# Global Survey and Distribution of Pennsylvanian and Mississippian Microbial Mounds

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## Introduction

This study serves to build a global database of microbial mounds from these geologic eras, which span 60 million years. This database will include geographic data from scientific studies of microbial mound structures from the last 31 years (1990-2021). We can construct paleogeographic maps and compare the ecology, location, and sedimentary character of each mound. This is done in order to find similarities in conditions on ancient shallow marine slopes and determine the fundamental controls on mound formation.

***Figure 1:*** *An example of one type of microbial mound material, stromatolites. The mounds in this study have varying compositions. (sciencesourceimages.com).*

## Microbial Mounds

Microbial mounds, including Waulsortian and Waulsortian-like mounds, are lithified structures composed of carbonate compounds and ancient microbes that aided in the production of those compounds (Figure 2). They commonly developed in shallow sea environments of the Pennsylvanian (323 to 299 Ma) and Mississippian (359 to 323 Ma) era strata due to the photosynthetic tendencies of cyanobacteria and its environmental symbionts that require marine environments (i.e.: phylloid algae). The fossilized remnants can create structures like stromatolites (Figure 1) or reflect geometries from other microbial growth.

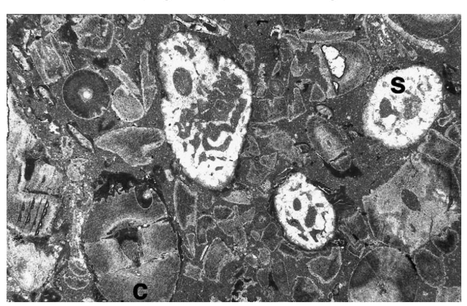


***Figure 2:*** *A photomicrograph of the composition of a microbial mud mound. Small brachiopods, crinoids, and bryozoans are visible (Samankassou and West, 2002).*

## Methods

Extensive data mining was done using research tools including Tennessee Tech Library, JSTOR, and Google Scholar to find previous peer reviewed studies concerning stromatolitic and microbial mound formations. Key search terms included the following: microbial mats, microbial mounds, mud mounds, Carboniferous, Pennsylvanian, Mississippian, and stromatolites.

The locality of the mounds studied as well as various occurrence notes, latitude and longitude, and names of the sites were recorded in a spreadsheet, pictured in Figure 4. Then, the latitude and longitude of each site was pinned in a Google Earth folder with a corresponding name. If no latitude nor longitude was found, locality information was used to determine the approximate site location. An aerial view of the sites is pictured in Figure 3 from Google Earth.

## Google Earth Data


***Figure 3:*** *Examples of pinned research locations in Google Earth. Yellow pins show documented mound localities in the NE United States.*

## Spreadsheet Data

| Nickname | Country | Latitude | Longitude | Note | Reference |
|---|---|---|---|---|---|
| Longdianshan Hill | Liuzhou, Guangxi, China | | | | Aretz, Poty, Devuyst, Hance and Hou, 2012 |
| Ramp Creek Formation | Indiana, United States | 38°57'9.42"N | 86°22'3.96"W | "Waulsortian mounds" | Brown & Dodd 1990 |
| Bluefield Formation | West Virginia, United States | 38°17'29.01"N | 80° 6'12.52"W | Girvanella-Bryozoan Mud mounds | Christopher 1990 |
| Lillo Formation | Puebla de Lillo, Spain | 43°0'2.6964"N | 5°18'9.695"W | Phylloid algal mounds | Corrochano and Armenteros 2017 |
| Agrio Formation | Patagonia, Argentina | 37° 44′ 54″ S | 69° 56′ 9″ W | Rippled beds also found | Fernandez and Pazos 2013 |
| Fort Payne Formation | Kentucky, United States | 36°54'2.7 N | 85°25'49.1" W | Four localities mentioned, carbonate mud mounds only associated with this one | Hannon and Meyer 2014 |
| Lumzhai mound | Lumzhai village, South China | 25°30'.27.0" N | 106°14'02.0"E | | Huang, Zhang, Guan, Miao, Chen, Yang, Li and Gong 2019 |
| Zhongxinzhai mound | Zhongxinzhai village, South China | 25°30'33.5" N | 106°12'08.0"E | | Huang, Zhang, Guan, Miao, Chen, Yang, Li and Gong 2019 |
| Rio do Sul Formation | Parana Basin, Brazil | N/A | N/A | 23 samples of MISS structures taken, individual locations not published | Noll and Netto 2018 |
| Joggins Formation | Nova Scotia, Canada | 45°45'8.66"N | 64°24'48.12"W | | Prescott, Stimson, Dafoe, Gibling, Macrae, Calder and Herbert 2014 |
| Wyandotte-Johnson #1 | Kansas, United States | 39° 2'28.81"N | 94°47'23.88"W | Phylloid algal mounds | Samankassou and West 2002 |
| Wyandotte-Johnson #2 | Kansas, United States | 39° 2'27.15"N | 94°47'24.68"W | Phylloid algal mounds | Samankassou and West 2002 |
| Wyandotte-Johnsone #3 | Kansas, United States | 39° 2'27.55"N | 94°47'26.34"W | Phylloid algal mounds | Samankassou and West 2002 |
| Frisbie | | | | Phylloid algal mounds | Samankassou and West 2003 |
| Snaibar | Kansas, United States | 37°49'18.70"N | 94°58'44.41"W | Phylloid algal mounds, exact site approximated | Samankassou and West 2003 |
| Winterset | | | | Phylloid algal mounds | Samankassou and West 2003 |
| Captain Creek | | | | Phylloid algal mounds | Samankassou and West 2003 |
| Spring Hill | | | | Phylloid algal mounds | Samankassou and West 2003 |
| Lillo Formation | Puebla de Lillo, Spain | 43°0'2.6964"N | 5°18'9.695"W | Exact location approximated | Samankassou, Allmen, and Bahamonde 2013 |
| Carnic Alps | Carnic Alps, Austria | 46°34'23.40"N | 12°53'18.18"E | 5 sample sites along the approximated location | Samankassou 1998 |
| Mengcun | Laibin, Guangxi, China | 23°31'9.45"N | 109°24'36.12"E | Very approximated site, was unable to find exact outcrop | Shen and Quing 2008 |
| Helv | Laibin, Guangxi, China | 23°30'30.96"N | 109°30'23.10"E | Very approximated site, was unable to find exact outcrop | Shen and Quing 2008 |
| Tabainout Complex | Khenifra, Morrocco | N32°56'59'' | W5°50'35'' | | Somerville, Rodriguez, Said, and Cozar 2012 |
| Alamogordo Member | Sacramento Mountains, New Mexico | 33° 7'37.22"N | 105°45'5.21"W | Location is approximate. | Wu and Chafetz 2002 |
| Shangdan Section | Inner Mongolia | 40° 0'0.00"N | 105° 0'0.00"E | Exact location approximated | Yan, Liu, Sun, Weng, and Huang 2017 |

***Figure 4:*** *Spreadsheet records of the sites studied. Each record includes a name for the site, general locality, latitude and longitude (when available), any notes on the site, and the paper in which the site is studied. Each row highlighted green represents a mound specifically paired with fossilized phylloid algae.*

## Moving forward

The next step in this study is to amass more articles through further research and compile the data points into a world map format. Certain papers like Roylance (1990) have coordinates that need to be converted into a proper latitude and longitude format in order to become a data point. In an article by Pratt (1982) contains a table of various mounds from other papers, so this study will be scrutinized to identify each example and add its location to the data. Lastly, the databases used to find the articles will be scoured for more papers with different variations.

## References

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**See spreadsheet data for other papers used in data collection.*