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More Than a City Bird: Unlocking the Bronze Age Origins of the Pigeon

Biology * Evolution * Animals

The Evolution of a Synanthropic Bond - Humans and Pigeons

For millennia, the rock dove (*Columba livia*) -- commonly known as the pigeon -- has been an enduring fixture of the human environment. In contemporary urban landscapes, feral pigeons are frequently dismissed as opportunistic pests, heavily stigmatized as the byproduct of industrialized cityscapes and criticized for their association with disease and architectural degradation[1]. However, this modern perception obscures a profound and complex co-evolutionary history. Prior to the advent of modern telecommunications and chemical fertilizers, the pigeon was a highly valued commodity. Domesticated rock doves served as vital couriers capable of traversing vast distances, a reliable source of easily accessible protein, producers of nutrient-dense fertilizer known as guano, and potent religious symbols across the Mediterranean and the ancient Near East[1].

The exact timeline, mechanisms, and geographic origins of pigeon domestication have long eluded zooarchaeologists and evolutionary biologists. Because the skeletons of wild and domesticated rock doves are morphologically plastic and virtually indistinguishable in their early domestic phases, identifying the exact threshold of domestication using traditional osteological metrics has proven exceedingly difficult[1]. Until recently, the earliest unequivocal archaeological evidence for morphologically domesticated pigeons came from the site of Nea Helos in Hellenistic Greece, dating to the fourth to first centuries BCE, alongside the emergence of large-scale stone dovecotes known as columbaria[1].

However, emerging research integrating advanced zooarchaeology, stable isotope analysis, and paleogenomics has radically shifted this timeline. Recent investigations at the Late Bronze Age harbor city of Hala Sultan Tekke in Cyprus have demonstrated that rock doves were already semi-domesticated and deeply integrated into human ritual and dietary practices by 1400 BCE -- pushing the timeline of the human-pigeon bond back by nearly a full millennium[1]. This report explores the exhaustive archaeological, isotopic, and genetic evidence outlining the pigeon's transition from a wild cliff-dweller to one of humanity's earliest and most adaptable companion species.

The Commensal Pathway and Evolutionary Frameworks

To understand the domestication of the rock dove, it is necessary to examine the theoretical frameworks of animal domestication. Domestication is not a singular event, nor is it always a deliberate human enterprise characterized by intentional, artificial selection. Evolutionary biologists and anthropologists generally classify the initial stages of animal domestication into three distinct trajectories: the directed pathway, the prey pathway, and the commensal pathway[12].

Unlike sheep or cattle, which followed a prey-to-management pathway aimed at controlling a depleting food resource, or horses, which were deliberately directed into domestication for transport, the rock dove followed the commensal pathway[12]. The commensal pathway describes a co-evolutionary process where a wild population adapts to an anthropogenic niche. As humans establish permanent settlements, practice agriculture, and alter their surrounding ecosystems, they inadvertently create novel ecological zones rich in resources, particularly food waste and shelter[12]. Wild animals that exhibit anthropophily, or an inherent attraction to human environments, and possess shorter flight-or-flight distances capitalize on these resources[14]. Over successive generations, these populations habituate to human presence, transitioning from wild opportunists to synanthropes, and eventually into a state of commensalism where their survival becomes intrinsically linked to human habitats[13].

The rock dove is a quintessential example of this evolutionary trajectory. In the wild, *Columba livia* nests on sheer cliff faces, rocky outcrops, and inside large caves along the coasts of Eurasia and North Africa[18]. As early human societies began constructing multi-story stone architecture and walled settlements, they unintentionally replicated the natural nesting habitats of the rock dove[8]. Drawn by the architectural shelter and the abundance of agricultural grain and food scraps, wild pigeons integrated themselves into human settlements, initiating a commensal relationship that would eventually culminate in active human management and captive breeding[1].

Crucially, modern feral pigeons represent a reversal of this pathway, known as feralization. Feralization is an evolutionary process by which a previously domestic population evolves to survive outside of direct human control, though feral pigeons remain anthrodependent, relying on the built environment much as their wild ancestors relied on cliffs[17]. This phenomenon mirrors the evolutionary trajectory of the Australian dingo, a descendant of domestic dogs that successfully adapted to a wild niche while retaining traces of its domestic genomic architecture[17].

Table 1 summarizes the progressive stages of human-avian interaction that conceptualize this continuum, clarifying the semantic distinctions between wild, commensal, and domestic statuses.

| Interaction Status || Ecological and Behavioral Definition |

| Wild || Avian populations existing entirely independently of humans, fulfilling their lifecycle in natural habitats, though they may occasionally be hunted as wild game. |

| Synanthropic || Populations that benefit from human-altered environments and agricultural expansion but remain fully capable of thriving in natural habitats. |

| Commensal || Birds habituated to anthropogenic niches, relying heavily on human architecture or waste, with significantly reduced survival rates outside these zones. |

| Managed || Populations actively encouraged to breed within human settlements, often through the provision of artificial nesting structures and supplemental fodder. |

| Domestic || Birds whose breeding, diet, and territory are strictly controlled by humans, resulting in distinct genetic, behavioral, and morphological divergence from wild ancestors. |

| Feral || Descendants of domesticated birds that have reverted to a free-living state, often persisting as urban commensals rather than returning to true wild habitats. |

Data synthesized from established evolutionary frameworks of avian domestication and commensal pathways[12].

Pre-Domestic Exploitation: The Paleolithic Record

Long before the rock dove embarked on the commensal pathway in the Bronze Age, it was subject to intense predatory exploitation. The earliest evidence of human-pigeon interaction dates not to early agriculturalists in the Fertile Crescent, but to Neanderthals in the Middle Paleolithic[23].

Excavations at Gorham's Cave, a massive dolomite sea cave located on the eastern face of the Rock of Gibraltar, have yielded an extraordinary assemblage of avian remains[23]. The cave, which served as a Neanderthal occupation site for tens of thousands of years, produced 1,724 rock dove bones from sediments dating between 67,000 and 28,000 years ago[23]. During this period, the cave overlooked a sandy plain broken up by wetlands and open areas populated by stone pine and juniper, providing an ideal foraging environment for the birds[23].

A detailed taphonomic analysis of these bones revealed that a significant portion bore distinct stone-tool cut marks, human tooth marks, and signs of localized charring[23]. The anatomical distribution of the cut marks was highly selective, appearing almost exclusively on the humerus, radius, ulna, and lower limb bones, which are the skeletal elements associated with the highest density of meat[23]. Furthermore, the charring patterns exhibited a phenomenon known as double coloring, indicating that the bones were unevenly exposed to fire. This specific thermal signature is a hallmark of roasting meat on an open hearth, where the flesh-covered portions of the bone are protected while the exposed ends burn[23].

Because pigeons are relatively small prey, extensive butchery with heavy stone tools was largely unnecessary. The Neanderthals likely skinned the birds, roasted them over embers, and dismantled the joints by hand and teeth, leaving subtle but unmistakable taphonomic signatures, including human dental impressions separate from carnivore gnaw marks[23]. The exploitation of these birds was not casual or sporadic; it was systematic, occurring in 58 percent of the Neanderthal occupation zones within the cave[25].

While the evidence from Gorham's Cave unequivocally demonstrates that hominins possessed the technological and cognitive capacity to hunt small, agile avian prey, it does not represent domestication[23]. Instead, it underscores the deep antiquity of the human-pigeon ecological overlap. The rock doves naturally nested in the high crevices of the sea cave, making them a predictable, easily accessible, and highly renewable resource for the cave's inhabitants, who likely harvested them sustainably over a period of 40,000 years[12]. Similar exploitation patterns have been identified in the Levant, such as at Qesem Cave and Manot Cave, indicating that the

rock dove was a highly ranked small game target long before the transition to agriculture[26].

The Late Bronze Age Pivot: The Archaeology of Hala Sultan Tekke

The critical transition from opportunistic hunting to deliberate management and early domestication is vividly preserved in the archaeological record of Cyprus. During the Late Bronze Age, stretching from approximately 1650 to 1150 BCE, the coastal settlement of Hala Sultan Tekke functioned as a thriving, cosmopolitan trade metropolis[1]. Situated around a protected bay that is now the landlocked Larnaca Salt Lake, the city was a major hub for the processing and export of copper and purple-dyed textiles, facilitating trade networks that spanned Egypt, the Levant, Anatolia, and the Mycenaean Aegean[27].

Recent excavations by the New Swedish Cyprus Expedition in City Quarter 1 and Area A have unearthed substantial architectural remains, including structures built with ashlar masonry -- cut and dressed stone blocks that provided sheer, vertical facades[8]. The city was characterized by intense industrial activity. Excavations have revealed over 300 kilograms of copper working debris, including tapped slag, furnace walls, and tuyeres, alongside massive installations for textile dyeing that yielded 25 kilograms of crushed murex shells, representing thousands of individual mollusks processed for purple dye[31]. The wealth generated by these industries is evident in the elite tombs of the city, which contained gold diadems, silver jewelry, imported Minoan piriform jars adorned with bird motifs, and Egyptian scarabs[30].

Within these wealthy complexes, particularly in contexts dating to the thirteenth and twelfth centuries BCE, archaeologists recovered an unusually dense assemblage of avian faunal remains. Of the 183 Columbiformes specimens analyzed from the site, 159 were confidently identified as *Columba livia*, alongside a minute presence of the Eurasian collared dove (*Streptopelia decaocto*)[1].

The condition and context of these bones provided the first major clues regarding the birds' status. The remains were not scattered randomly as natural deaths or simple urban refuse. Instead, they were heavily concentrated in specific loci, particularly beneath a constructed plaster floor in a space designated as Room 73, within Stratum 3[28]. This room contained the hallmarks of high-status ritual feasting: the pigeon bones were intermingled with heavily burned mammal and fish remains, fragments of precious gold leaf, industrial furnace debris, imported Mycenaean terracotta figurines, and high-quality, pictorial-style ceramic tableware[10]. Notable among these ceramics were the locally produced chariot kraters and the remarkable Horned God Krater, an oversized vessel featuring representations of a fish, birds, a charging bull, and an anthropomorphic figure wearing a horned helmet[27].

Roughly half of the pigeon bones in this ritual deposit exhibited traces of burning, and the skeletal element representation overwhelmingly favored the meaty portions of the wings and legs[18]. Furthermore, an age-at-death analysis of the assemblage revealed a demographic profile indicative of on-site breeding. While 81.8 percent of the specimens belonged to adult pigeons, 10.7 percent were classified as subadults, and 7.5 percent were highly porous bones belonging to fledglings and younger

juveniles[37]. Because fledglings are nest-bound and unable to fly, their presence strongly suggests that the pigeons were breeding within the architectural confines of the settlement itself, rather than being hunted in the wild and transported to the city[8].

Table 2 outlines the age demographics of the *Columba livia* remains, demonstrating a multi-generational presence indicative of a permanent, managed population.

Age Category	Number of Identified Specimens (NISP)	Percentage of NISP	Minimum Number of Individuals (MNI)	Percentage of MNI
Adult	130	81.8%	45	81.8%
Subadult	12	10.7%	6	10.9%
Juvenile/Fledgling	17	7.5%	4	7.3%
Total	159	100%	55	100%

Data derived from the zooarchaeological analysis of the Hala Sultan Tekke assemblage[37].

Table 3 outlines the skeletal element distribution, highlighting the dominance of meat-bearing wing structures consistent with human consumption.

Skeletal Element	Minimum Number of Elements (MNE)	Percentage of Total Assemblage
Ulna	36	20.9%
Humerus	31	18.0%
Femur	24	14.0%
Coracoid	18	10.5%
Carpometacarpus	17	9.9%
Tibiotarsus	17	9.9%
Radius	12	7.0%
Scapula	10	5.8%
Tarsometatarsus	5	2.8%

Data demonstrating the selective preservation of wing and upper leg elements typical of human butchery and consumption[37]. Highly fragile elements of the cranium and main body were absent due to taphonomic erosion.

Biomolecular Osteology: Stable Isotope Analysis

While the archaeological context strongly implied human management, proving domestication purely through bone morphology remains deeply problematic. It is generally accepted that domestic animals experience a size increase compared to their wild progenitors over millennia of selective breeding. However, early domesticated pigeons do not exhibit the dramatic size increases seen in modern domestic breeds[8]. Environmental pressures, such as Bergmann's rule -- an ecogeographical principle stating that populations in hot, arid climates tend toward

smaller body masses to aid thermoregulation -- can further confound biometric analyses[8]. For instance, pigeon bones from later Byzantine dovecotes at Shivta and Saadon in the Negev Desert were actually smaller than their wild counterparts, despite unequivocal architectural and contextual evidence of captive breeding for fertilizer production[8]. At Hala Sultan Tekke, biometric analysis of 154 long bones revealed that the specimens fell entirely within the expected size range of wild *Columba livia*, making them indistinguishable from a wild population on osteological grounds alone[20].

To bypass the limitations of osteometrics, researchers from the Groningen Institute of Archaeology turned to stable isotope analysis of bone collagen[8]. Stable isotope analysis provides a direct, biochemical record of an animal's diet over the last several years of its life. Specifically, the ratios of carbon-13 to carbon-12 and nitrogen-15 to nitrogen-14 in bone collagen are extracted and analyzed using a mass spectrometer[42]. The carbon isotope values reflect the types of primary producers at the base of the food web, distinguishing between terrestrial and marine diets, as well as between different photosynthetic pathways in plants. The nitrogen isotope values function as a biological trophic indicator; the heavier nitrogen-15 isotope accumulates at each successive step up the food chain due to metabolic fractionation, resulting in higher values for carnivores and omnivores compared to strict herbivores[42].

Wild birds that forage opportunistically across a varied landscape exhibit a wide scatter of isotopic values, reflecting a broad, generalized dietary niche[38]. In contrast, animals that are actively managed, foddered, or confined to a specific geographic locus exhibit tightly clustered isotopic signatures, indicating a highly restricted, specialized diet dictated by human provisioning[8].

The stable isotope data extracted from the collagen of 37 individual pigeons at Hala Sultan Tekke revealed a remarkable dietary pattern. Statistical modeling of the isotopic data, utilizing the SIBER package in R to measure the corrected standard ellipse area of the dietary breadth, showed that the pigeons possessed an unusually narrow dietary niche[37]. This isotopic clustering was tighter even than that of the site's actively managed cattle, which were prized livestock herded systematically[8].

Furthermore, the mean nitrogen-15 values of the majority of the pigeons were notably elevated. Averaging a high trophic enrichment level, these pigeons sat higher on the food chain than regional wild scavenger species like foxes and dogs, and overlapped almost entirely with the isotopic signatures of humans from the same Bronze Age period in Cyprus[8]. This biochemical overlap indicates that the pigeons were consuming an omnivorous diet rich in human-cultivated grains and seeds, heavily supplemented with animal-derived proteins or fats sourced directly from human food waste[1]. Only a small sub-group of three individuals exhibited lower nitrogen signatures akin to wild herbivores, suggesting a minor influx of unmanaged wild birds into the urban population[37].

The tight clustering of these isotopic values confirms that these birds were not merely opportunistic wild foragers visiting the city intermittently; they were permanent residents, habitually feeding from a consistent, human-controlled food source[9]. Combined with the presence of fledglings and the ritualized context of

the burials in Room 73, the isotopic data provides the earliest direct biomolecular evidence for the commensal domestication of the rock dove, establishing a timeline of 1400 BCE[2].

The Genomic Architecture of Domestication and Phenotypic Plasticity

The physical transformation of the rock dove under human selection is one of the most dramatic examples of phenotypic plasticity in the animal kingdom, a fact that profoundly influenced Charles Darwin in his formulation of the theory of natural selection. In *The Variation of Animals and Plants Under Domestication*, Darwin used the pigeon as his primary exemplar of artificial selection, observing that the vast diversity of pigeon breeds -- ranging from the inflated crop of the Pouter to the exaggerated plumage of the Fantail -- all descended from a single wild ancestor[46].

Modern paleogenomic research has provided a molecular corollary to the archaeological findings, mapping the genetic architecture that allowed wild *Columba livia* to radiate into over 350 distinct domestic breeds[47]. Phylogenomic analyses, utilizing whole-genome sequencing of historical and modern specimens, confirm that all modern domestic pigeons are monophyletic[1]. The genomic data points strongly to at least one primary domestication event originating in the Levant and the Middle East, with historical populations expanding out of geographic refugia established during Quaternary glacial cycles[2]. This genomic geographic origin perfectly aligns with the zooarchaeological evidence of early commensalism from Cyprus and the broader Eastern Mediterranean basin[2]. High genetic homogeneity among modern breeds reveals a history of intense, human-directed cross-breeding along ancient trade routes connecting the Mediterranean to India and Iran, which facilitated the introgression of diverse traits across continents[47].

To decipher the genetic mechanisms underlying specific domestic traits, a landmark study published in the journal *Science* utilized whole-genome sequencing to pinpoint the genetic basis of the pigeon head crest[50]. The head crest -- a phenotype where the feathers on the back of the neck and occiput grow upwards toward the head rather than downwards toward the tail -- is a prominent ornamental trait heavily selected for by breeders, appearing in variations ranging from small peaks to elaborate shell crests and full hoods (e.g., the Jacobin, Indian Fantail, and Old German Owl breeds)[47].

Using a high-coverage reference genome assembled from a male Danish tumbler pigeon, researchers analyzed the genomes of 40 additional rock pigeons, spanning numerous crested and uncrested breeds[47]. Through a genome-wide association scan utilizing variant annotation software, they isolated a region of extreme differentiation on a single genomic scaffold. The analysis revealed that the crest phenotype is controlled by a single, simple Mendelian recessive locus mapped to the *EphB2* gene (Ephrin receptor B2)[49].

EphB2 is a member of the receptor tyrosine kinase family, which plays a crucial role in cellular signaling, embryonic tissue patterning, and the morphogenesis of the cytoskeleton[51]. In all crested rock pigeons, the researchers identified a specific missense mutation resulting in a charge-changing amino acid substitution from a basic arginine to a polar uncharged cysteine at position 758 (Arg758Cys)[58]. This mutation occurs precisely within the highly conserved DLAARN motif of the catalytic

loop of the gene's intracellular kinase domain[51]. The structural alteration fundamentally abrogates the protein's kinase activity, disrupting downstream signal propagation much like observed mutations in the human and murine ZAP-70 orthologs[51]. At the embryonic level, this disruption reverses the polarity of the feather buds in the dermal placodes, forcing the developing feathers to grow in an inverted cranial direction[47].

The genomic data demonstrated that all crested breeds of *Columba livia* share this identical mutation surrounded by the same genetic haplotype, proving that the crest mutation evolved only once in the history of the species and was subsequently disseminated across hundreds of breeds through human-directed artificial selection[47]. Further genomic scans identified additional targets of intense artificial selection, including the *MITF* gene, which heavily regulates melanogenesis and plumage pigmentation, and the *NDP* gene, which interacts with Wnt signaling pathways to dictate complex wing patterns such as the "grizzle" or "badge" phenotypes[21].

Convergent Evolution in Avian Genomics

The discovery of the *EphB2* mutation also illuminated the phenomenon of convergent evolution under domestication. The domestic ringneck dove (*Streptopelia risoria*), a distinct species that diverged from the rock dove lineage approximately 23 to 35 million years ago, also features a visually identical, recessively inherited head crest mutation[58].

When researchers sequenced the kinase domain of the *EphB2* gene in crested ringneck doves, they discovered a completely different point mutation occurring in the same functional domain. In the ringneck dove, a guanine-to-adenine transition in the sixth exon results in a glycine-to-arginine substitution at position 636 (Gly636Arg)[58]. Despite being separated by over 100 amino acid positions from the rock pigeon mutation, the Gly636Arg mutation similarly disrupts the ATP-binding pocket of the kinase domain, leading to the exact same phenotypic reversal of feather bud polarity[58].

This remarkable molecular parallel demonstrates that specific, predictable genetic mechanisms can be repeatedly targeted by artificial selection to produce convergent morphologies in distantly related domesticated species, underscoring the limited number of evolutionary pathways available to alter fundamental developmental architecture without inducing fatal embryonic defects[60].

Table 4 summarizes the comparative genomic architecture of the head crest phenotype in these two domestic Columbiformes.

| Species | | Evolutionary Divergence | | Gene Target | | Specific Point Mutation |
| Effect on Protein Function | | Phenotypic Expression |

| *Columba livia* (Rock Pigeon) | | Baseline | | *EphB2* | | Arg758Cys | | Abrogation of intracellular kinase catalytic loop | | Reversal of neck/occipital feather polarity |

| *Streptopelia risoria* (Ringneck Dove) | | ~23-35 Million Years | | *EphB2* | | Gly636Arg | | Disruption of ATP-binding pocket in kinase domain | | Reversal of neck/occipital feather polarity |

Data compiled from comparative paleogenomic and molecular analyses of domesticated Columbiformes, highlighting convergent evolution[58].

Escalation of Management: Columbaria and Cultural Syncretism

Following the initial commensal domestication established in the Late Bronze Age at sites like Hala Sultan Tekke, the management of pigeons escalated dramatically into industrial-scale agriculture in the Hellenistic, Roman, and Byzantine periods[1].

This transition is marked archaeologically by the proliferation of columbaria (dovecotes). These specialized structures, ranging from subterranean caves hewn into limestone bedrock to towering mudbrick and masonry towers, were designed to house thousands of breeding pairs securely away from terrestrial predators[6]. One prominent early example is the subterranean dovecote at 'Ain al-Baida near Amman, Jordan, dating from the late eighth to the sixth centuries BCE. Cut directly into the soft limestone, the structure descends nearly three meters and features approximately 300 carved nesting niches arrayed around central supporting pillars[12].

By the Byzantine period, dovecotes became a critical component of agricultural infrastructure, particularly in marginal, arid environments. In the semi-arid Negev Desert, extensive dovecote complexes at sites like Shivta and Saadon -- active during the fifth and sixth centuries CE -- reveal the dual-purpose nature of intensive pigeon farming[8]. Excavations at Saadon yielded thick layers of pigeon manure intermingled with articulated skeletons, capturing the sudden destruction of the facility in the mid-sixth century CE[12].

While squabs provided a rapidly renewable source of protein, the primary economic driver in these arid regions was the mass production of guano[8]. Pigeon manure is exceptionally rich in nitrogen and phosphorus, making it a highly prized fertilizer essential for sustaining intensive agriculture in nutrient-poor desert soils[1]. As previously noted, zooarchaeological analysis of the Saadon and Shivta assemblages indicates that these birds were smaller than expected, suggesting that breeders prioritized the maximization of guano yield over fattening the birds for meat consumption, thereby demonstrating the intense economic specialization of late-antique pigeon husbandry[8]. The architectural legacy of this practice persists today, most notably in the Egyptian Delta, where hundreds of mudbrick pigeon towers continue to dominate the agricultural skyline[12].

Simultaneously, the pigeon maintained a profound symbolic resonance that permeated the cultural and religious fabric of the ancient Near East and Mediterranean. In Bronze and Iron Age Cyprus and the Levant, the dove was intimately associated with female fertility and served as the primary avian icon of the mother goddess -- manifesting in the cults of Asherah, Astarte, Tanit, and ultimately, the Greek Aphrodite[6]. Small clay shrines from the Iron Age Levant frequently depict doves perched atop doorways, and a prominent limestone sculpture from Cyprus dating to 600-480 BCE depicts a shrine completely covered in dovecotes[6]. The deposition of burned pigeon bones in the ritual feasting deposits of Room 73 at Hala Sultan Tekke was likely an early manifestation of these institutionalized cultic practices, integrating the bird into the socio-political and spiritual life of the Bronze Age elite[11].

This sacred association translated seamlessly into biblical and Judeo-Christian traditions. In the Hebrew Bible, pigeons and doves were the only avian species explicitly permitted for ritual sacrifice. They functioned as vital purification and atonement offerings, particularly serving as an economically accessible sacrifice for lower-class families who could not afford mammalian livestock, a practice codified in texts such as Leviticus and Luke[6]. Archaeological evidence supporting this practice includes stone bowls inscribed with the word "korban" (sacrifice) found near Jerusalem's Temple Mount, bearing scratched depictions of dead birds[6]. Consequently, the symbol of the dove was continuously reinterpreted over millennia, evolving from a marker of the Canaanite mother goddess to a representation of post-diluvian peace (Noah's dove) and eventually to the visual embodiment of the Holy Spirit in Christian iconography[6].

Conclusion

The history of the domestic rock dove offers a profound lens through which to view the mechanisms of animal domestication, evolutionary biology, and human ecological impact. By synthesizing traditional zooarchaeological analysis with high-resolution stable isotope profiling and whole-genome sequencing, modern science has reconstructed a highly nuanced narrative of the human-pigeon relationship that challenges long-held assumptions regarding the timeline and nature of commensal domestication.

The findings from Hala Sultan Tekke categorically shift the timeline of pigeon domestication back to at least 1400 BCE, providing the earliest direct biomolecular evidence of a wild species navigating the commensal pathway[5]. Lured by the sheer vertical architecture of early cities and the reliable caloric density of human agricultural waste, the rock dove voluntarily entered the human sphere, establishing a narrow dietary niche indistinguishable from the humans they lived alongside[1].

This initial symbiotic relationship was subsequently codified through centuries of artificial selection and industrial-scale breeding in the dovecotes of the classical world[12]. This long history of captivity left indelible marks on the pigeon genome -- most notably the EphB2 missense mutation that generated the ornamental head crests prized by breeders worldwide, serving as a textbook example of molecular convergent evolution[51].

The rock dove's transition from a cliff-dwelling wild bird, to a hunted Paleolithic resource on the shores of Gibraltar, to a sacred Bronze Age commensal in Cyprus, and finally to a highly specialized agricultural commodity highlights the fluid, non-linear continuum of animal domestication[13]. Far from being mere urban pests, the feral pigeons that populate modern cityscapes are the descendants of one of humanity's oldest biological partnerships. Their enduring presence in anthropogenic environments is a testament to their remarkable phenotypic plasticity and the enduring legacy of an evolutionary journey that began on the stone ledges of the Late Bronze Age.

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