
40	Patara	Antalya	Patar
41	Porsuk Höyük	Niğde	Saliya
42	Seyitömer	Kütahya	
43	Sirkeli Höyük	Adana	Kummanni
44	Tatarlı Höyük	Adana	Lawazantiya
45	Tavşanlı	Kütahya	
46	Tell Atchana	Hatay	Alalah
47	Troya	Çanakkale	Wilusa
49	Yumuktepe	Mersin	

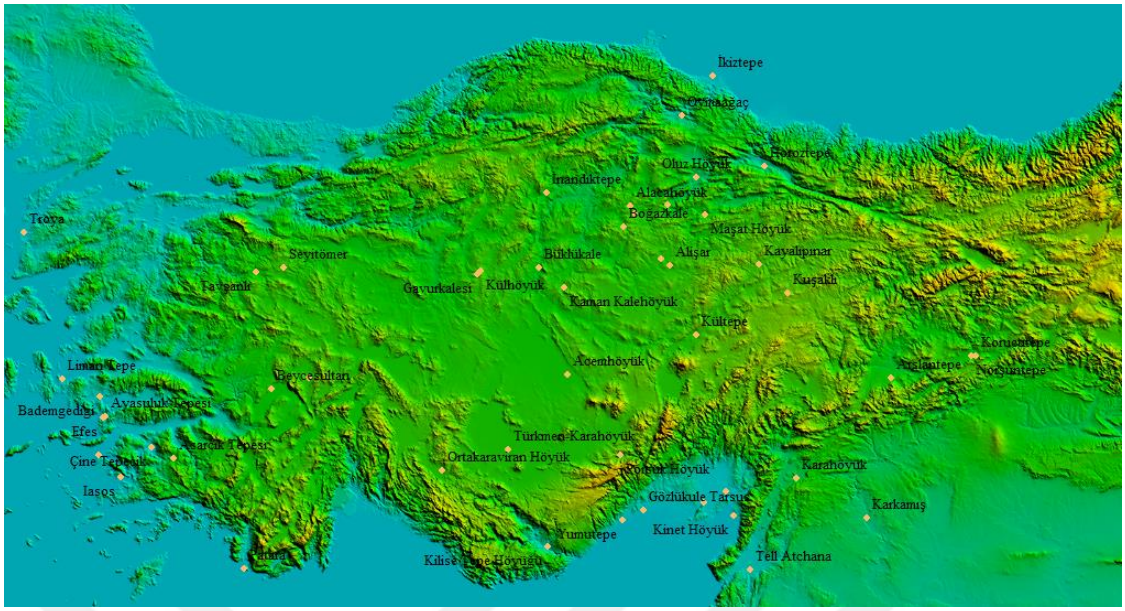

Figure 5: Nodes of the network on the Anatolian topographical map.

5.3 Edges of The Model

Edges of the model are essentially defined as the flow of people and goods among cities. To quantify the flow between cities, gravity model has been used. Settlement size has been retrieved from Google Earth data as the surface area of the mound or the archaeological site in square meters. The cost distance data is acquired LCP calculations in Global Mapper using Web Mercatrator WGS84 projection. For LCP calculations slopes outside of 0-10% and elevations below 50 meters has been avoided. Cost multipliers of slope and slope change are assigned as 15 and 5. The LCP calculations have been done for every city pair as a direct journey. The LCP results for the major Hittite cities are presented below in figures 5, 6, 7, 8 and 9. The size in square meters and cost distance values have been used in the gravity equation for each pair and the results have been compiled as a relationship matrix for the network model.

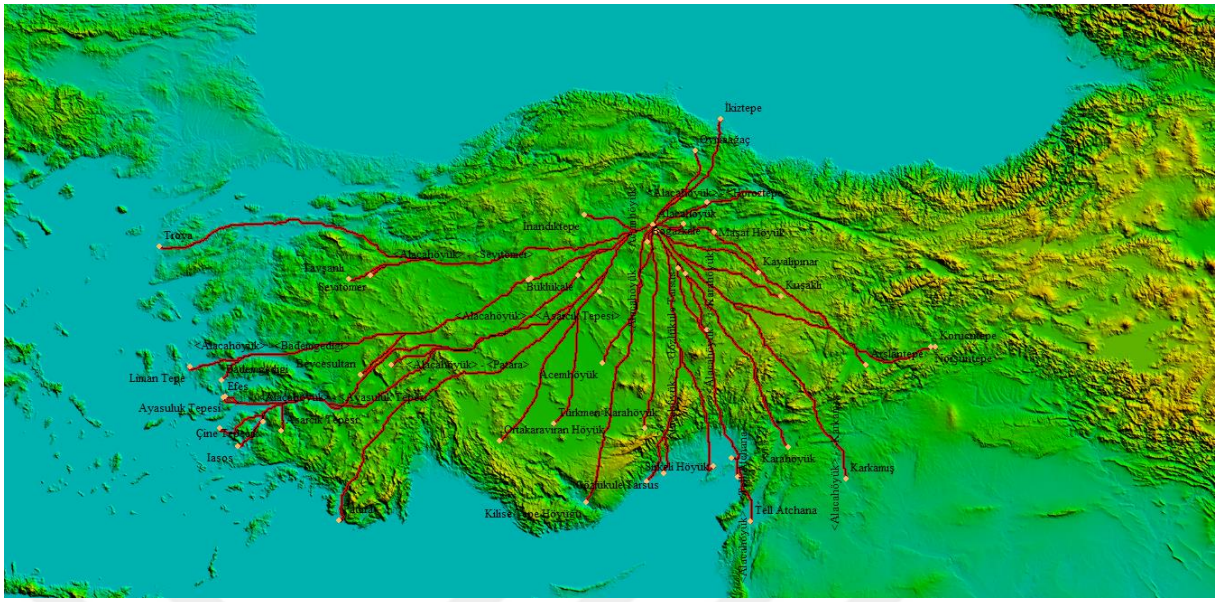

Figure 6: Least Cost Path results for Alacahöyük.

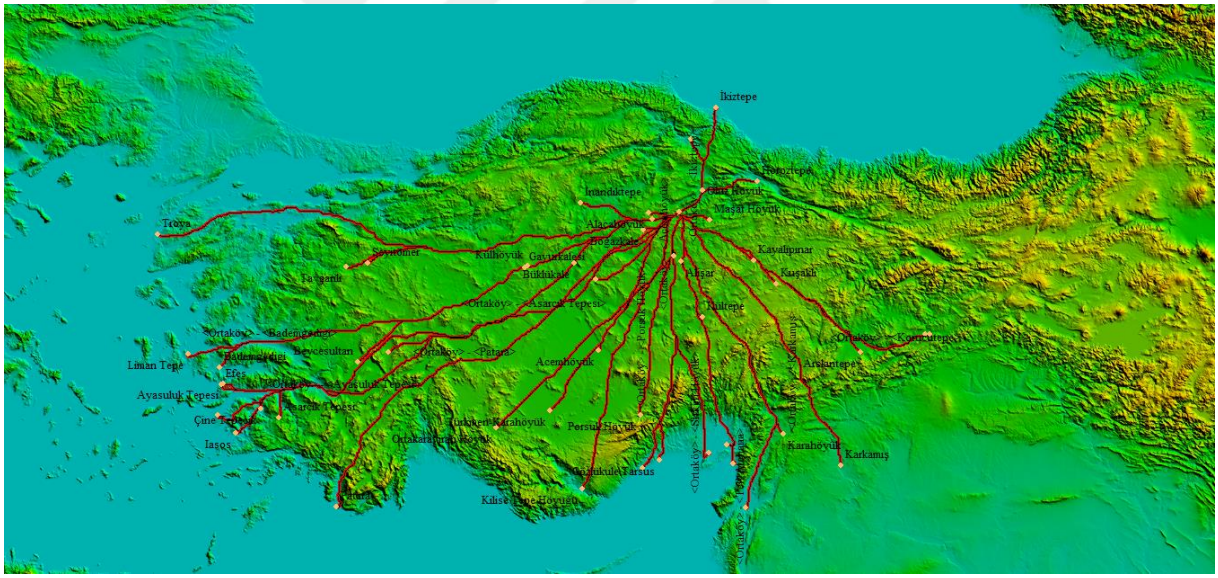

Figure 7: Least Cost Path results for Ortaköy.

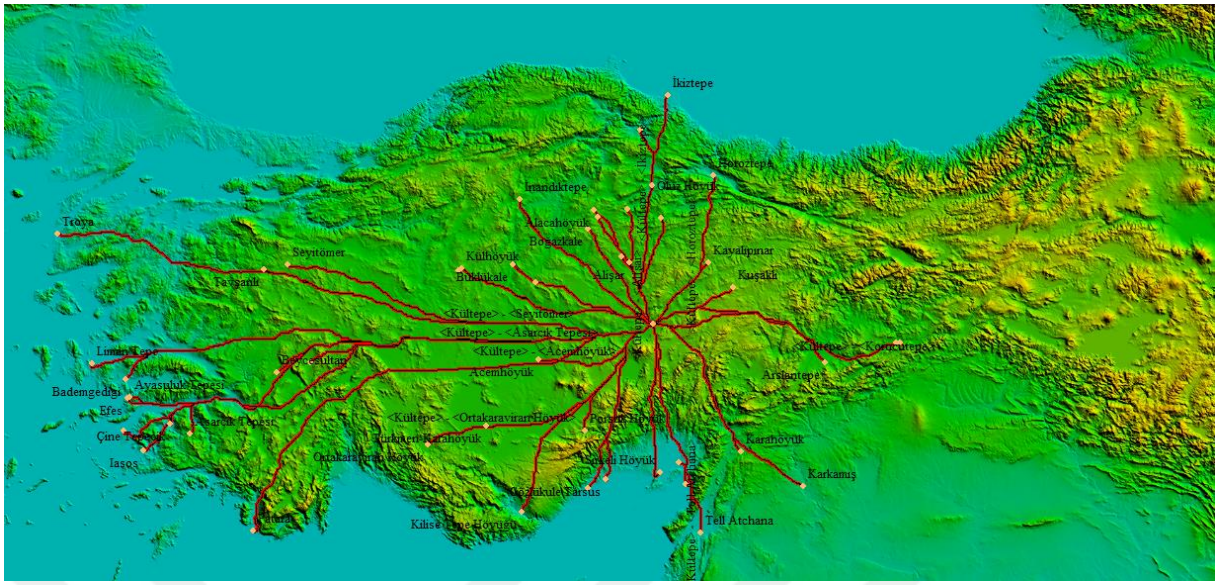

Figure 8: Least Cost Path results for Kültepe.

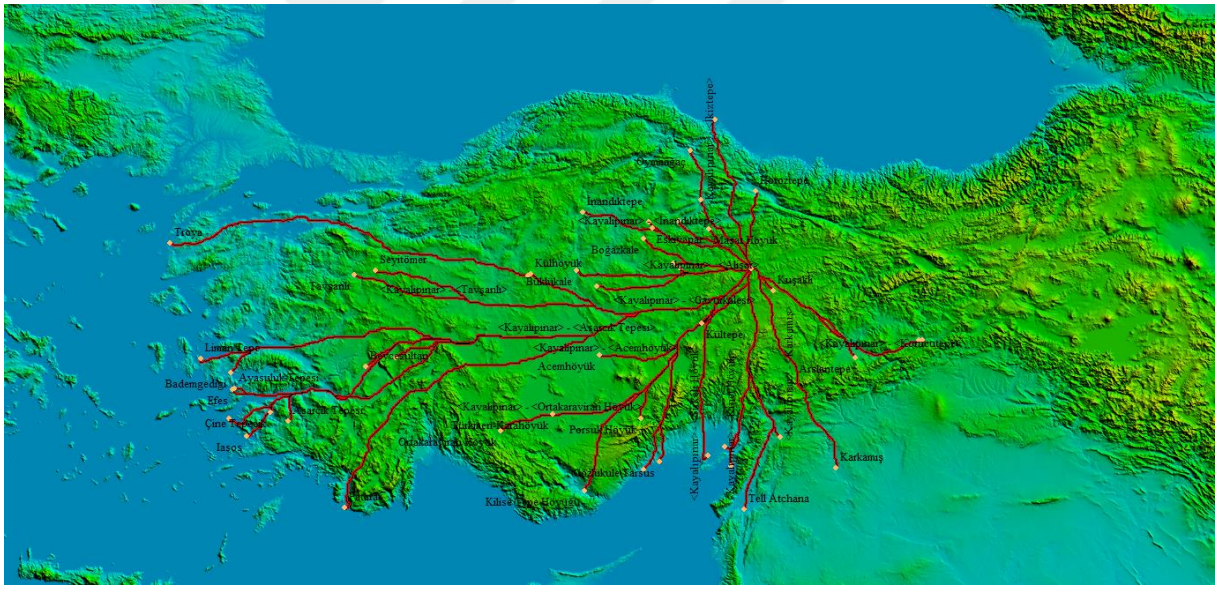

Figure 9: Least Cost Path results for Kayalıpınar.

The edges are weighted and undirected. Weight of the relationship is represented by the gravity values. A significant aspect of the network model is inclusion of the lack of direct relationship between certain cities. In order to make the model more realistic, certain cities have been considered too distant for direct transport and the relationship between them has been cancelled out. After calculation of gravity values for all of the city pairs in the index provided above, the values that are below the median gravity value (max: 8983102532, min: 299, average: 4925892, median:28522) have been

reduced to 0 in order to represent the lack of direct relationship between the pairs. The final relationship matrix used for the network model is presented below (Figure 10).

Table 2: The weighted, undirected relationship matrix built upon the gravity values.

Site name	Acemhöyü	Alacahöyü	Alişar	Arslantep	Asarcık Te	Ayasuluk	Bademgec	Beycesult	Boğazkale	Büklükale	Çadır Höyü	Çine-Tepe	Efes	Eskiypar	Gavurkale	Gözlükule	Horoztepe	Iasos	İkiztepe	İnandıkte	Kaman Ka	Karahöyül	Karkamış	Kayalıpına	Kilise Tep	Kinet Höy	Korucutep	Kusura Hö	Kuşaklı	Külhöyük	Kültepe	Liman Tep	Maşat Höy	Milet	Norşuntep	Oluz Höyü	Ortakaray	Ortaköy	Oymaağaç	Patara	Porsuk Hö	Seyitömer	Sirkeli Höy	Tatarlı Höy	Tavşanlı	Tell Atcha	Troya	Yumutepe
Acemhöyü	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alacahöyü	304974.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alişar	1046077	921455.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arslantep	45524.8	0	35479.82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Asarcık Te	161321.6	0	43089.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ayasuluk	122967.2	0	32213.54	0	1875269	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bademgec	0	0	0	0	308755.3	4995569	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Beycesult	555006.3	65163.3	123597.4	0	1767489	886741	180464.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Boğazkale	14328837	1.63E+08	45025876	441960.1	954901.4	607570.3	150241.4	2438384	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Büklükale	1429709	303284.3	458374.4	0	71062.49	43090.97	0	207806.9	15231129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Çadır Höyü	163466.5	203031.2	14856687	0	0	0	0	0	11770393	85984.59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Çine-Tepe	36632.43	0	0	0	7642308	444304.8	70880.93	344831.4	177855.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Efes	268290.6	34853.64	70424.59	0	3958541	1E+09	7429424	1919638	1336823	94759.84	0	956069	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eskiypar	86941.59	6869424	322178.3	0	0	0	0	0	73749678	76891.77	74401.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gavurkale	653653.3	82430.17	130794.1	0	57821.19	33586.5	0	201682.4	3269918	1141331	0	0	73211.08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gözlükule	159131.3	0	31269.57	0	0	0	0	0	403909.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Horoztepe	118523.3	101109.2	226463	0	0	0	0	33583.94	2931392	55797.16	36597.35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Iasos	0	0	0	0	574960	89726.24	0	89665.58	68179.27	0	0	208245	191685.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
İkiztepe	55038.9	51635.26	73200.92	0	0	0	0	0	1466799	31903.57	0	0	0	0	0	0	0	108019.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
İnandıkte	36387.66	35147.27	0	0	0	0	0	0	1319848	86007.93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kaman Ka	944201.5	139690.1	300928.6	0	30025.1	0	0	85465.43	8007222	3173256	54810.8	0	40115.65	41951.47	228489.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Karahöyül	344482.7	52376.72	176923.5	158381.6	41810.04	0	0	89355.18	2002413	78722.05	0	0	60298.85	0	36725.2	80459.87	47625.62	0	0	0	42757.64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Karkamış	607575.3	100313.4	299476.1	435968.2	97401.48	65457.36	0	200324.5	3715964	153227.9	46804.41	0	143345.5	0	74624.2	114108.2	102169.8	0	41223.62	0	80469.39	6073213	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kayalıpına	944746.9	485116.4	2607408	184940.9	82344.85	54591.29	0	189006.3	17817259	382486.2	376839	0	119454.7	141400.3	115554.8	53446.96	941492.8	0	150130.1	0	213614.6	488879.5	918738.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kilise Tep	205083.7	0	0	0	0	0	0	55812.65	438071.4	32060.89	0	0	31065.43	0	0	48968.6	0	0	0	0	0	44229.94	80056.21	48272.65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kinet Höy	69317.4	0	0	0	0	0	0	0	293174.7	0	0	0	0	0	0	0	0	0	0	0	0	326238.7	353749.2	57117.33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Korucutep	0	0	0	70799.87	0	0	0	0	227627	0	0	0	0	0	0	0	0	0	0	0	0	48162.93	185584.1	70282.78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kusura Hö	54244.14	0	0	0	93265.97	41625.86	0	1721243	220788	0	0	0	89895.79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kuşaklı	787197.6	278177.6	1300013	295641.2	73468.86	48913.49	0	166873.1	10593423	247683.5	184297.4	0	107044.3	79241.05	98208.68	54303.79	457685.7	0	92633.97	0	144344.2	613413.8	1127147	26042035	44252.91	64383.88	93203.58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Külhöyük	485744.3	64298.22	101454.6	0	42394.67	0	0	146548.3	2556449	965826.6	0	0	53823.68	0	1.24E+08	0	0	0	0	0	0	179165.2	0	56750	87883.05	0	0	0	0	74624.64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kültepe	1879164	343512.4	2594262	94419.28	80003.22	51908.92	0	197973.3	16031591	445702.7	335704.8	0	113493.2	102178.4	149816.4	84820.6	197498.7	0	65108.28	0	298751.8	538968.1	778929	4078335	64136.45	79110.9	38248.73	0	3147359	114639.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Liman Tep	46302.57	0	0	0	320134.5	1363663	630599.4	255315.2	261718.9	0	0	73149.57	2586243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maşat Höy	171834.9	263859.1	792651.1	0	0	0	0	33324.82	7625682	81596.01	142114.6	0	0	81762.63	29311.59	0	252296.7	0	48627.56	0	46203.52	46754.28	92094.38	1356357	0	0	0	0	542367.8	0	327414.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Milet	321166.2	42747.13	86479.44	0	7338325	1870175	339752.6	1962621	1635157	114045.8	0	3095559	4005943	0	87869.57	0	0	4588412	0	0	48865.29	78163.05	184822	148996.7	37736.4	0	0	97291.8	133697.6	64480.57	140058.9	426409.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Norşuntep	59757.27	0	41099.52	170765.4	0	0	0	0	508874.5	0	0	0	0	0	0	0	0	0	0	0	0	109360	412802.1	158990.4	0	0	54716861	0	212220.3	0	86110.14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oluz Höyü	136133.4	310792.8	399469.6	0	0	0	0	34929.29	7325439	83695.36	70412.01	0	0	77975.27	30013.95	0	302996.2	0	92387.5	0	43771.35	37522.1	77752	620051.6	0	0	0	0	320621.8	0	213217.9	0	827362.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ortakaray	193591.4	0	0	0	38333.17	0	0	125660.4	397766.1	35888.92	0	0	46835.9	0	0	0	0	0	0	0	0	0	38020.95	30926.36	32045.61	0	0	0	0	0	38769.51	0	0	55179.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ortaköy	438997.3	2611251	2021492	0	38096.71	0	0	94858.81	55230316	300545.2	417839.1	0	54035.06	845385.9	96776.14	0	296167.7	0	113405.1	30142.58	170592.5	95956.53	192064.7	1467582	0	0	0	0	730785.1	74905.01	678233.1	0	1559209	67094.56	28896.66	1760177	0	0	0	0	0	0	0	0	0	0	0	0
Oymaağaç	53909.4	79431.57	82413.17	0	0	0	0	0	1900729	39674.72	0	0	0	0	0	0	97291.18	0	180177.1	0	0	0	33699.56	145267.2	0	0	0	0	91524.71	0	64734.6	0	66635.4	0	0	170300.8	0	154674	0	0	0	0	0	0	0	0	0	0
Patara	389035.7	47282.24	97146.56	0	2129576	670454.8	131680.9	1908171	1846562	134906.2	0	349193.1	1450497	0	99320.1	30795.66	0	133731.8	0	0	57705.65	95854.04	219165.6	163367.8	67082.44	0	0	110893.3	145470.8	72728.35	160143.1	190126.8	0	2547476	0	0	116721.9	74073.97	0	0	0	0	0	0	0	0	0	0
Porsuk Hö	1308931	44723.18	144793.3	0	40940.67	0	0	102770.9	1860501	106354.2	0	0	54563.03	0	55825.07	207192.4	0	0	0	0	68633.99	191315.5	276319.7	219085	118648.7	47684.45	0	0	198978.4	41098.18	420207.6	0	29242.76	66944.31	0	0	39797.09	71476.38	0	95871.32	0	0	0	0	0	0	0	0
Seyitömer	60688.99	0	0	0	67572.29	56765.55	0	362012.5	350573.4	34249.72	0	0	120264.7	0	35644.86	0	0	0	0	0	0	0	0	0	0	0	0	30781.42	0	0	0	0	0	0	100370.5	0	0	0	0	73220.35	0	0	0	0	0	0	0
Sirkeli Höy	445501.1	35289.56	112480.4	31633.14	36336.58	0	0	82436.68	1416598	73801.39	0	0	50834.48	0	36447.45	313138	0	0	0	0	41282.74	709389.9	756883.9	228095.9	72109.04	467447.8	0	0	255390.5	0	375962.4	0	0	63203.19	31635.72	0	0	61197.16	0	83380.98	415218.3	0	0	0	0	0	0
Tatarlı Höy	94091.78	0	36965.9	0	0	0	0	0	432231.2	0	0	0	0	0	0	36906.74	0	0	0	0	0	525200.6	378379.1	87297.03	0	479307	0	0	100440.6	0	127028.7	0	0	0	0	0	0	0	0	0	63318.59	0	616803.8	0	0	0	0	0
Tavşanlı	55453.52	0	0	0	79199.2	71565.18	0	386796.6	316702.4	28688.1	0	0	151056.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28632.26	0	0	0	0	0	0	114840.3	0	0	0	0	82747.95	0	974794.2	0	0	0	0	0
Tell Atcha	239974.4	29100.44	88256.22	41712.29	32851.16	0	0	69631.74	1125021	54740.38	0	0	47582.99	0	0	65135.79	0	0	0	0	29021.07	984830.3	1925565	198173	35878.73	415320.4	0	0	223648.2	0	248405.5	0	0	59736.89	44571.81	0	0	45972.5	0	74327.88	131202.5	0	569811.1	283864.3	0	0	0
Troya	0	0	0	0	71659.54	83938.42	0	104688.5	180725.5	0	0	0	176878.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40074.17	0	118597.6	0	0	0	0	64620.87	0	0	0	0	0	0	0	0
Yumutepe	155975.1	0	0	0	0	0	0	0	340694.4	0	0	0	0	0	0	549890.2	0	0	0	0	0	59002.61	89952.48	44618.66	70467.8	0	0	0	44184.61	0	67633.18	0	0	0	0	0	0	0	0	30565.72	136910.1	0	172778.4	0	0	47921.62	0	0

5.4 The Network Graph

The network graph is built in the Social Network Visualizer (SocNetV) software. The relationship matrix has been turned into an edge list for the input data. Through this edge list a random network model has been built. In order to visualize the spatial relationships, the model has been overlapped with the Anatolian map with the nodes in their correct locations.

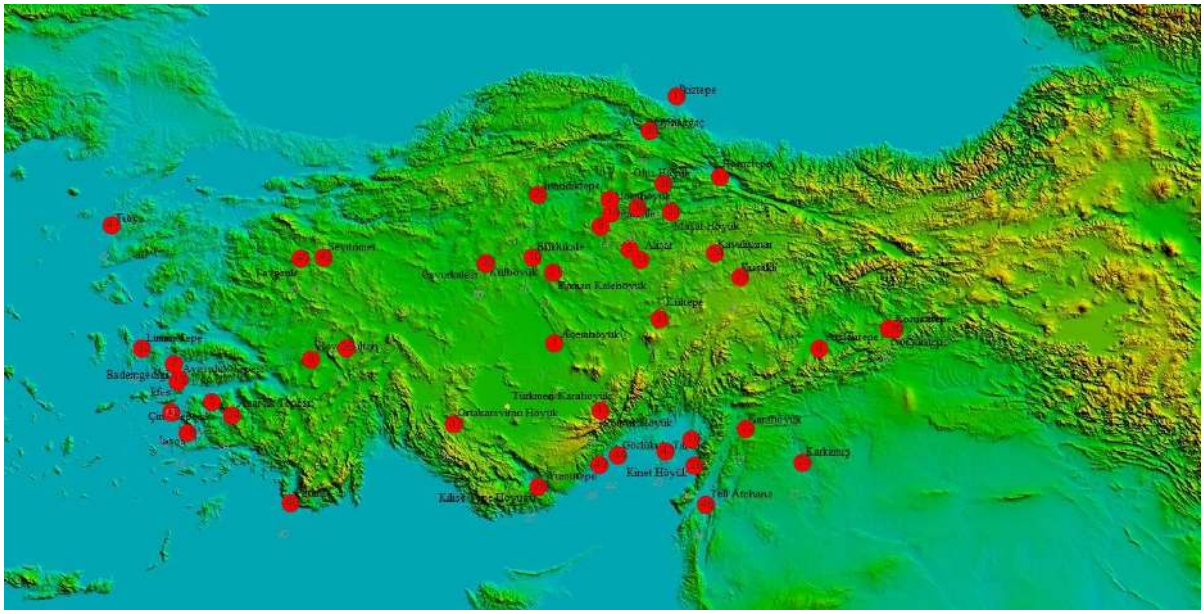

Figure 10: Nodes of the network on Anatolian map.

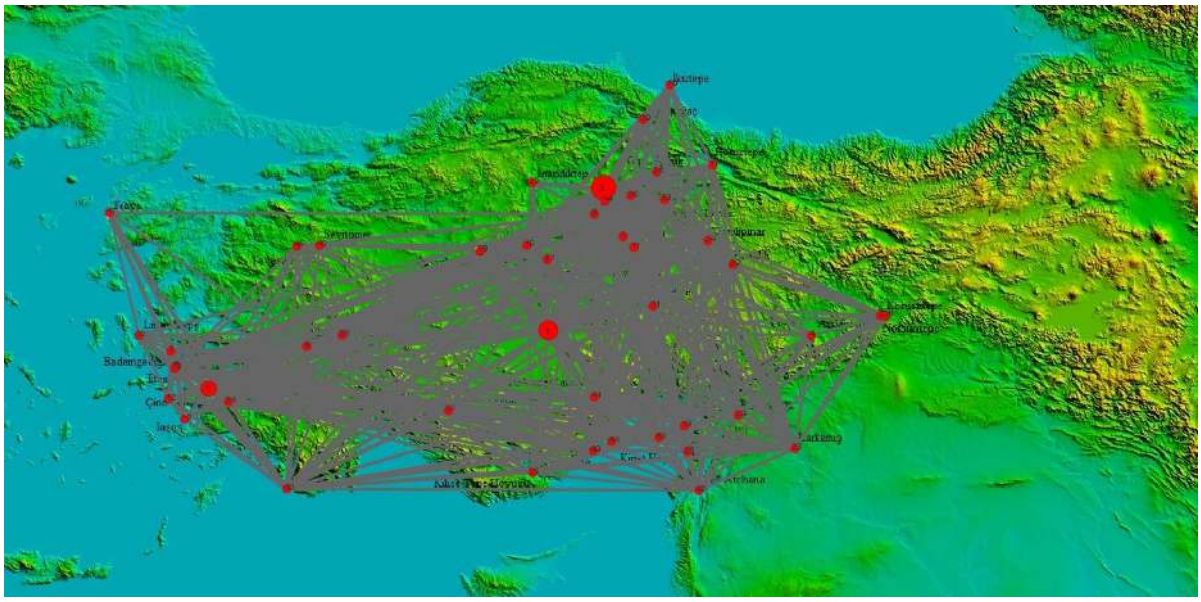

Figure 11: The random network built among the nodes on the Anatolian map.

5.5 Assesment of Centralities

The standardized centrality values of the nodes in the network model are presented below. Mean standardized Betweenness Centrality is 0.0079 and 19 nodes (1, 2, 4, 6, 7, 18, 20, 26, 28, 33, 35, 37, 39, 43, 45, 46, 47, 48) display betweenness centrality value as 0.

Tablo 3: Betweenness Centrality maximum and minimum values.

	Standardized value	Site
Maximum Betweenness Centrality	0.0448	Kültepe
Minimum Betweenness Centrality	0	Acemhöyük
Studied Betweenness Centrality	0.0370	Kayalıpınar (Samuha)

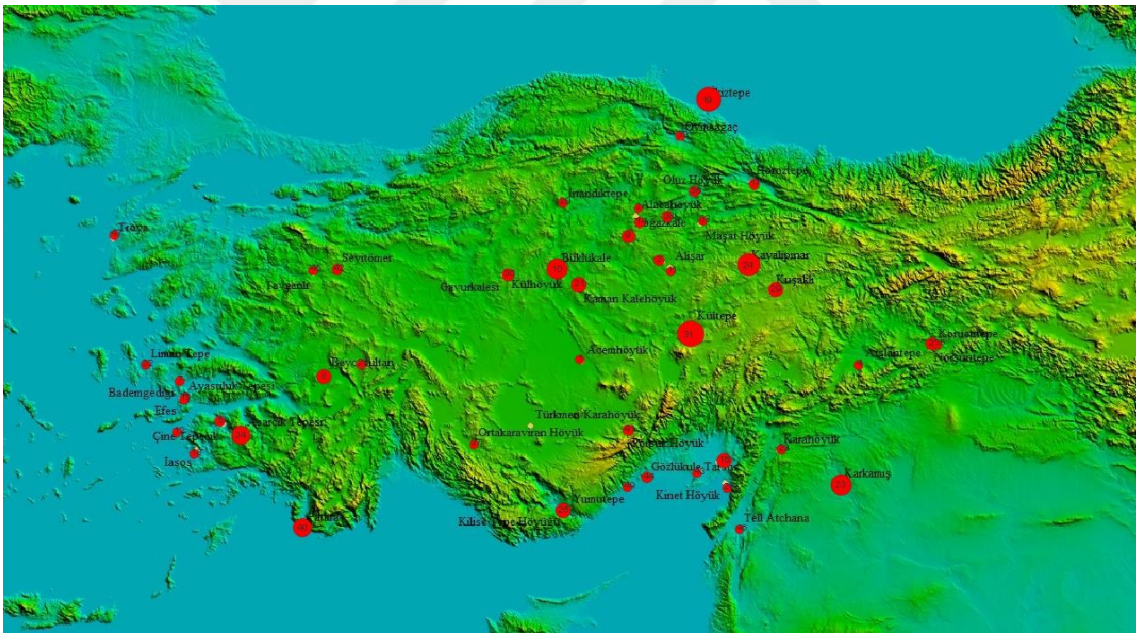

Figure 12: Node size representing betweenness centrality.

Mean standardized Eigenvector Centrality is 0.0362 and 11 nodes (20, 35, 39, 42, 43, 44, 45, 46, 47, 48) display Eigenvector Centrality value as 0.

Tablo 4: Eigenvector Centrality maximum and minimum values.

	Standardized value	Site
Maximum Eigenvector Centrality	0.3091	Alacahöyük
Minimum Eigenvector Centrality	0	Oymaağaç
Studied Eigenvector Centrality	0.0000000176	Kayalıpınar (Samuha)

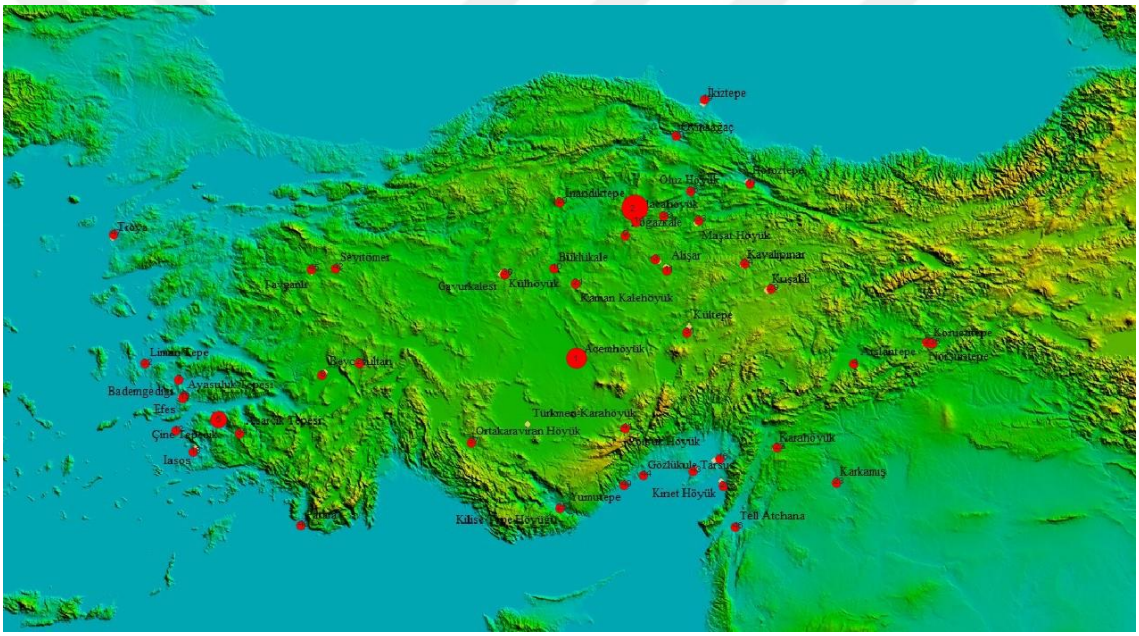

Figure 13: Node size representing Eigenvector centrality.

Mean standardized Degree Centrality is 0.0208 and 2 nodes (39, 47) display Degree Centrality value as 0.

Tablo 5: Degree Centrality maximum and minimum values.

	Standardized value	Site
Maximum Degree Centrality	0.3186	Alacahöyük
Minimum Degree Centrality	0	Oymaağaç
Studied Degree Centrality	0.0083	Kayalıpınar (Samuha)

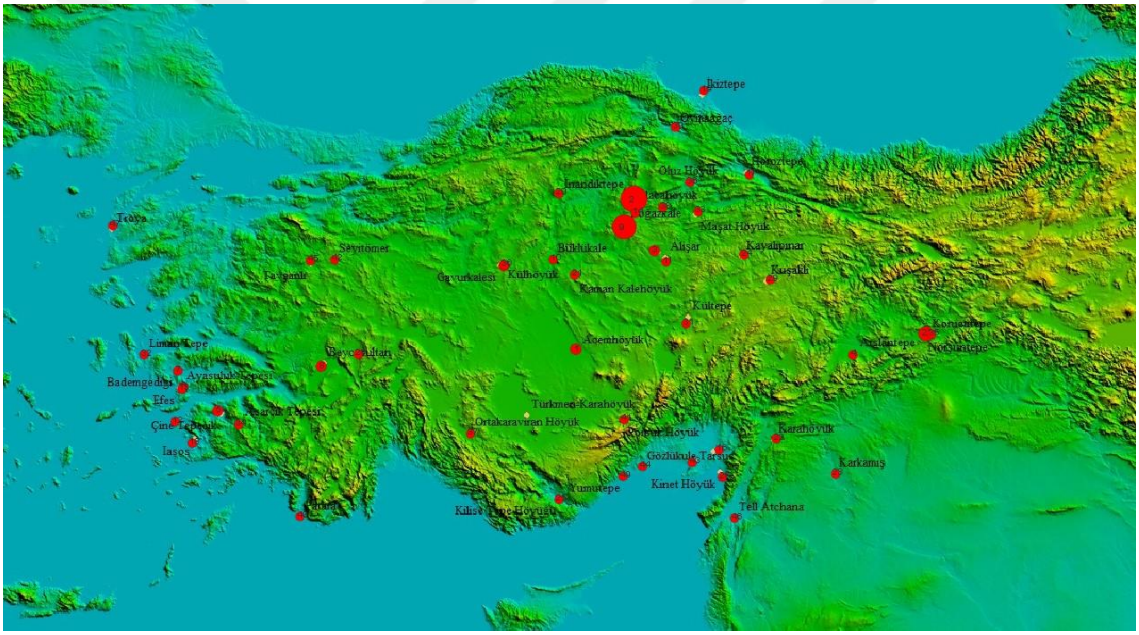

Figure 14: Node size representing Degree centrality.

Mean standardized Closeness Centrality is 0.026 and 3 nodes (39, 47, 48) display Closeness Centrality value as 0.

Tablo 6: Closeness Centrality maximum and minimum values.

	Standardized value	Site
Maximum Closeness Centrality	0.2097	Acemhöyük
Minimum Closeness Centrality	0	Oymaağaç
Studied Closeness Centrality	0.022	Kayalıpınar (Samuha)

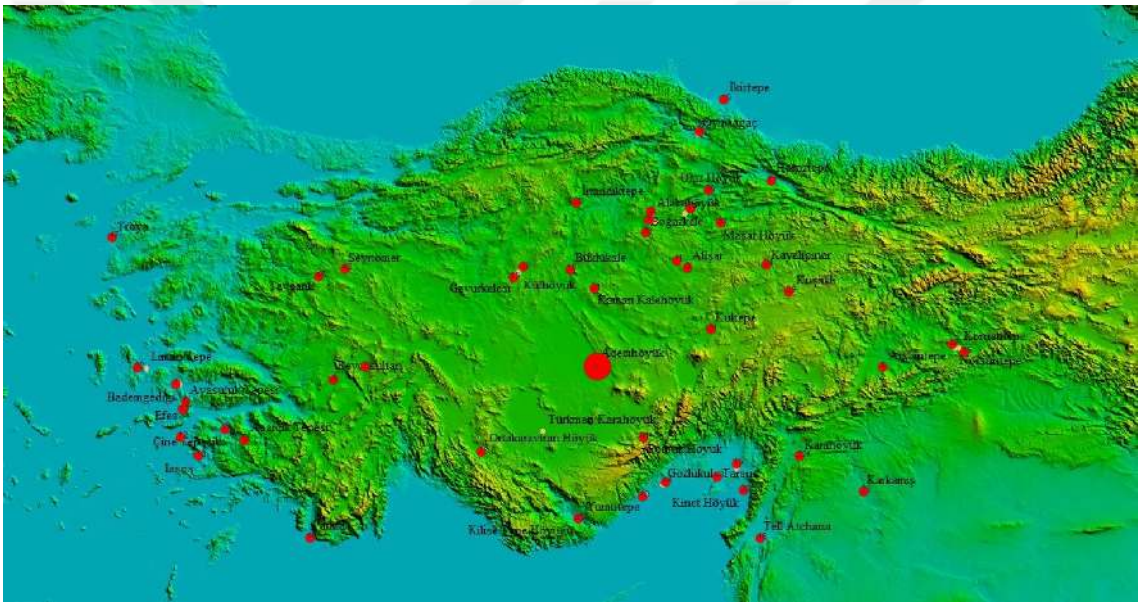

Figure 15: Node size representing closeness centrality.

The maps illustrating the nodes with higher centrality values in the network match with the significant cities in the Anatolian network although there are some discrepancies. The number of sites with centrality value as 0 appears as a discrepancy of the network model. In the future, this problem can be solved with exploration of different and more complex centrality calculations as well as integration of survey findings and increasing the number of nodes. Another discrepancy is related to the nodes with higher centrality values. Kültepe having the highest betweenness centrality although it was not a major center during the Hittite period corresponds to its locational advantage and is meaningful considering Kültepe's significance in in the Assyrian Trade Colonies network during the Middle Bronze Age. Similarly, Alacahöyük appears as one of the

most powerful centers with its high degree and Eigenvector centralities, but this result rather corresponds to its significance in the previous periods. The result can be interpreted as the significance of the location, as is seen in the Hittite capital Hattusha being in very close vicinity of Alacahöyük. Therefore, it is interpreted that these discrepancies are linked to the size estimations of settlements having low temporal resolution. The settlement size data has a low temporal resolution (including previous and later periods in certain cases) since the exact sizes of the chosen settlements for the specific period are not used in the model due to limitations of data. On the other hand, the most important cities and locations in the Hittite network as is known from the cuneiform tablets and excavation results appear as the central nodes of the network. Since these two data sets are not used in building of the model, it is possible to use this data as a comparison. Through this perspective, the model is successful in identifying the overall significance and advantages of the cities.

Chapter 6:

ASSESSING THE CENTRALITY OF KAYALIPINAR (SAMUHA): INTERPRETATION AND DISCUSSION

6.1 Implications and Comparison of The Different Centrality Values of Kayalıpınar (Samuha)

Kayalıpınar's (Samuha) four centrality values in the network are presented below (Table 7).

Table 7: Centrality values of Kayalıpınar (Samuha).

Centrality Type	Value	Standardized Value
Betweenness Centrality	80	0.037
Closeness Centrality	20440	0.022
Eigenvector Centrality	~0	~0
Degree Centrality	4586020	0.008

Considering the values above it appears that the highest centrality value is the betweenness centrality. In contrast its degree centrality and Eigenvector centrality are very low compared to the other two centralities. These results overlap with the initial hypothesis and indicate that Kayalıpınar (Samuha) has the quality of being a bridge node. Bridge nodes are characterized by not being part of a clique and having the quality of junction point between different clusters. This quality brings the advantage of access to different sources of information and being a passageway of relationships among different groups. The low Eigenvector and degree centrality indicates that Kayalıpınar (Samuha) does not have many neighbors compared to the rest of the nodes and it is not surrounded by a circle of cities that it has power on. These implications are in accordance with the archaeological data: Kayalıpınar (Samuha) is the capital of the Upper Land although it is not on a central location for this administrative unit of the Hittite State. It lays on the border between the Upper Land and the Hatti Land and Lower Land. Kayalıpınar's (Samuha) position as a bridge protects it from the politically unstable nature of the Upper Land and allows it to act a s a border garrison of the core province of the Hittite State, the Hatti Land. Kayalıpınar (Samuha) is located on the

crossroads of the naturally bounded routes in North to South and East to West directions which have historical significance in the previous and later periods, as well.

6.2 Comparison with The Textual and Archaeological Evidence

According to textual evidence, the Upper Land appears as a buffer zone against the Kaska and Azzi enemies on the North and East. Especially the Kaska groups that inhabit the mountain ranges on the Black Sea regions posed great threat to the Hittite security which results at a point with loss of the capital Hattusa and relocation of the capital to Kayalıpınar (Samuha). Kayalıpınar (Samuha) has been a garrison for the campaigns against Kaska and Azzi groups as well as action as a key market for these groups to contact the Central and Southern Anatolian trade channels. The case of market sanctions against the Kaska groups proves that the city benefitted from its position as an intermediary between different regions of Anatolia. The city was located on the inner edge of the Upper Land which possibly allowed it a safer location against the attacks. Another key factor is that the spoils of war were brought to the city to be re-distributed to the system. The soldiers in the region gathered in Kayalıpınar (Samuha) for the campaign in Sothern Anatolia.
The bulla archive that has been discovered so far in the city indicates that it has been a center for internal administrative and religious communication of the state. The rest of the archaeological and textual evidence that proves significance of Kayalıpınar (Samuha) as a junction point that received high flow in the network have already been presented in the thesis.

The results of the Social Network Centrality Analysis of Kayalıpınar (Samuha) are in accordance with the archaeological and textual data indicating its greatest advantage to be betweenness and its distance to the other major centers of power turns into an advantage through this perspective. The city receives goods, people and information from different clusters by being positioned on the intersection of frontiers of Upper Land, Land of Hatti, Kizzuwatna and Kaska Lands. In the future these findings would contribute to understanding Kayalıpınar (Samuha) as an archaeological site and a part of the Hittite world.

Chapter 7:

CONCLUSIONS AND FUTURE DIRECTIONS

The research question of the thesis is to identify the main advantage of Kayalıpınar (Samuha) in becoming one of the most important cities of the Hittite world as seen in its being the capital of the Upper Land, its significance for king Hattushili III and being used as the king's residence while the main capital Hattusha was under conquest. In order to answer the research question, a combination of different analysis has been employed. Social Network Analysis has been coupled with gravity model and LCP calculations. In the Social Network Model that is built, centrality analysis has been applied: Four different centrality values of Kayalıpınar (Samuha) have been calculated and compared in standardized value. The data used was limited with the size of the archaeological sites and their locations on the Anatolian topography. The archaeological data such as the excavation results or the information acquired from cuneiform tablets has been kept outside of the model in order to be used as a control data for the model. With this approach, the gap for use of Social Network Analysis in Hittite archaeology and the gap for evaluation of the localization data in comparison to the information on Kayalıpınar (Samuha) that has been gathered in the past decades through cuneiform tablets before its localization have been aimed.

The presented methodology showed fruitful results. In the results, it is seen that Kayalıpınar (Samuha) emerges as a pivotal city in the Hittite world, demonstrating multifaceted significance across different domains. The thesis explored Kayalıpınar's (Samuha) centrality using SNA, revealing its unique position within the Hittite sphere. Through comparative analysis of centrality indexes, betweenness centrality appeared as the key centrality of Kayalıpınar (Samuha) and the city emerged as a bridge, linking disparate regions of the Hittite rule and facilitating the flow of power and resources. This characteristic of bridging various cultural and economic hubs underscores Kayalıpınar's (Samuha) enduring significance throughout the Hittite history. Thus, while seemingly distant from other key cities, Kayalıpınar's (Samuha) geographical position and strategic role solidifies its critical status within the broader framework of the Hittite civilization.

The model proves to be insightful for local analysis of Kayalıpınar (Samuha) as a node in the network. The high centrality values of significant sites such as Hattusa,

Alacahöyük, Beycesultan and Kültepe point to the accuracy of the model so far. In the future the model is aimed to be improved through integration of different classes of archaeological data mentioned priorly in the thesis such as sites identified through surveys; Hittite landscape monuments; natural resources such as salt and metal beds; excavation results such as seals, tablets, pottery; and a more in-depth analysis of the results for the whole network with a focus on the dynamics of relationships among the different unities and centers of power in LBA Anatolia. Increasing the temporal and settlement size resolutions of the model is another goal for improvement. Overall, the model aims to respond to the need for a unified understanding of the Hittite world and the complex, fluctuating web of relationships it presents.

This thesis work is presented as a starting point of a methodological suggestion which combines different quantitative analyses and does not require use of excavation results in order to give meaningful results. It has been established that, although the application at this stage has room for improvement, the suggested methodology is fruitful in answering targeted questions on the local level. In the future, the LBA Anatolian network model and the suggested methodology will be explored further with integration of different classes of data and more sophisticated software, as well as utilizing further complex calculations SNA offers.

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