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INDIGENOUS HYDRO-ENGINEERING AND SETTLEMENT NETWORKS: THE GAURBANDS OF THE RAKHSHAN-RAS KOH REGION RECONSIDERED

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ABSTRACT

Balochistan over the millennia has produced numerous pre/protohistoric cultural traditions despite its geographic adversities. The traditions that developed from here were smart enough to use every resource that was available by then. This study, however, would shed a light on a region meagre with basic resources, yet flourished hundreds of settlements on its barren landscape. The piedmonts of Ras Koh in Rakhshan territory in the northwest of Balochistan is hardly known in archaeological literature. The inhabitants of the ancient Rakhshan, possibly with the start of settlement system up until the Kulli Traditions in the mid-third millennium BCE, erected hundreds of gaurbands (gabarbands) to sustain and feed vast cultures like Kulli through terraced fields. The gaurbands are defined as stone embankments built on the flood plains and foot hills were meant to attain the seasonal downpour. These torrential waters accumulated enough silt depositions and retained moisture for months, and eventually cultivation began once water evaporated. In this connection, this study brings new data in the field where sites like Kallag-i-Kour, Mammo-e-Koh, Soren Karod, and the Jalwar Archaeological Complex, were documented in Kharan and Washuk in association with series of gaurbands.

Keywords: *Balochistan, Gaurband, Hydro-engineering, Kulli Culture, Rakhshan-Kharan, Protohistory*

Introduction

The archaeological landscape of Balochistan is diverse and deeply rooted to the earliest settlement system of the Greater Indus Region. Archaeological literature now furnish that the region experienced its first Agricultural Revolution back in ca. eighth millennium BCE by domesticating only winter crops (wheat and barley), while its second Agricultural Revolution began at the beginning of the second millennium BCE by growing summer crops (rice, millet, and sorghum) in the Kachhi/Sibi Plains (Costantini, 1979; 2008). The irrigation mechanisms for the region during the Neolithic Period is yet obscure, however, during the Chalcolithic Mehrgarh in Period IV (ca. 3500 BCE), a trench filled with stone debris was exposed, which, according to the excavator, may have formed part of a canal. Seemingly flood agriculture (*khushkaba*) was practiced at Mehrgarh during the Neolithic and Chalcolithic stages, as sedimentological studies evident, the Bolan repeatedly deposited alluvium over its vast floodplain (Jarrige, 1991). Similarly, multiple agricultural engineering and water management schemes were introduced over the millennia that likely differed throughout the

massive land in order to meet the production requirement then. However, limited data hinders a comprehensive understanding of the province's paleo-hydrological innovations, with many regions remaining unexplored. This study, however, focuses one of the technological adaptations, known as '*gaurband*,' which was in practice during the protohistoric periods in the Rakhshan Region. The fresh findings from this manuscript related to gaurband mainly derive from the first author's doctoral surveys conducted between 2022 and 2024 in the Kharan-Ras Koh Mountain System (Pl. I).

Early Citations of Gaur/Gabar-band

Historically, these walled-structures made early travelers wonder, who often struggled to define their origins while traversed by Balochistan (Possehl, 1975). The earliest account comes from Henry Pottinger (1816), who found them in mountainous terrains accompanied them with mounds and *gumbad/z*. His local guide attributed these stone walls to pre-Islamic *Guebres* (fire-worshippers), a theory Pottinger embraced due to the non-Islamic architectural style. Pottinger was followed by Charles Masson in 1839, who documented these so-called "dams of infidels" across the region, though he uniquely misidentified them as defensive structures (Masson, 1843).

However, the twentieth-century researchers finally brought analytical depth to these sites, spanning Vredenburg (1901), Hughes-Buller (1907), Aurel Stein (1906; 1931), Tate (1910), Hargreaves (1929), de Cardi (1950), Raikes (1965 & 1968), and Fairservis (1971). Each advanced our modern archaeological understanding of these ancient walls.

Local Nomenclature and Etymological Perspectives

Over two centuries of geographical and archaeological surveys in Balochistan have documented a complex array of indigenous terms for the region's ancient stone hydraulic structures. To understand this local nomenclature, one must first look to fundamental linguistic components: in Balochi, *seng* or *sang* means "stone," *koh* denotes a "hill," and the widespread term *band* (or *bandh*) refers to a barrier designed to store, divert, or stop water (Balfour, 1885; Raikes, 1965; Brunner, 2006).

The present study, in this regard, brought another dozen of such localized vocabulary into light that came from personal communications, hence commonly spoken and known across the Baloch-speaking districts. Though they denote specific forms, functions, and locations:

- *Darband / Guwarband / Rabdband / Gaurband / Sangdalak/ Sangar / Kohwad / Kohband*: Documented in Nal, Awaran, Mula, Marri-Bugti hills, and the Ras Koh hills. These terms generally refer to stone embankments/terraces built along river channels and foothills to cultivate inside as field. This research, however, would opt for *gaurband* instead of *gabarband* as commonly refer to certain terraced-fields in the Ras Koh piedmonts.
- *Sendaat / Sengband / Gaurbasta*: This term indicates smaller, low stone bands erected along riverbanks to facilitate and protect the fields from the flash floods.
- *Gabrband:* this term is specifically applied to tall stone structures (dam) erected in the center of a narrow channel with high walls, sometimes more than 30 meters. Therefore, to be avoided for terraced fields or enclosed irrigation zone.

Among these, gabarband (*gaurband*) remains the most prominent designation in archaeological literature, formally introduced by E. Hughes-Buller in 1906. Featuring massive, quasi-Cyclopean masonry, contemporary populations often attribute these mega-structures to ancient infidels or superhuman giants. Etymologically, the prefix *gabr* in Balochi (as a replacement for *gabar*) bears a Persian origin that evolved during the Sasanian period, later used as a derogatory label for non-Muslims, specifically Zoroastrian fire-worshippers (Brunner, 2006; Kapadia & Cama, n.d.; Shaki, 2000).

Function and Scope of Gaurbands

It is observed that only rarely did gaurbands operate as perennial reservoirs (Buller, 1906; Stein, 1931; Raikes, 1965). These were instead check dams and agricultural terraces that were designed to increase runoff from marginal and

rocky lands by converting them into highly productive agricultural land (Possehl, 1975). In addition, these systems had a double agricultural purpose within their different topographic units (Balfour, 1885). Wide stone walls built into the bedrock at the mouths of the hill torrents trapped seasonal, erratic and torrential runoff. In turn, successive walls sculpted into the hillside moderated the flow to infiltrate sediments held in suspension, making it possible to produce fertile artificial soils on rocky terrains, while avoiding erosion (pl. II) (Hargreaves, 1929; Dales, 1962).

To support the continuity of protohistoric communities, human populations relied upon two fundamental hydraulic solutions: the *kach* system and diversion dams (Fairservis, 1971). Thanks to the *kach* system where it made possible to increase runoff from top soil and improve water infiltration at depth with the construction of low walls. Meanwhile, the diversion dams (locally known as *guwarjan*) operated as weirs, diverting flood waters into irrigation canals. Combined, these technologies reduced water stress, allowing inhabitants to shift from unpredictable rainfed agriculture (*khushkaba*) to dependable intensive dry season agriculture in now abandoned valleys (Stein, 19 34; Fairservis, 1971).

Geographic Distribution

The geographical distribution of gaurbands evident to a widespread water management system, extending from Balochistan to Kohistan in Sindh, India, and as far as the Near East. In Balochistan, these structures extend from the Makran coast—including Koh-e-Batil in Gwadar—to the mountainous areas of Jhalawan, Sarawan, and Kharan (Dales, 1962; Wright, 2010). They are so frequent that they are rarely arranged in series, often lining valley ravines in groups of five or six in larger valleys such as the Wadh, Nal, and Mula Pass valleys (Possehl, 1975).

Further east, in Kohistan, Sindh, more than a dozen gaurbands associated with the settlements of Amri and Kot Dijian, like those in the Taung Valley, regulated seasonal flows to irrigate alluvial depressions (Harvey & Flam, 1993). This strategy of collecting ephemeral water then spread throughout India, reaching the lower Indus Valley, Punjab, Rajasthan, and Gujarat (Ranjan, 2016). The Harappan city of Dholavira in Kutch is a prime example: it used immense stone reservoirs built with rubble stones to collect water from seasonal canals (UNESCO, n.d.). Further west, similar damming techniques, designed to exploit flash floods, emerged between the fourth and third millennia BCE, notably at Jawa in eastern Jordan, and in southern Mesopotamia (Brunner, 2006).

Present and Past Climatic Conditions of the Region

At present, the Kharan region experiences a hyper-arid subtropical desert climate with minimal rainfall. Present-day annual precipitation is low and irregular, averaging only 12.77 mm (0.5 in) due to the region's location outside the major monsoon zones (Weather and Climate, n.d.; Fairservis, 1961). This contrasts sharply with the high concentration of protohistoric sites and monumental gaurband ruins found in the present-day, arid, and sand-dominated basins. In light of this distribution, Sir Aurel Stein (1931) suggested that the past environment was significantly wetter than today, thanks to perennial springs and watercourses that have since completely dried up (Vredenburg, 1901).

While some 20th-century specialists initially favored the climatic stability of the Holocene, modern multi-disciplinary studies confirm significant paleoclimatic fluctuations (Jarrige et al., 2011). Drilling in the Arabian Sea and lacustrine sedimentary data reveal that the paleolakes of the Thar Desert retained permanent water between 10,000 and 2,800 BCE (Enzel et al., 1999). Furthermore, pollen analyses from the Makran coast highlight a peak in humidity at the beginning of the Holocene, followed by progressive desiccation between 3000 and 2000 BCE, in parallel with the weakening of the southwest monsoon, which ultimately weakened the old networks of regional settlements (Ansari and Vink, 2007; Jarrige et al., 2011).

Climatic Variability and Innovative Response

The increasing aridification of the mid-Holocene led to a sophisticated technological response to

profound environmental constraints. Most of the region's watercourses were intermittent and flowed into barren saline depressions, such as the Parumi Kap at Panjgur or the Hamun-i-Mashkel at Washuk, so agriculture was strictly confined to valley bottoms (Mughal, 1974; Jarrige et al., 2011). Whereas alluvial soils allowed for the annual cultivation of wheat and barley, traditional rainfed agriculture (*khushkaba*) made communities extremely vulnerable to climatic hazards (Fairservis, 1971). To mitigate this ecological fragility, protohistoric societies developed gaurbands, a hydro-engineering system designed to reduce evaporation and extend the lifespan of water (Jarrige et al., 2011). This technology has enabled populations to optimize the use of scarce resources, ensure the continuity of their settlements and demonstrate environmental possibilities (Fairservis, 1971).

Indicator of Denser Population

The wide distribution of gaurbands and their association with major Kulli centers like Nindowari testify to a dense, prosperous, and highly organized protohistoric population. Vredenburg (1901) was the first to note that the arid deserts of Balochistan once supported thriving communities. Stein (1934) confirmed this observation during his surveys at Kharan, Washuk, and Awaran, demonstrating that the extent of gaurbands along the arid slopes proves that these abandoned valleys historically supported denser populations and intensive agriculture.

Subsequent research shifted from mapping the ruins to assessing the socio-political complexity required for their construction. De Cardi (1950) argued that the size of these dams implied stable and dynamic agricultural societies capable of mobilizing a considerable communal workforce. Similarly, French Mission while excavating a Kulli period site at Nindowari in Ornach, quantified this demographic scale, by identifying fifty-two stone structures close to the site (Jarrige, 1985). Just like Ornach, such an intensification of gaurbands were seen at the Ras Koh mountains, demonstrating a demographic surge with artificial agricultural fields during the third millennium BCE.

The fresh findings from Ras Koh is looking these agricultural strategies from the scratch. Early researchers thought that this intense protohistoric occupation was due to a wetter climate, but Jarrige is up to the view that advanced human adaptation and technological ingenuity collectively helped these large communities thrive for millennia (Jarrige et al., 2011).

Hydro-Engineering and Social Organization

Constructing and maintaining gaurbands in protohistoric Balochistan needed an enormous labor force, which suggests an extensive degree of social organization. According to Raikes (1965), the skill involved in building and placing stones of such massive weight (up to 1.5 tons) implies a great level of sophistication in water management. Brunner (2006) estimates that, in order to build a site like the Duddar Dam at Hub, at least 500 laborers would have been needed for 200 days. In many of the Balochistan dams, it is clear that they were part of more complex systems, with people building and maintaining some dams in close succession (Hargreaves 1929; De Cardi 1950).

The possibility of the central locations being able to feed and house the thousands of laborers required, without nearby villages, is also not very likely (Hargreaves 1929). The dams, as with the cisterns, could have been controlled by small central administrations, who coordinated the work of a large number of farming communities living around them. These communities were already expert at managing complex systems and could have brought their existing skills to the building of dams and water harvesting systems. As Fairservis opines that a force of collective labor-work required to change a desolate arid land into lush green fields with a more complex building strategy (Fairservis, 1961; 1971).

Indigenous Engineering and Shared Architectural Traits

These protohistoric gaurbands in Balochistan demonstrate that there existed a sophisticated tradition of local technology that resulted in impressive longevity of the structures. The

available evidence suggests that the combination of these sophisticated hydro-designing and masonry technologies were not simply borrowed from other traditions (Vredenburg, 1901; Raikes, 1968).

The construction of these walls reflects a mastery of practical designing. The boulders used in construction were picked up from the river and stones were fitted in place. The massive stones of the structure were held together by smaller packing stones that were placed inside the gap between the massive stones in order to prevent the structure from being threatened by seasonal water pressure. Even in Jalwar and Sohr Karod, remnants of clay binder and variations in height of up to two to five meters were found that show an attempt to strengthen the structure in terms of water impermeability, keeping in view the topographic constraints (Lal et al, 2007). This is because of an internalized and synchronized architectural design and pattern within a shared field.

Observations of the soundings from recently discovered sites, such as Purki Chakul, Garuk and Puchen Damb, show the same masonry technology and structure plan as observed at Kulli, Anjira and Nindowari (pl. III) (Stein, 1931; de Cardi, 1965).

Current Data from the Ras Koh Piedmonts

The widespread distribution of such walled-remains across valleys—from eastern Ras Koh (Kallag Kour Gaurbands) to western Ras Koh (Sohr Karud Gaurbands)—demonstrates that water control was not an isolated innovation but part of a regional agricultural strategy spread throughout the Rakhshan districts. More generally, the entire foot of Ras Koh at Kallag is occupied with gaurbands, starting from the newly constructed highway known as the CPEC road beyond the Eri Kallag, stretching up to ten kms. They are more widespread in Kharan and Washuk areas than Noshki and Chagai. Some of them from the recent findings are as under:

Toji Gaurbands

Aurel Stein documented gaurbands at Toji prior to mounting the high bank to the east of the stream, consisted of ca. 36 meters long and about 6 meters wide at the base, constructed at right angles to the bank of seasonal course and showing a core of enormous masonry of unhewn stones. The stone structure at the bottoms of the mounds possibly suggests that they were used as defensive walls against the channel that once flowed between the mounds (Stein, 1906; 1931). Nonetheless, during my recent surveys in 2024, the authors could only find the foundation stones of these gaurbands while the rest of the stones claimed by earlier travelers either were taken away by the villagers or washed away by the streams.

Kallag-i-Kour-e-Gaurbands

The Gaurband of Kallag-i-Kour are located 22 kilometers west of Kharan city and 205 meters north of the CPEC road. Nestled at the immediate piedmont of the Ras Koh Range, the site sits at the mouth of the Kallag Pass (*Kallag-e-Dap*). The entire structural complex falls within the riverbeds of several hill torrents originating from the northern hills, with the major stream being the Kallag itself. The remaining gaurbands stretch from the north to the northeast. While torrential waters have washed away significant portions of the walls, surviving sections stand up to two meters high with massive bases measuring up to three meters wide, heavily accumulated with sand and gravel.

To the northwest of these walls lie the remains of an adjacent settlement. A small mound, covering an area of 903 square meters, rises 2.7 meters above the riverbed (pl. IV). Constructed from similar large stone blocks, its exposed southern face yielded a small quantity of thick, coarse potsherds, including basket ware.

Beyond this mound, the higher ground, less exposed to flash floods, shows evidence of seasonal settlements. These raised areas within the walls yielded thick, coarse, and fine pottery, wheel-thrown. This spatial distribution corresponds to the early observations of Pottinger (1816), who documented the presence of stone-covered mounds within each gaurband he visited, interpreting them, however, as ancient fire altars or tombs. More recently, excavations at sites in Ornach have confirmed the presence of

protohistoric Kulli pottery within these structural complexes (Raikes, 1965).

Mammo-e-Koh Gaurbands

These stone constructions are located at the foot of Koh-e-Mammu, near the entrance to Eri Kallag. Three kilometers northwest of Kallag-i-Kour-e-Gaurbands, the site also holds remains of habitation. Unfortunately, the passage of heavy machinery has reduced the remaining debris to an area of 28 meters by 25 meters, and clandestine excavations have dug ditches up to 2.4 meters deep. Extending from north to south from the foot of the hill to the Kallag road, a group of gaurbands adjoins these remains. Constructed using large stone blocks similar to the works along the Kallag stream, these walls occupy a smaller geographical area, and some of their stones have been reused in modern constructions.

Despite this obliteration, the site produced thick basketry fragments, including four complete discoid beads made of terracotta, soft stone, and soapstone or light green faience. The beads have been painstakingly perforated in the center and bear close resemblance to that of Jalwar in the west. In addition, a fragment of cylindrical pottery displays an altered red slip and a subtle pipal leaf motif, a decorative element characteristic of the Kulli repertoire (pl. V). Taken together, these artifacts suggest the existence of a small protohistoric community integrated into regional agricultural and economic networks, whose main nearby urban centers were Puchen and Jalwar.

Puchen Kalat

Further than these gourbands, the archaeological mound of Puchen lies in Eri Kallag village in the Ras Koh Mountains, crowned by a historic fort. Measuring 254×164 meters, it lies 28 km northwest of Kharan town and 4.5 km southeast of Kallag Middle Paleolithic stone industry and cave site, recently discovered during the survey. Two seasonal streams, Buzani Kour and Kallag Kour, surround the fort on two sides and join near the fertile *Machkadag* (date palm orchard) east of the site. The site is accompanied by dozens of stone embankments on four directions, many of them are being reused, and others have been buried under the new settlements by the local Baloch population.

The Puchen mound rises nearly ten meters above the riverbed and closer examination, however, revealed prehistoric pottery scattered across the site, indicating occupation from the early Chalcolithic to the Kulli period. Ancient *sengbands* also survive beneath later fort walls.

Soren Karod Gaurband

These walls are located in the *Kohpusht* area, west of the Ras Koh Range, at an elevation of 972 meters above sea level. Accessible via the Quetta-Taftan highway, the site lies close to Dalbandin although falls administratively within District Kharan. Modern road paving and flash floods have destroyed most of the erected stones. However, three meters of wall still stand above the riverbed, a testament to the ingenuity of the ancient indigenous engineers who had built them.

The surviving structures today stretched over the banks of a major seasonal river, covering some 20 hectares. The longest remnants left today measure 100 meters in total. Some stone blocks measure up to 2.3x1.4 meters (pl. VI), implying enormous amounts of work invested. The blocks have been set together with evidence of clay as bonding agent and mud-stones to fill gaps. Similar bonding materials were also evident at Bahlol and Jalwar (Buller, 1906).

The Jalwar Archaeological Complex (JAC)

The Jalwar Archaeological Site (JAC) includes several periodic remains spread over 3.5 kilometers. These consist of petroglyphs, inscriptions, a medieval mosque, tombs, a fortress, and an important hydraulic system (pl. VII). It can be accessed from Shahu Gedi in Washuk. It is situated 3.3 kilometers to the left of the CPEC road, in the Jalwar Pass. Historically, it was a key caravan route to Dalbandin, known for its strategic location and resources.

The Settlement Mound (Gumbadi Damb)

The main site features a large, flat mound located 5.6 kilometers north of the village of Shahu Gedi. It sits atop of a natural cliff on the west bank of the Jalwar Stream. This mound measures 667

meters by 211 meters and covers about 11 hectares. It contains thick layers of soil that date from Kulli to the historic periods as evident through ceramic remains.

The Mountain Path

To the northeast of the main mound, there is a unique mountain path that runs along the hillside from north to east. Constructed out of rubble masonry packed with mud mortar, the top is filled with river sand and gravel. The width varies from 1.2 to 5 meters and runs 244 meters following the steep hillsides. The length suggests to connect two gaurbands in the northwest and southeast, while its cultural affiliation is yet to be decided.

The Terraced Gaurband System

The Jalwar Pass bears a picturesque topography with three consecutive openings, each having steep ridges with width less than 100 meters. Thus, the three ridges form three distinct valleys. Entering the first valley one sees the series of gaurbands on the river course possessing tall statures, two to four meters high. These are constructed with river worn boulders filled with small rubbles to uphold the heavy mass. To identify each series of gaurband in separate valleys, they have been classed into three zones, Gaurband A to B.

Gaurband A spans over 13.2 ha. and lies on the southeast of the Kulli settlement. Some of the stone walls rise to 4 meters with 3 meters wide base. As recorded in the Saruna and Bhagwana (Baghbana) valleys in southern Balochistan, they too are supported by buttresses set at right angles to endure the torrential floods (Balfour, 1885; Buller, 1906). Some intact sections stretch up to 300 meters in spite of modern road network and flood destruction, where date palms and seasonal crops are still grown.

Gaurband B is located 0.4 km northeast of Gaurband A on the second entrance where the mound lies. It covers an area ca. 18 ha. making it the largest agricultural fields in the Jalwar complex at the eastern bank of the river. The walls are lower than A, however, follows a long sturdy construction mode that stretches from the river bank to the base of the hill.

Gaurband C is the smallest system of all the other gaurbands, ca. 4.80 ha., lying at the immediate north of Gaurband B. The steep slope with smaller streams has eroded its actual course significantly.

Multi-functions of these Structures

Apparently certain stone structures did not merely function as water storage reservoirs, rather they had more functions than previously interpreted. They were not only terraced fields with spillways to hold the required water and silt and bypass the water in a way that did not damage the walls, too. The other possibly functions were:

River Channeling

This technique works by building a permeant barrier on the channel whether perennial or seasonal to raise the water level and later divert it towards the agricultural fields through a channel. This method of river diversion is known as *kour-ju* in southern and western Balochistan and still applied in parts of Balochistan (pl.VIII). After several decades buried in the gravel, such a concrete structure arose in Panjgur on the Rakhshan River in 2022, when heavy rains hit Balochistan. On the perennial Mula River in eastern Balochistan, a similar structure is erected to channelize the water into five directions, known as *panjuk*.

Flood Protection Walls

The present survey revealed several protohistoric sites have been laid down on the riverine site, therefore, in order to avoid seasonal flooding, they established protection walls. This levee is known as *sendaat* built in a style of gaurband. At Toji, Stein discovered similar structures next to the two mounds to protect the settlement from *gwanden Toji*, a rivulet originates from the nearby mountains. We also experienced akin boulders lying beneath Bibi Aazadgaz and Puchen Fort sites (Pl. IX).

Earth Dams

Another mode of survival on the desert plains was to construct *bands*, as commonly known for. It functioned likewise gaurband to catch the run-off and hold humidity for cultivation. It is built with earthen or mud materials with slopping sides and

thick base, the stature ranges from 1 to 3 meters. We doubt that the Daak Plain, lying between Noshki and Chagai, where recently many settlements came to light, had such subsistence strategies. Due to the perishable nature of earth, they might not have survived well or buried under the silt depositions. Similarly, Gujarat in India possessed such a soil-based approach for agricultural enclosures. During the Iron Age, near Khilosara earthen banks stretched over a kilometer and rose 4 meters high, significantly providing a 13 ha. agricultural field (Possehl, 1999; Ranjan, 2016).

Sequence and Chronology

The foundational know-how building structures with river stones goes back to Pre-Chalcolithic Periods, evident from the architecture of Kili Ghul Muhammad and Anjira settlements (Raikes, 1965). As the Holocene Epoch ended, the smart way to encounter the drier environment was to construct stone enclosures for preparing agricultural soil (Dales, 1962). The architectural and ceramic traits went under a refinement from the Chalcolithic to the Bronze Age by various cultural groups (Raikes, 1965; Jarrige et al., 2011). Therefore, at present, the exact timeline for these stone structures is unclear as available data is way scanty and lack reliable justifications. However, the literature in hand support a date between the mid-fourth millennium to early second millennium BCE, linked with Kechi Beg, Togau C, Nal, and Kulli traditions. Jarrige during his excavations at Mehrgarh unearthed a trench filled with rubble stones for the Kechi Beg levels, later hypothesized for a structure like river channel (Jarrige, 1985). The gaurband ingenuity reached its zenith by the end of third millennium BCE, often associated with civilizations like Kulli and Indus.

After this tradition went into decline during the second millennium BCE, the later Iron Age and Muslim settlers introduced another irrigation technique by digging subterranean channels, generally identified as karez (*qanat*). This transitional shift from *gaurband* to *qanat* systems made livable these barren lands to be settled down continuously over the millennia, which also shows their mastery over these regions.

Possible Reasons for their Abandonment

Because of limited number of excavated sites and proper field explorations in these regions, the actual cause of their abandonment is yet to be established. Hydrologists and field experts tend to know that climate change played a major role to resource scarcity and compelled the large population to disperse and vanish. A prolonged drought most probably cut down the major supply chain then needed to meet the subsistence requirement. This water scarcity must have depleted the water table correspondingly, particularly close to the riverbeds and alluvial fans. This perspective was understood at the sites of Said Qala Tepe and Deh Morasi Ghundain to the north in Kandahar when the drop-in water table was evident (Fairservis, 1952).

Present-day Exploitation

At several localities, the reuse of ancient gaurbands has been experienced, for instance, farmers at Jalwar, Kallag, and even in northern Balochistan often cultivate crops in these stony structures when abundant rainfall occur (pl. X). It must be born in mind that, after their decline, they might have been exploited similarly by the succeeding cultures, like Londu and Islamic peoples as their large sites are clearly found in the vicinity (Raikes, 1965; Possehl, 1975). Buller notes that when these walls receive leakages or other damages, the local cultivators repair them by filling the gaps either with mud or smaller stones. Other such examples come from the fertile plains of Hab River; presently near Toji mounds, each year farmers reshape riverbeds of Abdari, Rozijal, and Chahsit streams where they collectively form the Baddo River, practice the traditions that was adopted several thousands earlier by the Toji people.

Analysis and Conclusion

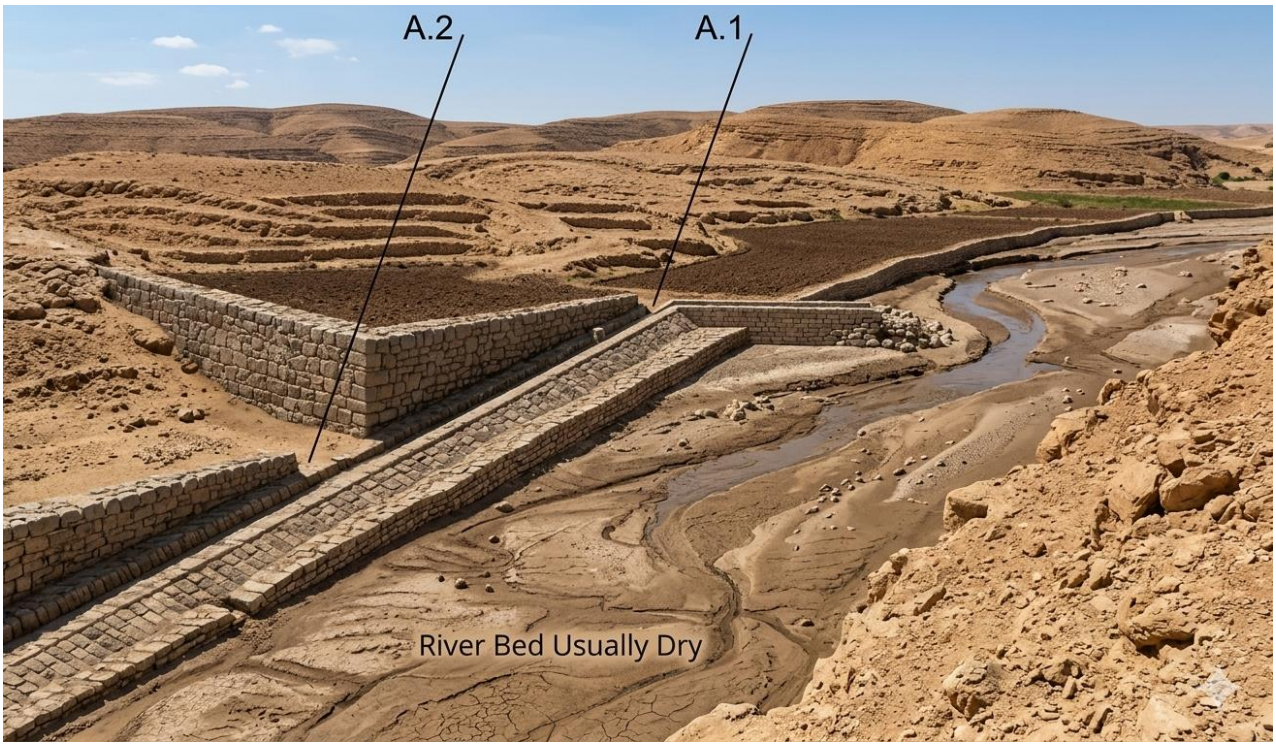
The vast chain of gaurbands stretched from the eastern piedmonts of Kirthar up until the hilltop of Koh-e-Batil in Guwadar signify the significance of these hydrological structures for the growth and expansion of the protohistoric traditions in Balochistan. The Ras Koh Mountain System likewise provided a suitable environ for the growth of these cultures in a semi-desert terrain. Their

growing number and loci inside and outer fringes of Ras Koh lucidly mark the strategic depth and local growth of demographic landscape in farthest Balochistan. It further justifies that each corner of the region was crucially equivalent for the interaction, growth, and exchange networks within the region and beyond.

Equally one can behold the essential mastery of the ancient Balochistan for planning, building, and maintaining of these engineered structures. Sites like Bibi Azadgaz, Toji, Jalwar, and Puchen now very well change our understanding that these regions in Balochistan were as significant as central and southern in Protohistoric periods. The large permanent settlements and rich material culture found within and adjacent to these terraced fields decide the fate of these stony structures belonging surely from the protohistoric population of Balochistan.

The work in southern Balochistan brought by American and French Missions at Edith Shahr and Nindowari are equally important (Raikes, 1965; Fairservis, 1971; Jarrige et al., 2011). They are large settlements with hundreds of gaurbands discovered in their surroundings over the years by the foreign missions. The present findings from the Rakhshan corridors affirm an akin tradition, the larger the site, the more extensive their hydrological networks. Each site that has been named in the preceding paragraph, comes from the Kulli Culture, therefore Kulli, undoubtedly, became the dominant tradition by the middle of the third millennium BCE in Rakhshan-Kharan regions.

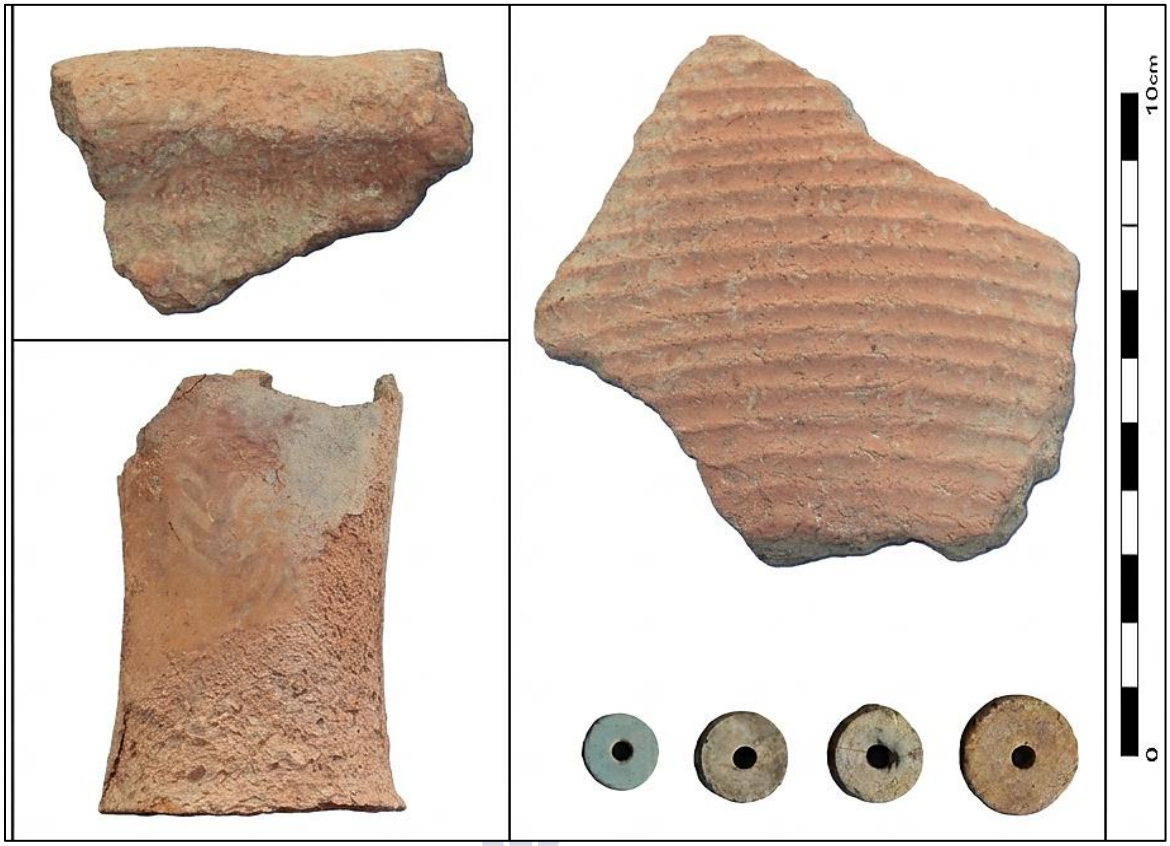
Plates



Pl. II- A reconstructed example of gaurband by Raikes, 1965, colored after him for more clarity.

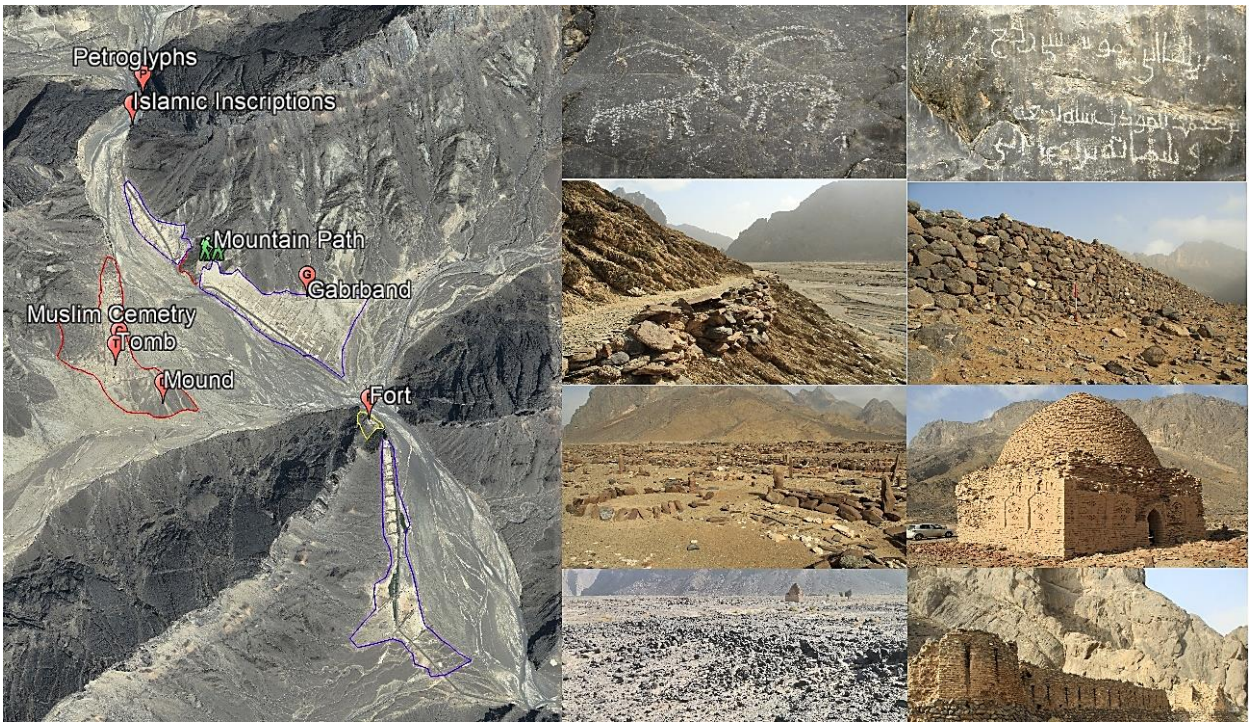
Pl. III- The left wall is from Jalwar gaurband, the right wall is from Nindowari site (@Jarrige et al., 2011).

Pl. IV- Settlement remains at Kallag-i-Kour-e-gaurband.



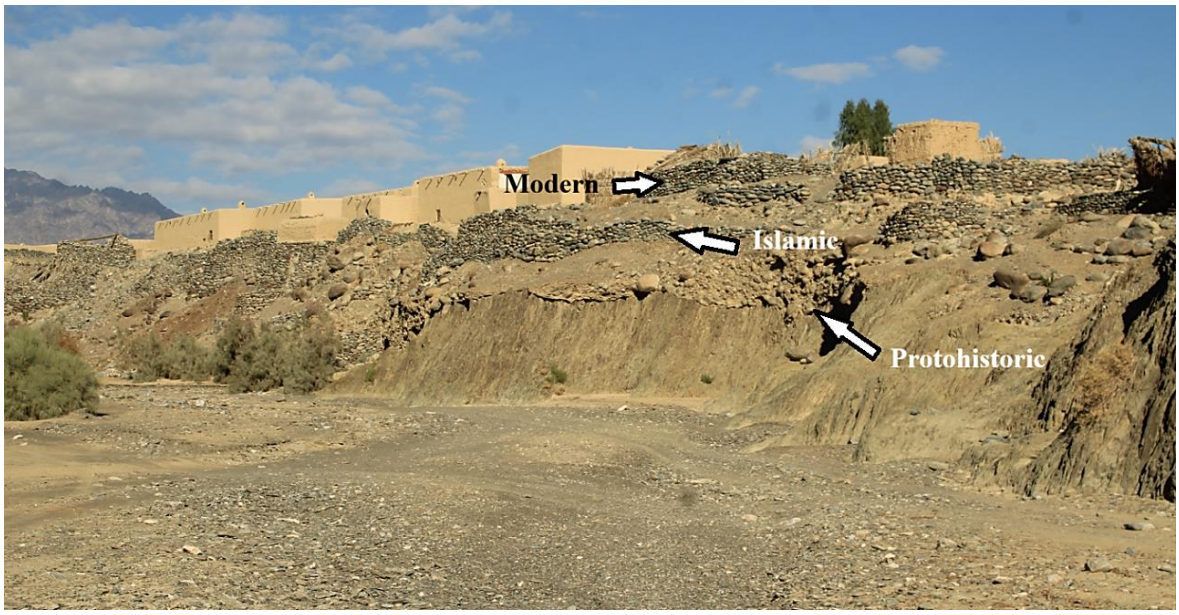
Pl. V- Some of the findings from Mammu Koh Gaurbands, basket ware, spindle whorls/beads.

Pl. VI- One meter ranging rod showing an enormous boulder at Sohren Karod west of Ras Koh.



Pl. VII- The (JAC) with various periodic remains, from Protohistoric to Islamic periods.

Pl. VIII- Constructing a traditional diversion weir somewhere in Balochistan (@ Oosterbaan, 1982).



Pl. XI- Different Chronological flood protection walls at Puchen Fort, Kharan.

Pl. X- Protohistoric gaurband with modern cultivation inside at Jalwar Pass, Washuk.

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