

# Supporting Information for MagIC as a FAIR repository for America's directional archaeomagnetic legacy data

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## Introduction

Four subsets of data from the Four Corners region were explored in the development of the polynomial fit model of paleosecular variation. Only the selected model based on the subset of data that satisfy  $\alpha_{95} \leq 4$  was included in the main text and transformed into to a VGP projection. The other three (all the data,  $\alpha_{95} \leq 5$  or  $\kappa \geq 100$ , and  $\alpha_{95} \leq 3$ ) are presented here in Figure S1.

Due to the low density of accepted data from the Lower Mississippi River region, northern Mexico, Mesoamerica, and South America, those data were not graphically depicted in the text. The magnetic declination and inclination of the sites from these regions, with respect to time, are presented here in Figures S2, S3, S4 and S5, respectively.

Digital reproductions of previously published but difficult to access VGP models for the other regions are available by contacting the corresponding author (saj012@ucsd.edu).

**Table S1: Parameters used in data clustering**

To eliminate subjectivity of human bias and ensure that the scatter caused by paleosecular variation was maintained, the azimuth adjustments required to correct the archived data were completed using the OPTICS clustering functions within the sklearn.cluster python module. The parameters used are presented in Table S1 and an example python Jupyter Notebook, associated with this paper, is available on ERDA (<https://earthref.org/ERDA/2478/>). The notebook presents the code used to cluster and adjust the DuBois data from the United States.

In some cases, a filter was used in addition to the OPTICS clustering to ensure that directions that fell between clusters (i.e. Declination = 45 or 135°) were not included in a cluster. Instead those data were filtered out and assigned to no cluster, to avoid misidentifying the cluster they belong to.

Contributor	Step 1	Step 2
<b>DuBois</b>		
- USA	Epsilon = 11	Epsilon = 19
- Mexico and Central Am.	<i>Not Corrected</i>	
- South America	<i>Not Corrected</i>	
<b>Wolfman</b>		
- USA	Epsilon = 10	Epsilon = 18
- Mexico and Central Am.	Epsilon = 21	Filter = Decs 330-20°, 60-110°, 150-220°, and 240-290°
- South America	Filter = Decs 60-130°	
<b>Eighmy</b>		
- USA	Epsilon = 18	
- Mexico and Central Am.	<i>Not Corrected</i>	
- South America	<i>Not Corrected</i>	

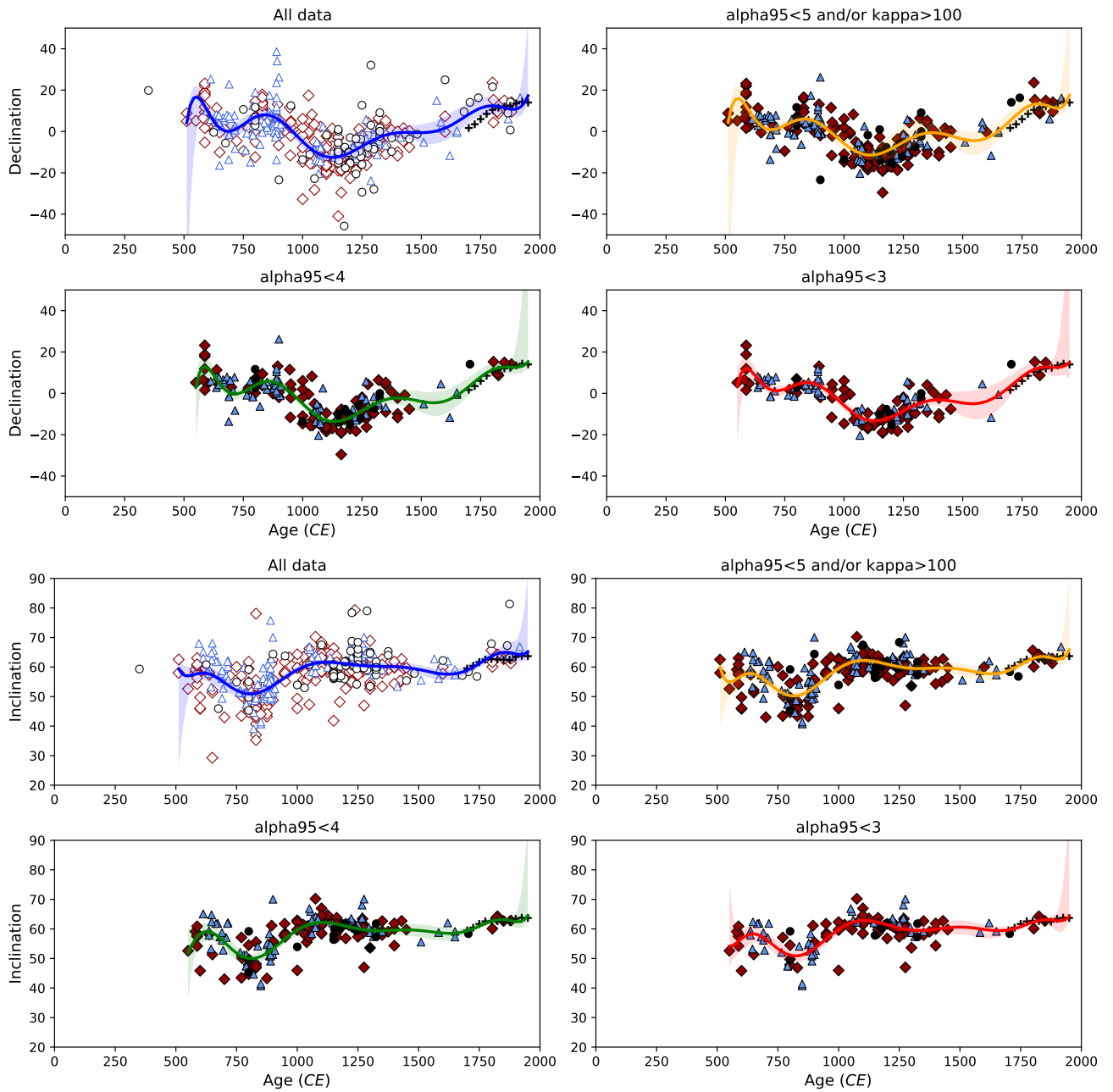
### Figure S1: Other polynomial fit models explored

Blue (top-left): The model derived from all the data (402 data points in the last 2000 years) does not reliably fit the declination predictions from gufm, black plus-sign symbols.

Yellow (top-right): The model derived from the subset of data that passed this paper's selection criteria (239 data points in the last 2000 years) has a phase offset in the declination during the 8<sup>th</sup> – 14<sup>th</sup> centuries that does not fit the data adequately.

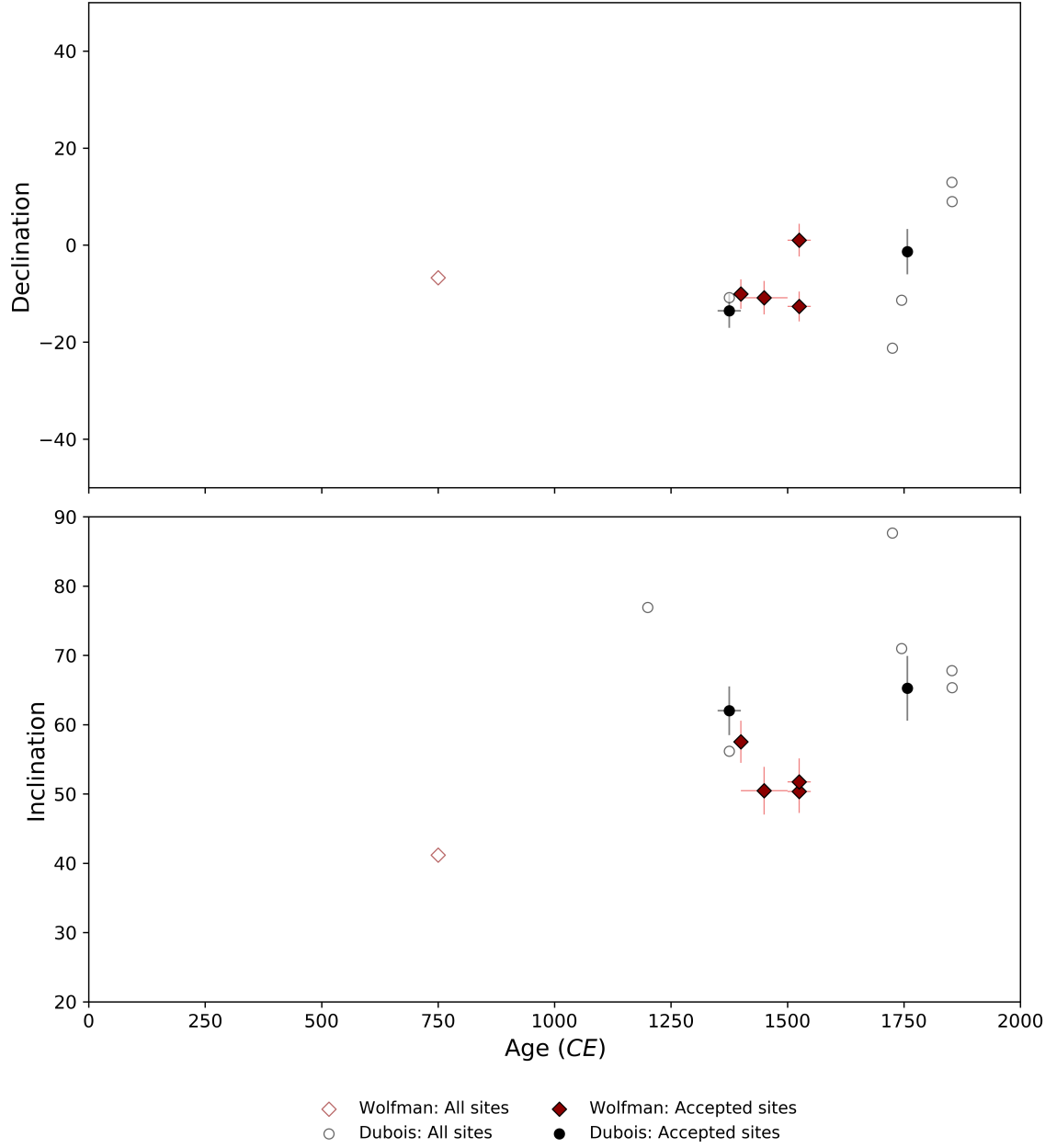
Red (bottom-right): An  $\alpha_{95}$  threshold of 3 degrees, decreased the subset of data available for modeling to 130 data points in the last 2000 years and was deemed to be an overly strict interpretation for the data.

Green (bottom-left): A balance of precision and quantity of data was favored, resulting in the preference to select this model based on the subset of data with an  $\alpha_{95}$  threshold of 4 degrees (152 data points during the last 2000 years) for conversion into VGP coordinates.



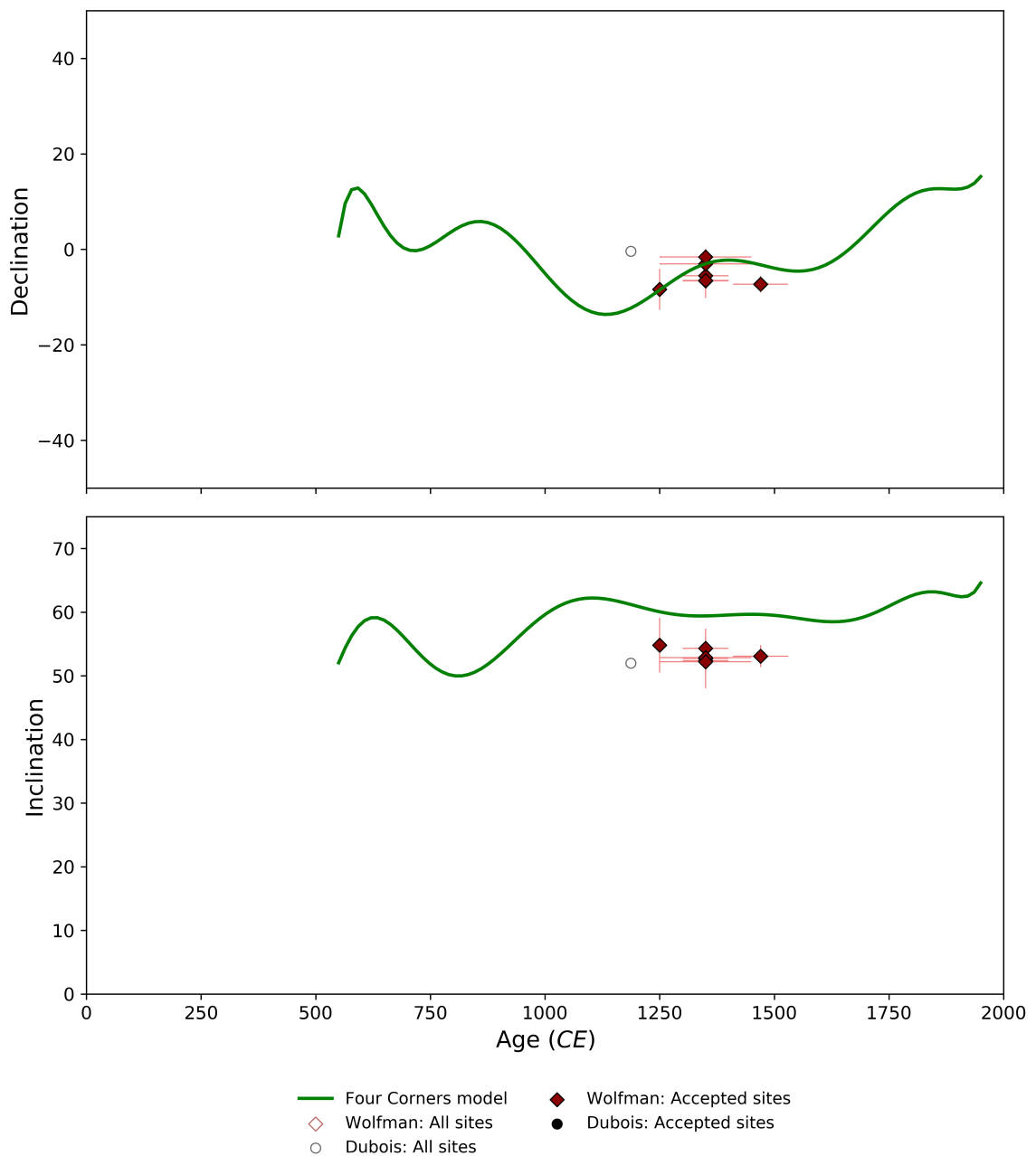
**Figure S2: Lower Mississippi River region**

Within the Lower Mississippi River region, DuBois sampled material from 287 burned features, Wolfman sampled 33 features, and Eighmy sampled 63. Of these only twenty-two have independent age chronology (ten of which are older than 2000 years before present), and seven passed this paper’s acceptance criteria (Table 4 in the main text). Those data are presented here, with respect to age. There are too few data to confirm or refute the previously published models for the region that were compiled by Wolfman.



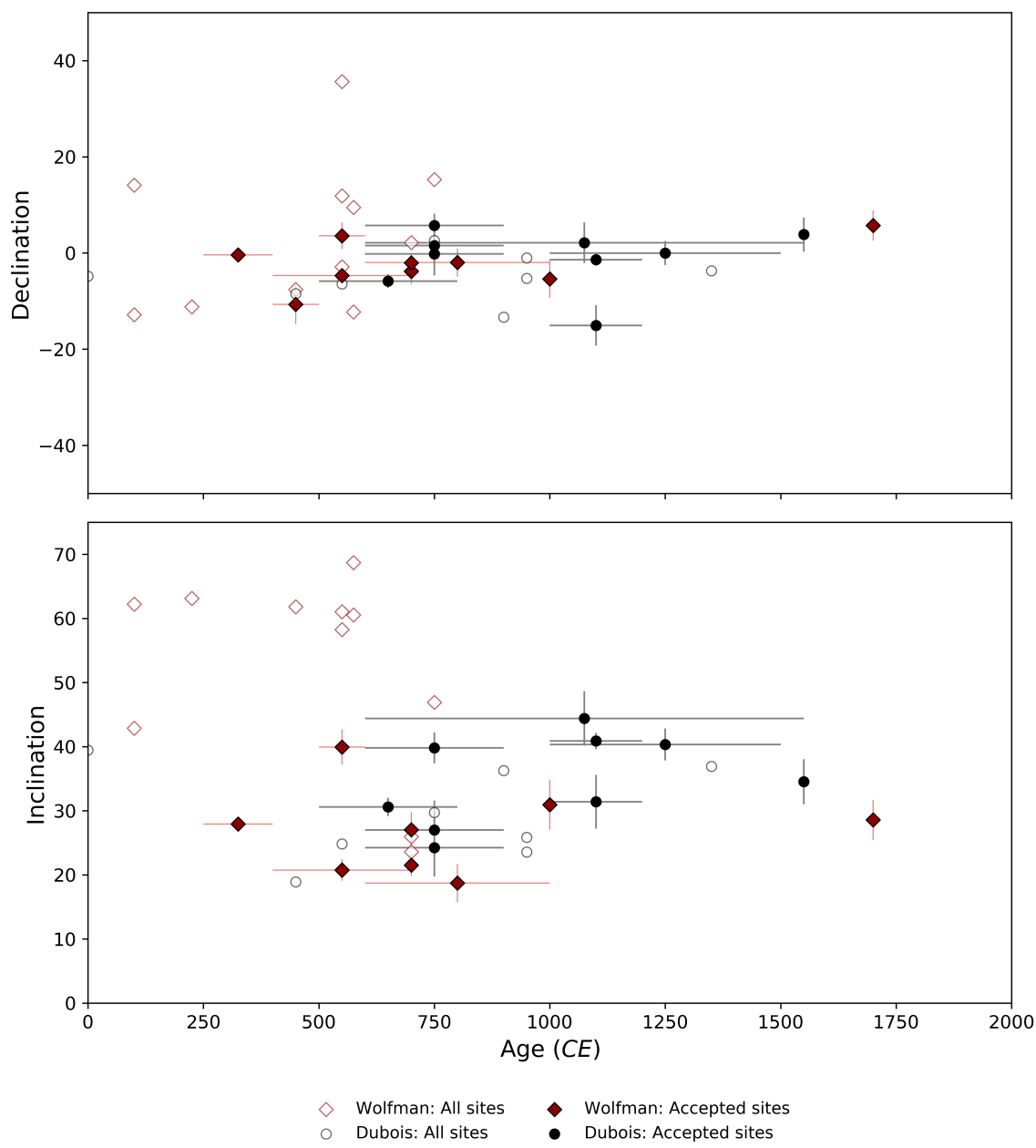
### Figure S3: Northern Mesoamerica

Due to the latitudinal dependence of inclination, the data from Mexico and Central America were interpreted in two divisions - northern Mexico and Mesoamerica. The few sites in the northern region (24 archaeological features), are culturally similar to the indigenous populations of the southern Four Corners region and are in close enough proximity that they could potentially be included in regional modeling efforts in the future. Those data are presented here, with respect to age. The eight sites are overlaid on top of the new polynomial fit model for the Four Corners region. The inconsistency noted between the inclination data and the model could be the result of a latitudinal dependence but could also be an artifact in the model, due to low data density in the Four Corners region, during the same time interval.



**Figure S4: Mesoamerica**

Of the 376 archaeomagnetic sites sampled in Mesoamerica, forty-seven have independent age constraints and only twenty-four passed this paper’s acceptance criteria (Table 4 in the main text). Those data are presented here, with respect to age. The data are too dispersed to confirm or refute the previously published models for the region that were compiled by Wolfman.



**Figure S5: South America**

South America is the least sampled region in the archive and of those, only fourteen archaeomagnetic sites passed our acceptance criteria. Those data are presented here, with respect to age. There are too few data to confirm or refute the previously published models for the region that were compiled by Wolfman and Dodson.

