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Archaeological ^{14}C assemblages and the Chavín Phenomenon in the Central Andes

Daniel A. Contreras

University of Florida, Department of Anthropology, Gainesville, FL, 32611, USA

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ABSTRACT

Using the Central Andean Chavín Phenomenon as a case study, this paper explores the middle ground between top-down (big data) and bottom-up (Bayesian modeling) approaches to archaeological radiocarbon data. Compiling radiocarbon dates associated with the Chavín Phenomenon addresses questions of chronology, demonstrating that the relevant phases at interacting sites are relatively brief and broadly contemporary. In addition, the definition of a discrete span of time associated with the Chavín Phenomenon makes it possible to explore the context for that period of heightened interaction. Juxtaposing that timespan with a compilation of Central Andean radiocarbon dates identifies contemporary non-participatory sites, enabling characterization of the sociopolitical milieu within which the Chavín Phenomenon emerged, flourished, and faded. The identification of that corpus of sites also highlights the importance of a shift in focus from identification of interaction to characterization of interaction. Bottom-up approaches to radiocarbon chronology will be a key element of that effort, while high-level summary of radiocarbon assemblages can identify where additional dating and Bayesian modeling can have the greatest interpretive impact.

1. Introduction: The Chavín Phenomenon

Since Julio C. Tello's (1943) proposal that a Chavín Culture constituted a shared ancestor for later Central Andean societies, Andeanist archaeologists have broadly accepted the idea of a relatively early period of heightened interaction across much of the region. By analogy to the two later and more thoroughly documented periods of regional integration produced by Wari/Tiwanaku and Inka influence, and with reference to then current theoretical models of culture history, this was termed a horizon and understood to constitute a period of increased social and economic interaction (Bennett, 1943; Kroeber, 1944; Willey, 1945, 1948, 1951). The causes of that connectivity, exactly which sites were implicated, and whether "horizon" was an appropriate and useful term have been – and remain – disputed (see reviews in Burger, 1988, 1993; Kaulicke, 2010; Vega-Centeno, 2020; Contreras, 2023).

Burger (1993, p. 62) specifically rejected the analogy to later horizons even while arguing for the continued use of "horizon" as an identifying term. He also re-coupled that label to the particular cultural process associated with the widespread occurrence of the material culture and iconography of Chavín de Huántar (today more commonly described by the more neutral term "Chavín Phenomenon" [Burger and Nesbitt, 2023; Contreras, 2023]). Ironically, Burger's insight that the Early Horizon could become an object of study came in a volume that eulogized the concept of the horizon as obsolete in both methodological and theoretical terms. In his concluding chapter to the volume, Rice (1993, p. 362) noted that, "the concept of the horizon style is out of step with processual archaeology … [and] radiocarbon dating makes the horizon redundant and outmoded as a temporal index." Nevertheless, as Burger highlighted, a sense persisted that *something* underpinned the geographically extensive distribution of material culture described as Chavín-related.

The current consensus about this period of heightened interaction extends only as far as a rough outline: it is clear that there existed, during the period now recognized as the first millennium BCE, some form of interaction between far-flung areas of the Central Andes, detectable archaeologically primarily in material culture (particularly ceramics) and iconography (particularly in ceramic, lithic, and textile media). The period of interaction is notably distinct from what came before and went after, when interaction appears to have been limited in spatial extent and less intense. The regions most clearly involved include highland Ancash, Cajamarca, the North Coast, the Central Coast, Ayacucho, Huancavelica, and the Paracas region of the South Coast (see distributions of sites in Fig. 1). Debate continues about exactly which evidence should be considered, how that evidence should be interpreted, and

E-mail address: daniel.contreras@ufl.edu.

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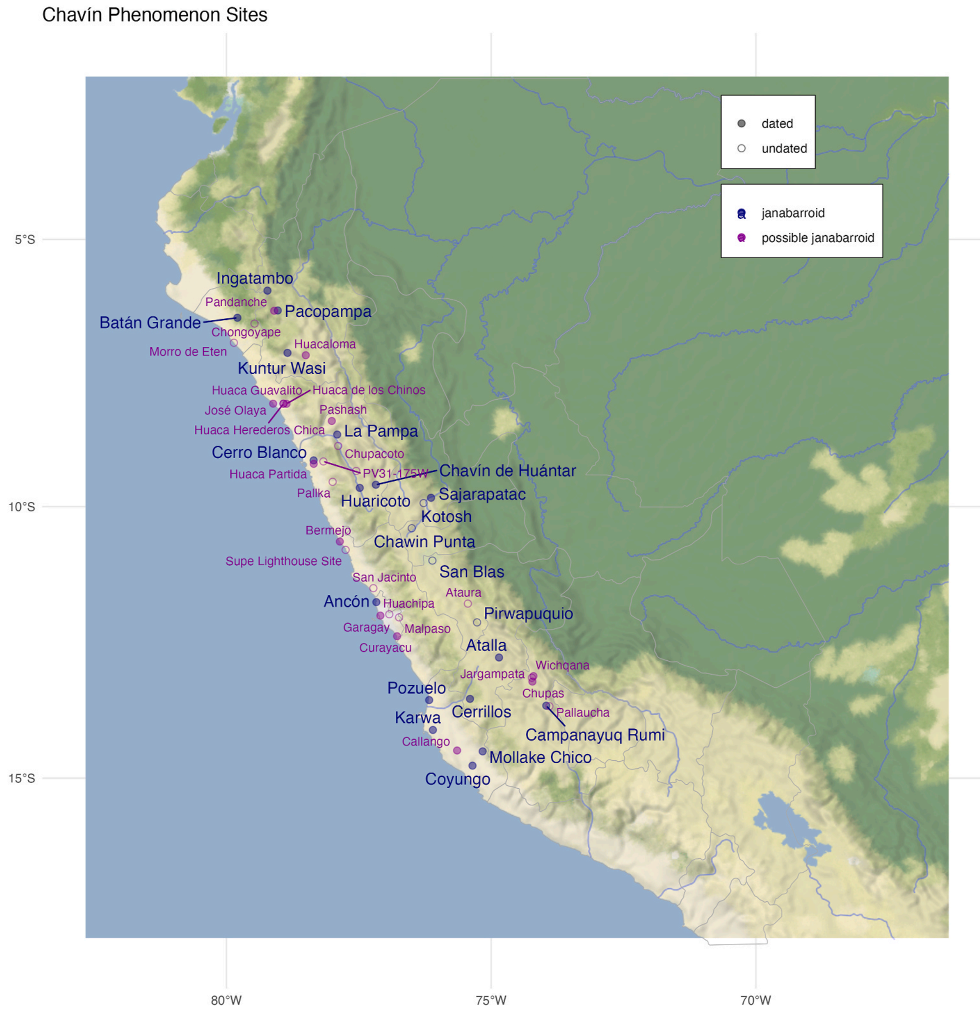

Fig. 1. Distribution of sites associated with the Chavín Phenomenon.

what social/political/economic dynamics underpin the observed distributions of evidence (Contreras, in press).

The introduction of radiocarbon dating promised to shift the terms of debate, making the *use* of an early horizon obsolete as chronological tool. However, uncertainty about the method, its expense and consequent limited diffusion, and the limits of its precision (particularly given the Hallstatt Plateau in the middle of the first millennium B.C.E [Hamilton et al., 2015, p. 643].) combined with the persistence of pre-existing chronological schema to limit the interpretive impact of radiocarbon dating in the Central Andes (Ramón Joffré, 2005; Contreras, 2022). As a consequence, only in the last decade have significant numbers of radiocarbon dates from secure contexts at the core sites implicated in the Chavín Phenomenon become available.

In principle, the widespread availability of such ^{14}C dates can replace the *chronological* function of the Early Horizon, returning the focus to the question of what kind of interaction underpinned the Chavín Phenomenon, how widespread it was, and how long it lasted. That is, it is now possible, three decades after Burger (1993, p. 46) proposed that "the horizon phenomenon can itself become the object of investigation," to realize that aspiration.

In practice, dates associated with the Chavín Phenomenon suggest that a relatively brief and discrete period of heightened interaction is indeed evident (Contreras, 2023). The contemporaneity of the relevant phases at the most salient sites broadly accepted as participating in a Chavín interaction sphere, and the apparent brevity of the period during which they interacted most intensely, suggest that this period itself is in need of further investigation.

I here leverage the available radiocarbon evidence to explore the extent and character of interaction in the Central Andes during the first half of the first millennium BCE. This radiocarbon evidence, I argue, can do three things:

1) meet Burger's (1993, p. 46) challenge to make, "the horizon phenomenon … itself … the object of investigation,"
2) address persistent culture-historical and chronological questions about Chavín and its contemporaries (what happened and when), and
3) address the related theoretical and processual questions of which social/political/economic processes produced the widespread commonalities in material culture that have stimulated discussion of a horizon/phenomenon.

Crucially, the radiocarbon evidence can do so without relying on a self-reinforcing approach that considers only sites already identified as involved. Assessing the Chavín Phenomenon through the associated radiocarbon evidence provides a case study in the potential utility of medium-scale analyses of archaeological radiocarbon assemblages, and explores productive means of utilizing such assemblages. Such a study, by occupying a middle ground, addresses the growing tension between studies reliant on large-scale regional data-harvesting of archaeological radiocarbon dates (see overviews in Crema and Bevan, 2021; Crema, 2022) and Bayesian modeling based on detailed site-scale dating programs (Whittle and Bayliss, 2007; Bayliss, 2015).

Table 1
Approaches to archaeological radiocarbon evidence.

Top-down/Big Data	Bottom-up/Bayesian Modeling
regional	local
data harvesting	dating programs
SPD/summary methods	Bayesian models
rely on data classification	require detailed description of individual datapoints
produce low precision results, aim for macro-patterns	produce high precision results, aim for meso/micro-patterns
faith in signal despite noise	value explicit characterization of uncertainty

2. Methodological context: Top-down and bottom-up approaches to the archaeological radiocarbon record

Attempts to compile archaeological radiocarbon dates in order to elucidate broad patterns in Central Andean prehistory date to John Rick's pioneering dates-as-data study (Rick, 1987). Date compilations less explicitly coupled with methodological developments are even older (e.g., Ravines and Alvarez Sauri, 1967); these are epitomized by the comprehensive effort undertaken by Ziółkowski and colleagues (Ziółkowski et al., 1994) that has recently been refreshed (Radiocarbon Database for Central Andes, 2023).

These efforts foreshadowed a 21st century global boom in compilation of archaeological radiocarbon data, largely animated by attempts to bring larger datasets and greater processing power to bear on the potential for such datasets to serve as demographic proxies (reviewed in Crema and Bevan, 2021; Crema, 2022). Critiques on both conceptual and methodological grounds (e.g., Contreras and Meadows, 2014; Bronk Ramsey, 2017; Crema and Bevan, 2021) notwithstanding, the archaeological radiocarbon record has come to be seen as an underexploited resource that can shed light on past human demography and patterns of human behavior (in the Central Andes, for instance, Gayo et al., 2015; Goldberg et al., 2016; Riris, 2018; Roscoe et al., 2021).

If the successes of these approaches demonstrate the potential of this data source, their use also illustrates some of the risks involved in top-down approaches: data harvesting at large spatial and temporal scales increases the probability of overlooking dates, including problematic dates, or eliding contextual information (reviewed for the Central Andes in Contreras, 2022).

Data harvesting is an understandable temptation, but if carried out pragmatically – and the possibility of gathering an abundance of data efficiently is fundamental to the temptation – can complicate any subsequent attention to challenges inherent in radiocarbon assemblages. These include the need for chronometric hygiene (Spriggs, 1989), including assessment of the characteristics of dated material and the need to confirm clear association of dated events and target events; the likelihood that any pattern recognition will have to account for taphonomic and research biases (Contreras and Codding, 2023); and the common desire to be able to identify material culture associations of dated samples.

These challenges point to a tension – unacknowledged, so far as I am aware – that has emerged in the uses of archaeological radiocarbon. On the one hand, regional or even continental efforts at data-harvesting seek broad patterns in the spatiotemporal distribution of radiocarbon-dated archaeological materials, confidently summarizing those with an approach that treats all radiocarbon dates as essentially equally valid data points. These approaches have re-invigorated macro-scale studies and arguably provided demographic proxies that are vital to addressing many of the big questions with which archaeology aspires to grapple (Kintigh et al., 2014). On the other hand, archaeological applications of radiocarbon dating have been revolutionized since the mid-1990s by Bayesian approaches to chronological data, achieving startling accuracy and precision (Whittle and Bayliss, 2007; Bayliss, 2009). Attaining those results relies fundamentally on close attention to each dated sample and the relationships between them (Bayliss, 2015). This contrast is evident in the level of detail that reviews of radiocarbon in archaeology suggest should be considered for individual samples and incorporated into dating programs (Bronk Ramsey, 2008, Fig. 2; Wood, 2015, Fig. 2) with, for example, the data recorded by the EuroEvol project (Manning et al., 2016), which collected 14,053 dates from 4757 sites, but – perhaps necessarily at such a scale – only includes six simple classificatory variables to describe samples and contexts.

These approaches are summarized in Table 1. The fact that top-down and bottom-up approaches generally involve different scales of investigation does not dispel the tension between them, since a) archaeological questions may span multiple scales, and b) macro-scale patterns rely on the accuracy of micro-scale data. The sensitivity of top-down approaches to the effects of changes introduced by the improved precision produced by bottom-up approaches will vary depending on specific questions and data. Assuming that top-down approaches will be sufficient disregards potentially significant problems with the constituent data. Advocating exclusively bottom-up approaches runs directly contrary to the imperatives and appeal of "big data" – i.e., those approaches require close attention to detail and time investment in metadata for each datapoint, effectively forbidding use of prior compilations and requiring return to original sources, where sufficient information about sample material and context may or may not be available.

This paper uses the persistent archaeological conundrum of the Chavín Phenomenon in the Central Andes as a case study in the utility of a middle ground between top-down and bottom-up approaches to archaeological radiocarbon evidence. By combining Bayesian modeling at the site/phase level (based on stratigraphic priors and/or simple phase models) with summary of both posterior age estimates and compiled radiocarbon ages, I use the chronology to shed light on the Chavín Phenomenon while also identifying which sites/phases/dates will provide the greatest interpretive payoff for additional dating and/or modeling (a cycle of sampling and chronological inference that expands upon Wood, 2015:Fig. 2).

3. 3The contribution of the radiocarbon record to the study of the Chavín Phenomenon

One of the basic functions of an early horizon was to serve as a chronological tool: if affiliated material could be identified in a given context (stratum, burial, structure, etc.), it served to temporally locate that context. While this was invaluable for establishing broad contemporaneity at relatively distant sites in the era before widespread and reliable radiocarbon dating, it could offer only limited temporal precision. The introduction of absolute dating promised to, as Burger (1993, p. 46) put it, free the horizon "from its function as a chronological tool."

In practice this proved optimistic. The first radiocarbon dates from the site of Chavín itself (Lumbreras and Amat, 1966; Lumbreras, 1972; Burger, 1981) located Chavín in the first millennium B.C.E., but the results were ambiguous and even contradictory enough that they were difficult to interpret more precisely (Burger, 1984, 1998; Lumbreras, 1989). Burger (1981, pp. 595–596) rejected all three of his own dates associated with Janabarriu ceramics, recognized as one of the clearest horizon markers, and only selectively accepted samples published by Lumbreras and Amat (see summary in Rick et al., 2009, pp. 95–105). As he later described the process, he concluded that, " La naturaleza anomala de estos resultados no permite que sean utilizados como base de nuestro calculo del lapso temporal de la fase Janabarriu," [the anomalous nature of these results does not allow them to be used as a basis for our calculations of the temporal span of the Janabarriu Phase] (Burger, 1998, p. 257) which instead was defined by dates associated with the preceding and subsequent phases. Lumbreras (1989, pp. 107–114) objected to this approach, but evinced his own frustrations with the radiocarbon results and certainly did not regard all of the dates as reliable (e.g., "En cuanto a los fechados de Chavín de Huántar, las discordancias de fechas hacen muy difícil la cronologización de sus

Table 2
Janabarroid sites.

SiteName	Classification	Lat	Lon	n	Phase	Source
Ancón	janabarroid	−11.76838738	−77.16856983	5		Carrión Cachot, 1948; Willey and Corbett (1954); Scheele (1970); Rosas la Noire (2007)
Atalla	janabarroid	−12.79006	−74.85111	6	Willka	Burger and Matos Mendieta (2002); Young (2020)
Ataura	possible janabarroid	−11.79598304	−75.44063602	0		Matos Mendieta (1972; 1978)
Batán Grande	janabarroid	−6.471630124	−79.79292407	4	Stratigraphic Position 3	Shimada et al. (1998)
Bermejo	possible janabarroid	−10.6475022	−77.85863013	2		Silva S. (1978)
Callango	possible janabarroid	−14.49526366	−75.64342466	6	Early Paracas	DeLeonardis (2005)
Campanayuq Rumi	janabarroid	−13.675558	−73.959607	6	Campanayuq II	Matsumoto and Cavero Palomino (2009); Matsumoto et al. (2018)
Cerrillos	janabarroid	−13.55	−75.4	2		Wallace (1962); Splitstoser et al. (2009)
Cerro Blanco	janabarroid	−9.138508167	−78.35347645	5	Cerro Blanco/ Nepeña	Shibata (2008)
Chavín de Huántar	janabarroid	−9.592038165	−77.17781181	27	Black and White	Rick et al. (2009)
Chawin Punta	janabarroid	−10.399539	−76.4995	0	Willka	Brown (2022)
Chongoyape	possible janabarroid	−6.581590049	−79.46962311	0		Lothrop (1941)
Chupacoto	possible janabarroid	−8.868005716	−77.88916827	0		Thompson (1962)
Chupas	possible janabarroid	−13.2331103	−74.22091255	3	Kichka Pata	Lumbreras (1974a); Ochatoma Parvicino (1998)
Coyungo	janabarroid	−14.77212007	−75.35247566	6		Kaulicke et al. (2012)
Curayacu	possible janabarroid	−12.397973	−76.77774	2	Curayacu 3/4	Engel (1956)
Garagay	possible janabarroid	−12.0175345	−77.0925945	1		Ravines and Isbell (1975); Ravines et al. (1982)
Huaca Guavalito	possible janabarroid	−8.078226959	−78.92309552	1		Watanabe (1976)
Huaca Herederos Chica	possible janabarroid	−8.081862597	−78.92329712	0		Watanabe (1976)
Huaca Partida	possible janabarroid	−9.203003	−78.351429	4		Watanabe (1976):107–108; Burger (2008); Chauchat et al. (2006)
Huaca de los Chinos	possible janabarroid	−8.083005094	−78.86498724	13		Pleasants (2009)
Huacaloma	possible janabarroid	−7.17393099	−78.50148238	19	Layzón	Terada and Onuki (1982)
Huachipa	possible janabarroid	−11.99285511	−76.92412636	0	Huachipa AB	Silva S. et al. (1983); Silva S and Garcia Soto (1997)
Huaricoto	janabarroid	−9.65033	−77.4817385	2	Late Capilla	Burger (1985)
Ingatambo	janabarroid	−5.962921	−79.225085	2	Ingatambo	Yamamoto (2008)
Jargampata	possible janabarroid	−13.16131532	−74.23108561	0	Kichka Pata	Ochatoma Parvicino, 1998
José Olaya	possible janabarroid	−8.08038576	−79.11780512	11		Prieto et al. (2022)
Karwa	janabarroid	−14.12	−76.1	1		Cordy-Collins (1976)
Kotosh	janabarroid	−9.932310294	−76.27622919	0	Kotosh Chavín	Izumi and Sono (1963); Izumi and Terada (1972); Onuki (1994)
Kuntur Wasi	janabarroid	−7.1299526	−78.84669	18	Kuntur Wasi	Carrión Cachot (1948); Onuki (1995); Inokuchi (2008), (2014)
La Pampa	janabarroid	−8.656893	−77.907778	2	Phase 2/3	Terada and Kato (1977); Terada (1979)
Malpaso	possible janabarroid	−12.05060929	−76.7389674	0	Milagro	Milan (2014)
Mollake Chico	janabarroid	−14.51139267	−75.16054746	2	Paracas Temprano	Isla Cuadrado and Reindel (2006)
Morro de Eten	possible janabarroid	−6.940715937	−79.85882189	0		Elera Arévalo (1992); Lorenzo (2023)
PV31–175W	possible janabarroid	−9.157856963	−78.16953286	0		Proulx (1973)
Pacopampa	janabarroid	−6.335304226	−79.02975982	11	Pacopampa II	Rosas la Noire and Shady Solís (1970); Morales Chocano (1998b); Seki et al. (2008)
Pallaucha	possible janabarroid	−13.685368	−73.90052	0	Fase 1	Mendoza Martínez (2017)
Pallka	possible janabarroid	−9.538119835	−77.99448653	0		Chávez Echevarría (2011); Gamboa (2015)
Pandanche	possible janabarroid	−6.34092357	−79.09759344	2	C1/C2	Kaulicke (2005)
Pashash	possible janabarroid	−8.403258	−78.009851	1	Phase I	Lau et al. (2023)
Pirwapuquio	janabarroid	−12.142687	−75.266714	0	BC/DEF	Browman (1970), (1977)
Pozuelo	janabarroid	−13.57193	−76.171131	3	Pozuelo	Tantaleán et al. (2024)
Sajarapatac	janabarroid	−9.834191	−76.135801	4	Sajara-patac 1/2	Matsumoto and Tsurumi (2011)
San Blas	janabarroid	-11.107015	-76.182769	0		Morales Chocano, 1978; 1998a; Saez Díaz (2019)
San Jacinto	possible janabarroid	−11.51061289	−77.22532655	0	San Jacinto IV	Carrión Sotelo (1998)

(continued on next page)

Table 2 (*continued*)

SiteName	Classification	Lat	Lon	n	Phase	Source
Supe Lighthouse Site	possible janabarroid	−10.80229195	−77.74896501	0		Willey and Corbett (1954)
Ucush Pampa	possible janabarroid	−9.33516073	−77.54930319	0		Lynch (1970)
Wichqana	possible janabarroid	−13.13230677	−74.20163194	2	Kichka Pata	Lumbreras (1974a); Ochatoma Parvicino (1998)

componentes" [With respect to the dates from Chavín de Huántar, the disagreements among the dates makes the ordering of their components very difficult] (Lumbreras, 1989, p. 107)).

The difficulties of radiocarbon dating at Chavín were mirrored elsewhere, as a comparison of published dates from Chavín and associated sites (Chavín, Huaricoto, La Pampa, Kuntur Wasi, Pacopampa, and Garagay) demonstrated (Rick et al., 2009, pp. 105–109). Across all of these sites, the results have historically been difficult to interpret due to small quantity of dated samples, the large uncertainties associated with them (stemming from both the measurement imprecision common in samples run in the early decades of the method and the unlucky overlap of the crucial period with the Hallstatt Plateau), and scarcity of published details about materials dated and their contexts. With respect to interpretation of the existence of an early horizon, much less the specifics of its duration and the relationships between constituent sites, the evidence was ambiguous enough to sustain multiple interpretations. As Burger's (1981) assertion that Chavín was later than its broad contemporaries, turning the site from origin center to synthetic apotheosis, demonstrated, this ambiguity was not trivial: the interpretive ramifications of distinct chronologies were profound.

In recent decades the quantity and quality of available evidence has improved dramatically. Burger's 1981 analysis could draw on only 44 dates from 5 sites. Three decades later, Rick et al. (2009) drew on a corpus of 75 dates from Chavín (50 from the Stanford project begun in 1995 (Rick et al., 2009, Tables 1 and 2) and 25 from previous projects by Lumbreras, Amat, and Burger) as well as 46 from six broadly contemporary sites (Kotosh [9], Huaricoto [2 from the Capilla Tardío phase], La Pampa [7], Kuntur Wasi [20 from the Kuntur Wasi phase], Pacopampa [4 from the Pacopampa II phase], and Garagay [4]). My recent synthesis of only the period of peak interaction (Contreras, 2023) included 101 dates from ten sites considering the janabarroid phases alone (see SM 1).

3.1. Recognizing interaction

Much of the discussion of the role of Chavín in an early horizon focused on how sites involved should be recognized. Definitions have been more (e.g., Tello, 1943) and less (e.g., Willey, 1951; Burger, 1988) broadly inclusive, and proposed indicators have varied accordingly (recently reviewed in Contreras, in press). Ceramics, as they have for definition of many cultural entities on the basis of pre- and proto-historic material culture globally, have played a leading role.

The problem of which ceramics constitute markers of interaction in the 1st millennium BCE Central Andes is itself disputed. Here I follow Burger (1988) and Rick and colleagues (2009) in focusing on a relatively narrow range of ceramics: what Rick and colleagues term janabarroid, based on the assemblage that Burger used to define a style he termed Janabarriu at Chavín (Burger, 1984).

Janabarroid ceramics are associated with discrete phases at Chavín and the nine contemporary sites considered here as the comparatively well-dated core of the Chavín Phenomenon (Contreras, 2023, pp. 135–138). Rick and colleagues (2009, p. 113) opt for the term janabarroid to describe the associated ceramics, characterized as "formally stamped with designs or icons typical of Chavín, like those associated with Burger's Janabarriu Phase" [my translation]. That Janabarriu Phase, in Burger's (1984) formulation, is entirely congruent with Janabarriu ceramics, best described in Burger's (1992, p. 170) synthesis, in which he notes an emphasis on polished red and black wares and, "the frequency of designs made by stamps and seals. Circles, circle-dots, S's, and other stylized designs … are impressed in rows on the exteriors of bowls, cooking pots, plates, and cups." The term has supplanted what Lumbreras (1972, p. 77) termed Rocas ceramics. Because the ceramics since excavated at Chavín – not to mention related ones from other sites – encompass a range of variability greater than that captured by Burger's definition of Janabarriu (Rick, 2014, pp. 270–273), but apparently belong to the same parent population of ceramics associated with Chavín at its apogee, I here use the broader descriptive term rather than the specific descriptor of a particular style. The relationships between these assemblages should be explored; describing them as "janabarroid" suggests that further research is necessary, where classifying them as "Janabarriu" would imply that we already know what they are. I refer to the periods of time during which janabarroid ceramics were in widest use at each site as Janabarroid phases, and infer them to constitute those periods of time when the sites where these ceramics are found were most actively interacting with one another. The particulars of that interaction – whether it should be understood as occurring in the context of core/periphery relationships, as part of a network of peer polities, as the material precipitate of contacts between elites, etc. – remain surprisingly little explored in spite of the various models that have been proposed.

Because style has generally been treated as a classificatory variable (i.e., assemblages or portions thereof classed as Chavín-related or not, though see Roe, 1974; Tellenbach, 1998), vocabulary (much less recorded data) for describing the diversity within the janabarroid corpus is scarce. Degrees of similarity within and between assemblages from distinct sites remains largely and surprisingly unexplored, although it is a line of evidence with potential to address questions about the various processes proposed to underly the Chavín Phenomenon. Unfortunately, published evidence is generally limited to presence/absence data and does not allow exploration of relative abundance or use contexts of janabarroid ceramics, much less of degrees of similarity between assemblages brought together under the janabarroid umbrella.

For purposes of exploring the radiocarbon evidence associated with the Chavín Phenomenon, however, the issue of diversity within associated assemblages is a secondary one. Even while stipulating that degrees of similarity between assemblages can and should be interrogated further, assessing the chronology of janabarroid phases at those sites widely argued to be integrated into the Chavín Phenomenon offers an independent line of evidence for examining both those arguments themselves and their implications. That is, we can ask:

1. Does the radiocarbon evidence support the contention that the appearance of similar (but not identical) ceramics is a marker of contemporaneity?, and
2. Does contemporaneity suggest effectively simultaneous development, or is there some spatiotemporal pattern (e.g., and origin and/or direction(s) of spread? Was this a brief process or a drawn-out one?

Burger's (1988, pp. 133–135) compilation of sites where janabarroid materials have been found remains the most comprehensive, but has here been updated with the addition of more recently published evidence. The result (Table 2) is a list of 21 sites with published evidence of janabarroid ceramics, and a further 27 sites whose janabarroid

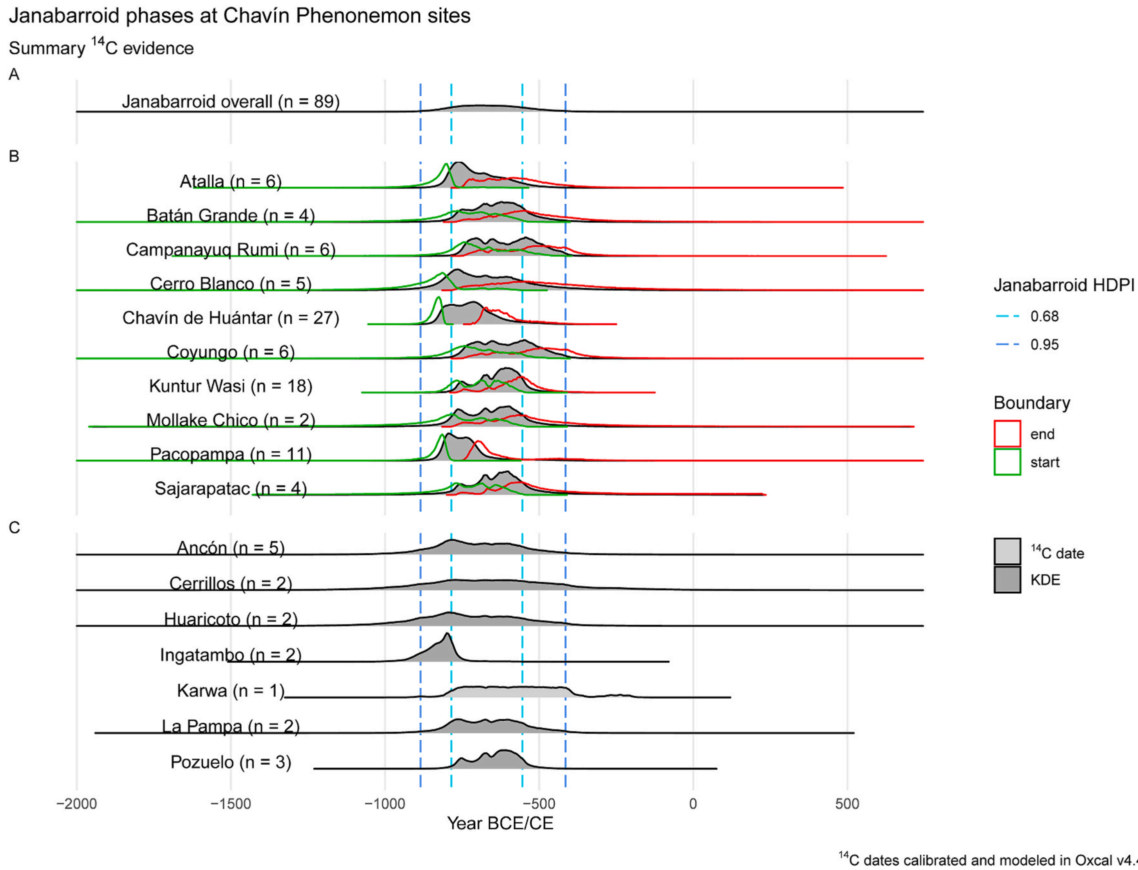

Fig. 2. A) KDE of janabarroid phases at the 10 relatively well-dated core sites, each of which is illustrated in B) boundaries and KDE summaries of posteriors from bounded phase models of core janabarroid sites (detailed in Contreras, 2023 and SM 2), and C) ^{14}C evidence from other sites associated with the Chavín Phenomenon. All constituent dates can be found in SM 1.

association is less broadly accepted but has at least been proposed. Published data unfortunately generally allow only presence/absence characterization, and not any quantitative assessment of the abundance of janabarroid ceramics at any given site. Of the 21 where janabarroid ceramics have been reported, ten have associated radiocarbon evidence that is robust enough to have previously been the subject of chronological modeling (Contreras, 2023; See Contreras, 2023:Section 4 for summary descriptions and illustrations of the ceramics at the core well-dated sites employed here.

4. Methodology: interrogating the Central Andean ^{14}C record

The ^{14}C dates associated with janabarroid ceramics from the ten well-published sites with multiple reliable associated radiocarbon dates (Contreras, 2023, Table 1) provide the best evidence of the timespan of the period of heightened interaction inferred from this shared ceramic style. That analysis of bounded phase models (Bronk Ramsey, 2009) of ^{14}C dates associated with the specific phases associated with janabarroid ceramics at various sites demonstrated that those phases are remarkable for their brevity and their contemporaneity (Contreras, 2023, Fig. 6–3), falling within a span of ∼500 years at most, between 900 and 400 BCE (95% highest posterior density interval [HDPI] 885–415 BCE; 68% HDPI 785–555 BCE; see Fig. 2).

The timespan defined by those models is here used to filter a compilation of >6000 archaeological radiocarbon dates from the Central Andes (Contreras, 2022), asking in effect, “What *else* was happening during the period when janabarroid ceramics were widespread?” This addresses a significant limitation of the discourse about the Chavín Phenomenon: studies have historically *de facto* considered only indications of the *presence* of interaction, ignoring its absence.

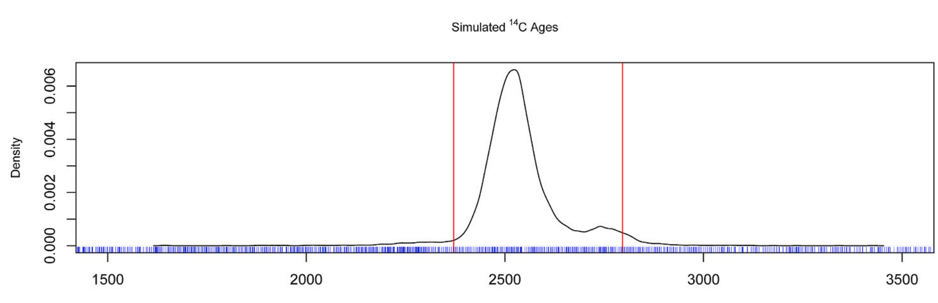

Fig. 3. Temporal window used to filter uncalibrated radiocarbon dates from compilation of Central Andean radiocarbon dates (blue rug), based on 95% HDPI (red lines) of combined janabarroid KDE (black line).

Table 3
Non-janabarroid sites with ^{14}C evidence that intersects the janabarroid temporal window.

SiteName	Lat	Lon	Elevation	n
Acaray	−11.059121	−77.535637	195	2
Canchas Uckro	−9.404835011	−77.10235322	3127	8
Cardal	−12.18604416	−76.84848357	181	5
Casa de la Tia PAC-14	−10.3	−74.3	1315	1
Casma Valley	−9.3	−77.93333333	3267	2
Caylán	−9.197191185	−78.39765901	346	3
Cerro Arena	−8.135815393	−78.95789121	153	1
Cerro Max Uhle	−14.16333333	−75.40333333	1483	1
Cerro Sechín	−9.480723	−78.258902	115	6
Cerro del Palmo	−11.56	−77.08	1080	1
Cerro Ñañañique	−5.094163737	−80.15201016	101.2105263	19
Chanapata	−13.50738	−71.98613	3548	3
Chankillo	−9.557458	−78.235918	299	1
Chilca 12B-VII	−12.3972	−76.56425455	1473.4	5
Chiripa	−16.43211	−68.81852	3847	22
Chu'uxuqull	−17.57932	−68.636249	4083	1
Condor Cerro A	−8.66266379	−78.282027	498	1
Corowa	−10.2	−75.14	288	1
Cruzpata	−17.3	−66	4197	1
Cutamalla	−14.31290002	−74.85261002	3231	1
Disco Verde	−13.83027007	−76.30639121	12	3
El Porvenir	−3.659946	−80.258174	81	7
Hacha	−15.47181332	−74.62051633	130	4
Huaca Lucía	−6.464612	−79.754708	80	1
Huaca Prieta	−7.919889572	−79.30613034	18	3
Huaca de los Reyes	−8.072943	−78.928584	152	1
Huachuamachay	−11.33	−76.03	4451	1
Huambacho	−9.26765	−78.418804	48	7
Huancarani	−17.30317	−67.90199	3766	1
Huaricanga	−10.49283211	−77.75137237	198	1
Huayurco	−5.380726369	−78.75305295	442	7
Huillca Raccay	−13.21722	−72.43182	3064	2
Jauranga	−14.54557294	−75.21005183	312	13
Jose's Hill	−8.15	−74.39	161	1
Kampa	−16.769167	−69.983333	4689	1
Kayarani	−17.5	−65.9	2941	1
La Fortaleza	−10.6528	−77.8413	23	1
La Vega	−4	−72.23	125	1
Laguna Paca	−11.45	−75.3	3091	1
Las Haldas	−9.701331	−78.296346	32	10
Limoncarro	−7.291702	−79.431053	118.5384615	13
Loma de Camotillo	−12.31	−76.4	2770	1
Machu Picchu	−13.15646	−72.54253	2152	3
Marcavalle	−13.5186	−71.97804	3395	3
Miraflores Alto	−17.512367	−71.362696	7	1
Pachamachay	−11.11432	−76.187229	4283	1
Pampa Rosario	−9.487477567	−78.23979976	133	3
Panalauca	−11.322	−76.065	4205	1
Pechiche	−3.673867768	−80.38579368	43	1
Pernil Alto	−14.479807	−75.202928	393	4
Pikicallepata	−14.2694	−71.2261	3551	5
Piruru	−9.243499	−76.629402	3302	1
Piñuta	−17.583369	−69.550021	4177	2
Pucara	−15.281624	−70.18891	3836	4
Puerto Nuevo	−13.82903777	−76.24533027	12	9
Punta y Suela	−10.693808	−77.74228	276	3
Putushio	−3.28	−79.11	3204	5
Qaluyu PPu 5-2	−15.01	−70.22	3895	1
Quelcatani	−16.88448133	−69.88848133	4508	1
Quelccaya	−13.56	−70.52818182	3506	1
Quemado	−14.816667	−75.083333	415	1
Quives	−11.38	−76.46	4172	1
San Diego	−9.466953295	−78.34432557	50	3
Sechín Alto	−9.465152295	−78.24268379	153	1
Sehuencas	−17.3	−66	4197	1
Tablada de Lurin	−12.11	−76.55	2936	1
Telarmachay	−11.18596	−75.869299	4375	1
Tiwanaku	−16.55549465	−68.68429075	3838	3
Upaca	−10.67664289	−77.73457639	163	1
Uña de Gato	−3.525629	−80.315165	17.6	5
V-137	−8.47675745	−78.7895188	127	1
Valle Ibirza	−17.24	−66.09	4093	2
Vetilla	−14.812199	−74.769531	1490	1
Waywaka	−13.6606	−73.3867	3006	2

4.1. Defining a temporal envelope

The ten well-dated sites associated with the Chavín Phenomenon are represented by 101 ^{14}C dates, of which 11 were identified as misfits and discounted from the analysis (see Contreras, 2023). To define a timespan in radiocarbon years that can be used to identify contemporary archaeological radiocarbon dates, the kernel density estimates (KDEs) from the bounded phase models of the Janabarroid periods at the ten sites described above are themselves summarized with a KDE (Fig. 2); the 95% HPDI of this KDE spans the period 890 BCE – 385 BCE. That KDE is treated as a distribution from which a large sample (10000) of random ages is drawn; for each of those ages a randomized estimate of a corresponding age in radiocarbon years is produced using the 'uncalibrate' function in the R package **rcarbon** (Bevan and Crema, 2017). The central 95% of the resulting values – ranging from 2800 to 2370 radiocarbon years – defines the envelope of ages (Fig. 3) subsequently used to filter the compilation of archaeological radiocarbon dates from the Central Andes. Working in radiocarbon years allows efficient preliminary exploration of a corpus of >6000 dates, with the goal of identifying dates to be further considered.

This approach is conservative in the sense that it is more likely to include sites that pre- or post-date the Chavín Phenomenon than it is to exclude sites that were in fact contemporary. The uncertainty of individual radiocarbon dates makes this an inclusive method, returning ^{14}C dates from events that may pre- or post-date the implicated span of calendar years and incorporating dates that might be eliminated if chronometric hygiene procedures (Spriggs, 1989) were applied to the entire dataset.

4.2. Compiling and filtering the Central Andean ^{14}C assemblage

The ^{14}C assemblage for the Central Andes used here is a compilation of prior compilations (Contreras, 2022, Table 1), filtered for duplicates and updated with dates from more recently published compilations (e.g., Chamussy and Goepfert, 2019; Roscoe et al., 2021) and additional published ^{14}C dates that are clearly relevant either because of the age or cultural affiliation of the sites from which they come (e.g., Prieto et al., 2022; Tantaleán et al., 2024). Of the resulting set of 6913 Central Andean ^{14}C dates, >90% (6297) have been georeferenced. Filtering those dates with temporal envelope described above, and spatially limiting to latitudes between −3° and −18° to exclude areas clearly not relevant to the Chavín Phenomenon, produces a set of 239 ^{14}C dates from 74 sites (Table 3).

These dates, in various configurations detailed below, have been calibrated and modeled in OxCal (Bronk Ramsey, 2001), using SHCal20 (Hogg et al., 2020) for coastal sites and an undefined mixed curve (Marsh et al., 2018) combining IntCal20 (Reimer et al., 2020) and SHCal20 for highland sites. The well-dated janabarroid sites are modeled using stratigraphic priors for Chavín and sequenced by sub-phase for other sites, detailed in Contreras (2023); identification and treatment of outliers and misfit dates is also discussed there and the OxCal code is reproduced in SM 2. The less well-dated janabarroid and potentially janabarroid sites, as well as the sites identified with the temporal envelope, have been modeled as simple bounded phases to minimize the tendency to overestimated phase lengths as a results of dating uncertainty (Bayliss et al., 2007, pp. 8–9); the results are summarized using KDEs (Bronk Ramsey, 2017).

5. Results and discussion: What do ^{14}C assemblages tell us about the Chavín Phenomenon?

The combination of published archaeological evidence and the radiocarbon record makes it possible to isolate three collections of sites: a) sites broadly accepted as associated with janabarroid ceramics (17 sites; see Table 2), b) sites that may be janabarroid (13 sites; see Table 2), and c) sites with published radiocarbon dates that overlap the

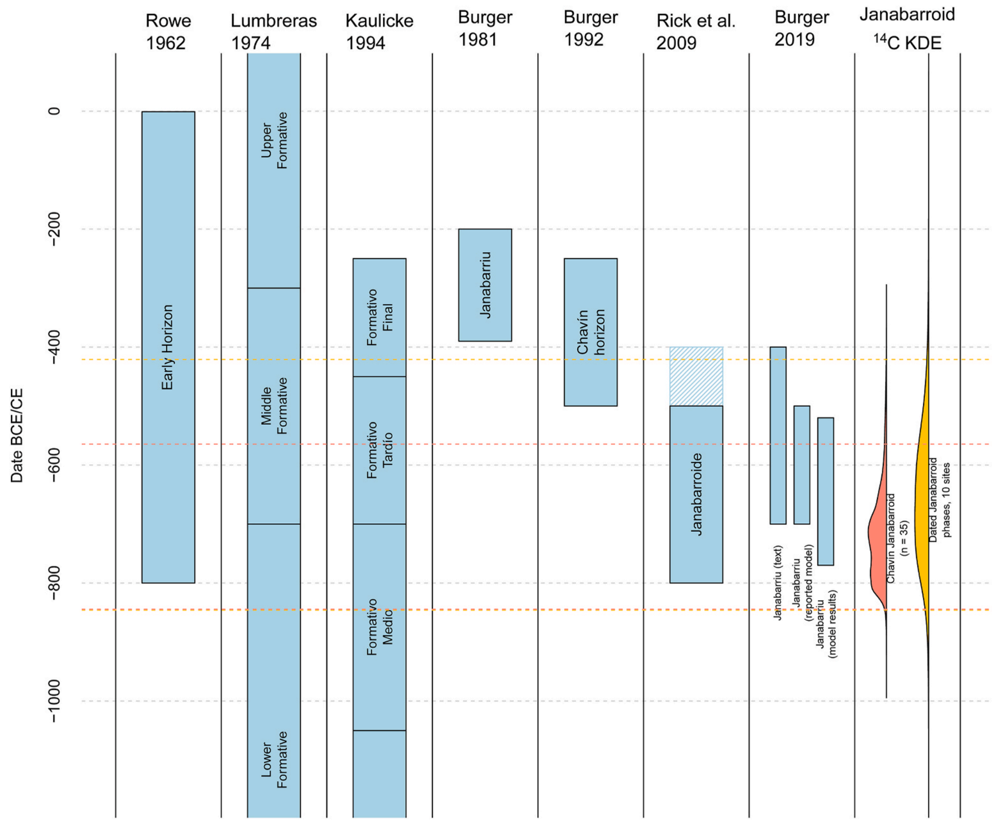

Fig. 4. Chronologies proposed for Chavín and the Chavín Phenomenon.

janabarroid timespan, suggesting their potential contemporaneity (75 sites, of which 29 have at least 3 associated radiocarbon dates within the relevant span and 16 have at least 5 associated dates; see Table 3). To the first two categories can be added 4 undated janabarroid sites and 14 undated possible janabarroid sites; since the contemporary sites can be identified only through associated radiocarbon dates, it is not possible to enumerate additional undated sites that may be contemporaries.

5.1. *Timing and duration*

The core well-dated sites associated with the Chavín Phenomenon, as noted above, produce a combined KDE with a 95% HDPI that spans 885–415 BCE (Fig. 2); at a 68% HPDI this interval is restricted to 785–555 BCE. It is suggestive that the most thoroughly dated and modeled of these sites, Chavín de Huántar, produces a KDE that is amongst the shortest in duration (840–540 BCE); Pacopampa and Kuntur Wasi, the two other sites with >10 dated samples associated with the period during which janabarroid material culture was present, also present relatively short intervals (Fig. 2). These comparatively short spans are likely more reliable than the long-tailed KDEs that reflect greater uncertainty at less well-dated sites; phase models of these comparatively well-dated sites address the tendency to overestimate period spans when visually inspecting arrays of calibrated radiocarbon dates (Bayliss et al., 2007, pp. 8–9). The KDEs described here are of the posteriors from bounded phase models.

Although the estimated start and end dates of the period are vulnerable to how well the constituent dated samples capture the beginning and end of the periods during which janabarroid material culture was common at the sites involved – both of which present sampling challenges – the Chavín Phenomenon appears to have been at its most active between approximately 850 and 500 BCE. Phases extending later in time cannot be definitively ruled out without careful dating of the terminus of the Chavín Phenomenon and what came after at various sites, but the probability tails of current estimates that extend later than 500 BCE are likely affected by the Hallstatt Plateau.

This time period is both relatively brief and relatively early with respect to previously proposed chronologies (Fig. 4). As a result, it addresses a significant critique of the application of the term “horizon” to the Chavín Phenomenon: that the period was too long to represent a discrete phase of heightened interaction (Pozorski and Pozorski, 1987). Both the core janabarroid sites and other sites proposed to have been associated with the Chavín Phenomenon, in fact, fall within a span of time comparable to that proposed for the Middle Horizon (commonly ~400 years).

5.2. *Assessing potential contemporaries*

The 13 dated sites classified as possible janabarroid can also be compared to the janabarroid span. Their consistency with that span (Fig. 5) lends credibility to claims of association with the Chavín Phenomenon. While most of these sites do not have enough associated dates to make confident assertions about their chronologies, the extant chronological information argues that association with the Chavín Phenomenon is plausible. Further investigation of associated material culture and additional dating likely would add significant additional information.

The sites not associated with janabarroid material culture include geographically distant contemporaries (e.g., Chiripa, Pukara, Putushio), perhaps known or even visited by core participants in the Chavín Phenomenon, but likely beyond the reach of regular interaction, and nearby contemporaries, not notably further away geographically than other sites that were part of the Chavín Phenomenon (e.g., Canchas Uckro, Cerro Ñañañique, Cerro Sechín, Las Haldas, Puerto Nuevo). An additional category could be composed of sites for which some published dates are no longer accepted as reliable (e.g., Tiwanaku [Marsh, 2012] and Machu Picchu [Burger et al., 2021]). KDE summaries of bounded

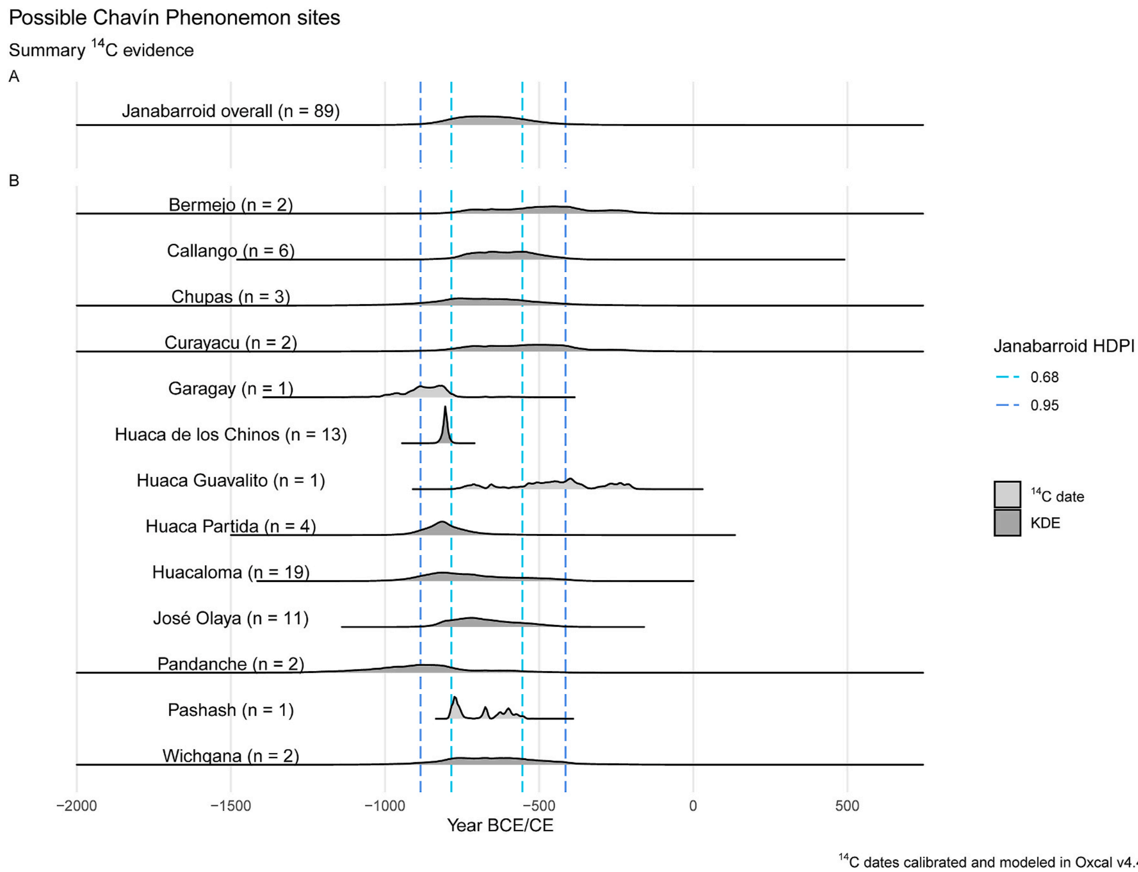

Fig. 5. A) KDE of janabarroid phases at the relatively well-dated 10 core sites, and B) summary ^{14}C evidence from possible Chavín Phenomenon sites. Constituent dates can be found in SM 2.

phase models for these dates at these sites can be classified (Fig. 6) as:

1. *distant* (unlikely to be directly or closely involved in the Chavín Phenomenon),
2. *early* (likely predate the Chavín Phenomenon, but have been included by the conservative filtering window [see Section 4.1]),
3. *late* (likely postdate the Chavín Phenomenon, but have been included by the conservative filtering window [see Section 4.1] and/or the poorly constrained terminus of the Chavín Phenomenon), and
4. *contemporary* (fall primarily within the 68% HDPI of the combined core janabarroid HPDI).

Because these assessments are based on filtering an unedited compilation of radiocarbon dates, more detailed chronological comparisons (e.g., using OxCal's 'Interval' query to compare KDEs), would produce spurious precision. Though such tools are invaluable for comparing modeled chronologies, they depend on accurate and precise chronologies of the elements being compared. In this case, the existence of gaps and overlaps in the the archaeological radiocarbon record identifies foci for further research: radiocarbon dates from the sites indicated should be subject to chronometric hygiene and modeled (where sufficient information is available), and where robust chronologies can be produced the relationships between them can be explored in more detail. . Identification of all of these sites as potential contemporaries of the Chavín Phenomenon, and a subset of them as likely contemporaries, opens additional avenues of inquiry that have the potential to shed light on the Chavín Phenomenon and its milieu. I return to those in Section 6.

5.3. *Spatial distributions*

The geospatial component of the Chavín Phenomenon is as important to its interpretation as the temporal component. As a consequence, maps illustrating the distribution of the sites involved have been a staple of debates about the roster and character of the Chavín Phenomenon since the mid-20th century. Maps illustrating the sites implicated in the Chavín Phenomenon reflect the horizon concept in two ways: first, they depict sites implied to be interacting, whose spatial relationships may be revealing about the nature of that interaction, and second, the sites identified with the horizon are by extent contemporary, and so a map that portrays them is a snapshot of the region during that time period.

Maps commonly depict the Chavín Phenomenon by either illustrating the associated sites with points, or by drawing a polygon that encompasses the area within which associated sites are found. The sites that are included have varied as definitions of the Chavín Phenomenon have evolved and increasing numbers of sites have been investigated, but examples of both points (Carrión Cachot, 1948, Lámina XXVII; Willey, 1951, Fig. 1; Shibata, 2011, p. Fig. 1; Matsumoto et al., 2018, Fig. 1; Nesbitt et al., 2019, Fig. 1) and areas (Lumbreras, 1974b, Fig. 54; Lumbreras, 1989, Fig. 7; Pozorski and Pozorski, 1987, Fig. 4; Burger, 1988, Fig. 4.12) are abundant. Although both types are intended to be illustrations of the regional reach of the Chavín Phenomenon, points on a map suggest a node-and-network phenomenon while an area suggests a continuous territory of influence.

A persistent challenge for both modes of illustration has been the necessary focus on sites positively identified as involved in the Chavín Phenomenon. As with the application of Rowe's (1962) Early Horizon, while conceptually there is space for contemporary but uninvolved sites, the identification of such sites presents enough of a practical challenge that they are rarely depicted, leaving the space in between networked

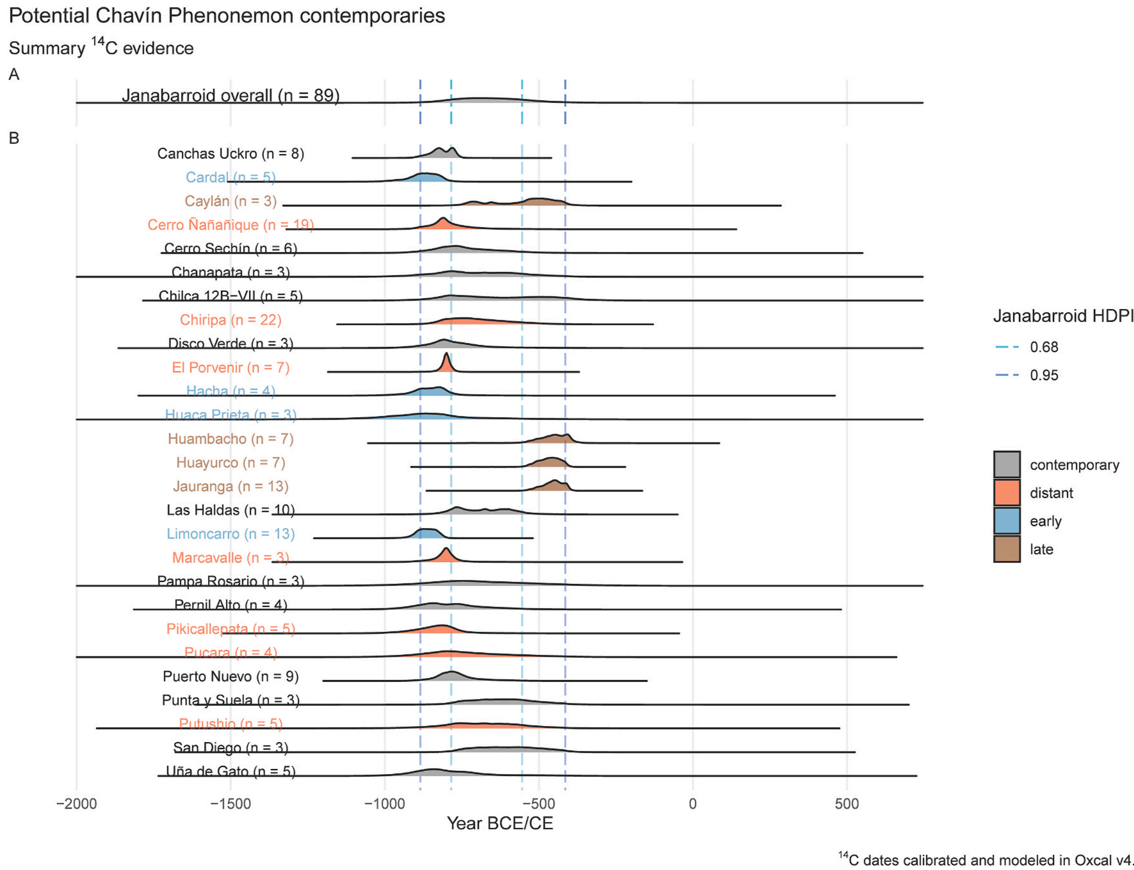

Fig. 6. A) KDE of the relatively well-dated janabarroid phases at the 10 core sites, and B) summary ^{14}C evidence from janabarroid-contemporary sites with >3 associated dates, classified as distant (red), early (blue), late (brown), and contemporary (grey). Dates from Tiwanaku and Machu Picchu, regarded as unreliable (Marsh, 2012; Burger et al., 2021), have been excluded. Constituent dates can be found in SM 3.

sites empty. The effect is to depict the region as a blank canvas for the Chavín Phenomenon and to imply a degree of hegemony by tacitly suggesting that all sites were involved. Producing maps of a region populated exclusively by apparently contemporary and related sites reifies the horizon concept; any investigation of the phenomenon requires a means of identifying contemporary but non-participating sites.

Fig. 7 demonstrates that sites associated with the Chavín Phenomenon are widespread – the extremes are ~1000 linear km apart – and spread across multiple environments. That is, this was not a phenomenon confined to coast, highland, jungle, or any other simple environmental classification. It is also notable that in spite of Chavín's putative links to the *selva* (Lathrap, 1971), sites are rare even on the eastern slope, much less in the jungle – but this may reflect the history of research intensity (Coomes et al., 2021) as much as actual distribution of sites.

The more complete picture in Fig. 8, which includes contemporary but apparently uninvolved sites, does not of course alter any of the inferences about the extent or coverage of the Chavín Phenomenon. Nor, it is worth stressing, is it innovative to recognize that there were contemporary but non-participating sites; Burger (2012, p. 140), for example, has argued that "even within the core area the Chavín sphere of interaction was not continuous or fixed in extent". However, the ability to estimate the quantity and distribution of those sites is novel, and opens new analytical possibilities.

Where the temporal component of radiocarbon evidence, by arguing for a relatively brief duration (perhaps three centuries) of the Chavín Phenomenon, opens the door for a reconsideration of the horizon concept, the spatial component of that evidence does the opposite. The thorough interdigitation of sites presents a challenge to any concept of an all-encompassing phenomenon; rather, the Chavín Phenomenon appears to constitute, as Kroeber (1944, p. 92) observed even when it remained ill-defined, "a spotty but considerable array". The ability to identify sites that did *not* form part of that array makes it possible to compare sites that were integrated in the Chavín Phenomenon with those that were not (begging the question of whether they were resistant to the Chavín Phenomenon, or excluded from it).

6. Conclusions

Reviewing the radiocarbon evidence associated with the Chavín Phenomenon not only serves to refine the chronology of that iconic period in Central Andean prehistory, but also provides new means of characterizing the phenomenon itself. The contemporaneity of the sites implicated and the relative brevity of the span of time involved revive the ghost of the Chavín Horizon – but at the same time emphasize the absence of uniformity amongst Central Andean sites of the first half of the first millennium BCE. Although there was apparently a period of heightened interaction of relatively short duration – roughly spanning 850–500 BCE – that time period was evidently not an entirely homogenizing one: not all sites were involved in the Chavín Phenomenon, and the area involved was not spatially contiguous.

While recognizing this diversity, can we also – as Burger (1993) suggested for a Chavín Horizon – make it an object of study? This analysis of the associated radiocarbon evidence is an initial step in that direction. The radiocarbon evidence offers a means of identifying contemporary but non-participating sites, as well as the promise of more closely assessing the broad contemporaneity of sites integrated in the Chavín Phenomenon. Did janabarroid ceramics appear synchronously, or spread from one or more source sites, along pre-existing or newly established networks and/or across territory? Were there early adopters and holdouts (and were these clamoring to participate, or did they

Fig. 7. Janabarroid and possible janabarroid sites.

eventually succumb to proselytizers)? These questions remain for future research, but it is tantalizing to be able to begin to describe the apparently asynchronous appearance of janabarroid ceramics at the best-dated sites; these seem to appear earlier at Chavín than at either Pacopampa or Kuntur Wasi, and to persist longer at the latter two sites (Table 4).

Making the phenomenon the object of investigation will also require a means of characterizing interaction rather than simply stipulating its existence. Making interaction rather than membership the focus necessitates not only re-examining classification (just how similar is the material classed as "janabarroid" at each site?) but also examining chronology more closely (how close to synchronous is the appearance of janabarroid material, and in what way(s) are its appearance and disappearance patterned?). Asking these questions will require a shift in scale from regional to local, as accurate and precise site chronologies must rely on stratigraphically informed Bayesian chronological models.

Using the radiocarbon evidence to identify non-participating but contemporary sites opens other questions as well, prompting us to wonder, for example, what *else* was happening during the Chavín Phenomenon? In what milieu did this interaction come about, flourish, and fade? What *else* was happening at the time of the appearance and disappearance of Janabarroid material, both at the sites involved and elsewhere, both socio-politically and environmentally? We might also ask how much these non-participating sites share with one another, and how different they are from sites involved in the Chavín Phenomenon. Did they persist from earlier times, or arise even while the Chavín Phenomenon flourished? Was there interaction between participating and non-participating sites (i.e., interaction that did not produce exchange of material culture)? Were there *degrees* of affiliation with the Chavín Phenomenon? Rather than two or three categories of sites, should we have a continuum?

Such questions are made possible by a top-down analysis of the Central Andean radiocarbon record, but as the ambiguity of the KDEs presented in Section 4 illustrates, addressing these questions will require both bottom-up analysis and additional dates. This medium-scale evaluation of the Central Andean archaeological radiocarbon evidence highlights particular sites where additional chronological attention – e.g., chronometric hygiene and Bayesian models that incorporate stratigraphic information – will be of particular interest. Approaching the Chavín Phenomenon as I have here demonstrates the utility of a middle ground – certainly individual Bayesian models from each site could improve the picture presented here, but the overview presented here efficiently demonstrates why such models will be of particular interest.

Data availability

Radiocarbon dates and OxCal code are available as Supplementary Material.

CRediT authorship contribution statement

Daniel A. Contreras: This is a single-author paper, and as such D.

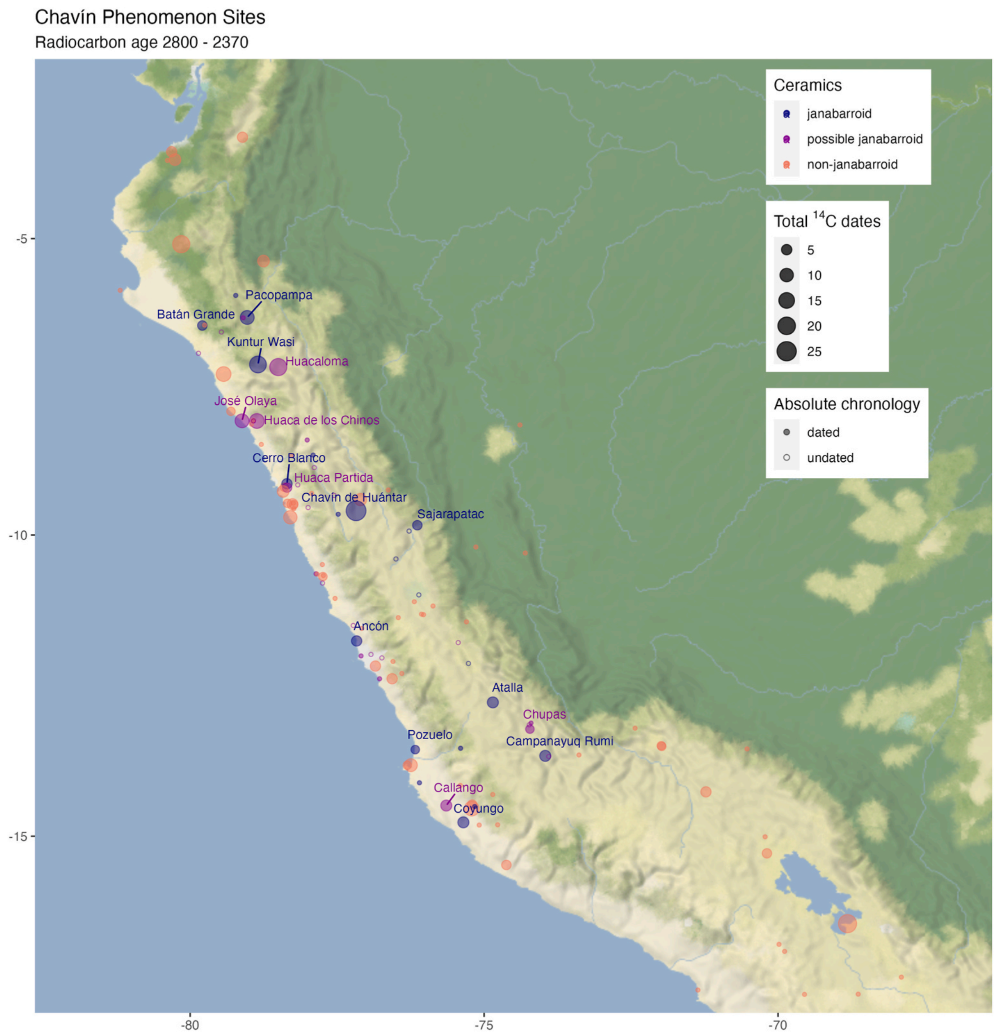

Fig. 8. Janabarroid and possible janabarroid sites, with contemporaries identified through ^{14}C evidence. Dates from Tiwanaku and Machu Picchu, regarded as unreliable (Marsh, 2012; Burger et al., 2021), have been excluded.

Table 4
Results of OxCal 'Order' query for the boundaries of the janabarroid phases at best-dated sites (Chavín, Kuntur Wasi, and Pacopampa).

Probability t1 < t2						
t1	t2					
	Chavín Janabarroid - start	Chavín Janabarroid - end	Pacopampa II - start	Pacopampa II - end	Kuntur Wasi - KW start	Kuntur Wasi - KW end
Chavín Janabarroid - start	0	1	0.6343	1	0.9903	1
Chavín Janabarroid - end	0	0	0.000111	0.3462	0.23452	0.6967
Pacopampa II - start	0.3657	0.9999	0	1	0.9825	1
Pacopampa II - end	0	0.6538	0	0	0.3583	0.7169
Kuntur Wasi - KW start	0.009698	0.7655	0.0175	0.6417	0	1
Kuntur Wasi - KW end	0	0.3033	0	0.2831	0	0

Contreras is responsible for all aspects of it.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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radiocarbon dates.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.quaint.2024.05.001.

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Laboratory of the Institute of Physics. Silesian Technical University, Warszawa - Gliwice.