References used to create Figures 2 and 5.

Akins (1987); Battillo (2017, 2019); Berry (1983); Bollong (2010); Brand (1994); Clary (1983, 1987); Cummings et al. (2009); Danforth et al. (1994); East (2008); El-Najjar (1986); El-Najjar et al. (1975); El-Najjar et al. (1976); Ferguson (1980); Fry and Hall (1986); Harrod (2012); Kuckelman and Martin (2007); Marden (2011); Palkovich (1980, 1985); Reinhard (1988, 2006); Reinhard and Hevly (1991); Scott (1979); Shipman (2006); Stiger (1977, 1979); Stodder (1989, 1990a, 1990b); Stodder and Martin (1992); Stuart-Macadam (1991a); Sutton and Reinhard (1995); Taylor (1985); Trigg et al. (2000); Williams-Dean and Bryant (1975); Zaino (1967)

Supplemental Table 1. Definitions of terminology and different types of anemia.

| **Terminology** | **Definition or description** |
| --- | --- |
| Erythropoietin | Primary hormone that regulates the production of red blood cells |
| Erythrocytes | Red blood cells (RBCs); function to distribute and carry oxygen |
| Hematopoiesis | The process of RBC formation (Jagannathan-Bogdan & Zon, 2013); produces all components of blood and plasma |
| Trilineage hematopoiesis | Blood is made up of multiple cell types that fall into three general categories (red, white, platelet). Trilineage hematopoiesis refers to the process of production of the cells in each category. |
| Pancytopenia | Low counts of all three types of blood cells, often occurs due to marrow issues |
| Mean corpuscular volume (MCV) | Measures the average size of RBCs |
| Microcytic | RBCs are smaller than normal (MCV is decreased) |
| Normocytic | RBCs are normally sized (MCV is normal) |
| Macrocytic | RBCs are larger than normal (MCV is increased) |
| Anisocytosis | RBCs are unequal in size |
| Hypochromic | Pale cell color |
| Normochromic | Normal cell color |
| Aplasia | Failure of RBCs to develop or function as they would normally |
| Hemolysis | Rupture or destruction of RBCs before the end of the normal life span (120 days) |
| Hemoglobinopathy | Used to refer to any genetic disease of hemoglobin (sickle cell, thalassemia) (Kohne, 2011). |
| ***Types of Anemia*** | |
| *Macrocytic Anemias* | Characterized by larger than normal RBCs and lower normal RBC counts. Macrocytic anemias are relatively uncommon in children (Irwin & Kirchner, 2001; Lewis, 2017). Megaloblastic anemia is a general term referring to anemia caused by impaired DNA synthesis. Megaloblastic anemia is characterized by increased MCV, ineffective erythropoiesis, and hypercellular bone marrow (Braunstein, 2020). Megaloblastic anemia associated with small intestine lesions; erythroid hyperplasia in the bone marrow; neuropathy |
| *Normocytic Anemias* | In normocytic anemias, the MCV is within normal limits, but hemoglobin and hematocrit are decreased (Brill & Baumgardner, 2000; Irwin & Kirchner, 2001). Causes include Sickle cell, Thalassemia, pyruvate kinase deficiency; G6PD deficiency. |
| *Hemolytic Anemias* | Characterized by RBCs with shortened lifespans. Can be hereditary or acquired. Hereditary causes include thalassemia, sickle cell anemia, hereditary spherocytosis, G6PD deficiency; acquired causes include infection (malaria), microangiopathy, and autoimmunity (Dhaliwal, Cornett, & Lawrence M. Tierney, 2004). |
| *Aplastic Anemias* | Characterized by bone marrow failure. RBC counts are low, bone marrow has “empty” appearance (Young, Scheinberg, & Calado, 2008); failure of hematopoiesis. |
| *Microcytic Anemias* | Characterized by smaller than normal RBCs, often hypochromic. |
| *Sideroblastic Anemias* | Disorder where the body is replete with iron, but cannot use that iron to make hemoglobin. So, iron accumulates in the mitochondria of RBCs and give the nucleus a ringed appearance (NORD, 2007). Most of these anemias are acquired (Matthes, Meyer, Samii, & Beris, 2000). Acquired kinds are much more common in adults (Alcindor & Bridges, 2002). Some sideroblastic anemias can lead to leukemia. Different kinds – some are characterized by dyserythropoiesis others are characterized by ringed sideroblasts (Gattermann, Aul, & Schneider, 1990). |
| *Dyserythropoietic anemias* | Characterized by morphologically abnormal erythroblasts in bone marrow (defects of red blood cells or progenitors) (Kamiya & Manabe, 2010). |

Supplemental Table 2. Number of coprolites by food type and site; for all references see Table 4; frequencies presented in Figure 4 were estimated using these totals.

This data was used in Supplemental Figure 1 and Figure 2 [in paper]; for the most part pollen studies required >=200 grains.

|  | Pueblo Alto | Pueblo Bonito | Kin Kletso | Atlatl Cave | Chaco Canyon | Aztec Ruins - West Ruin | Salmon Ruin | Bat Cave (Mogollon, 200-1000) | NM\_ALL | Mesa Verde\_CO\_BMIII | Mesa Verde\_CO\_PIII | Hoy House\_PII\_CO | Hoy House\_PIII\_CO | Step House\_BMIII\_CO | Step House PIII\_CO | CO\_ALL | Antelope House PII | Antelope House PIII | Inscription House PIII | Glen Canyon - BMII AD 300? | Glen Canyon - PIII 1250 | Ventana Cave | AZ\_ALL | Turkey Pen Ruin - Utah |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Maize | 12 | 9 | 6 | 2 | 28 | 3 | 30 | 11 | 101 | 20 | 77 | 56 | 59 | 20 | 17 | 249 | 20 | 68 | 16 | 10 | 30 | 0 | 144 | 44 |
| Squash (cucurbita) | 12 | 9 | 6 | 2 | 28 | 3 | 20 | 11 | 91 | 20 | 77 | 56 | 59 | 20 | 17 | 249 | 15 | 68 | 16 | 10 | 24 | 0 | 133 | 28 |
| Bean | 0 | 0 | 0 | 0 | 6 | 3 | 112 | 11 | 132 | 20 | 77 | 56 | 56 | 47 | 17 | 273 | 15 | 68 | 16 | 10 | 30 | 0 | 139 | 28 |
| Cheno-Ams | 12 | 9 | 6 | 2 | 28 | 0 | 20 | 11 | 88 | 20 | 77 | 56 | 59 | 20 | 17 | 249 | 15 | 68 | 16 | 10 | 24 | 0 | 133 | 44 |
| Chenopod (goosefoot, amaranth, quinoa) | 12 | 9 | 6 | 2 | 0 | 3 | 112 | 11 | 155 | 20 | 77 | 56 | 56 | 20 | 17 | 246 | 15 | 68 | 16 | 10 | 30 | 0 | 139 | 44 |
| Amaranthus | 22 | 9 | 6 | 2 | 47 | 3 | 112 | 11 | 212 | 20 | 77 | 56 | 56 | 20 | 17 | 246 | 15 | 68 | 16 | 10 | 24 | 0 | 133 | 44 |
| Beeweed | 12 | 9 | 6 | 2 | 28 | 3 | 30 | 11 | 101 | 20 | 77 | 56 | 59 | 20 | 17 | 249 | 15 | 68 | 16 | 3 | 24 | 0 | 126 | 28 |
| Grasses | 12 | 9 | 0 | 0 | 28 | 3 | 20 | 11 | 83 | 20 | 77 | 56 | 59 | 20 | 17 | 249 | 15 | 68 | 16 | 3 | 24 | 0 | 126 | 44 |
| Purslane (portulaca) | 12 | 9 | 6 | 2 | 28 | 3 | 112 | 11 | 183 | 20 | 77 | 56 | 59 | 20 | 17 | 249 | 15 | 68 | 16 | 3 | 30 | 0 | 132 | 44 |
| Pinus (Pinon) | 12 | 9 | 6 | 2 | 47 | 3 | 20 | 11 | 110 | 20 | 77 | 56 | 56 | 20 | 17 | 246 | 15 | 68 | 16 | 10 | 30 | 0 | 139 | 28 |
| Opuntia | 12 | 9 | 6 | 2 | 28 | 3 | 20 | 11 | 91 | 20 | 77 | 56 | 59 | 20 | 17 | 249 | 15 | 68 | 16 | 10 | 24 | 1 | 134 | 44 |
| Yucca | 12 | 9 | 6 | 2 | 28 | 3 | 20 | 11 | 91 | 20 | 77 | 56 | 59 | 20 | 17 | 249 | 15 | 68 | 16 | 10 | 30 | 0 | 139 | 28 |
| Ribes (Gooseberry) | 12 | 9 | 6 | 2 | 28 | 3 | 20 | 11 | 91 | 20 | 77 | 56 | 59 | 20 | 17 | 249 | 15 | 68 | 16 | 3 | 24 | 0 | 126 | 44 |
| Helianthus (sunflower) | 12 | 9 | 6 | 2 | 47 | 3 | 26 | 11 | 116 | 20 | 77 | 56 | 56 | 37 | 17 | 263 | 15 | 68 | 16 | 10 | 30 | 0 | 139 | 44 |
| Descurainia (tansy mustards) | 22 | 9 | 6 | 2 | 47 | 3 | 20 | 11 | 120 | 20 | 77 | 56 | 0 | 20 | 17 | 190 | 15 | 68 | 16 | 10 | 30 | 0 | 139 | 44 |
| Cactus - other | 12 | 9 | 6 | 2 | 47 | 3 | 20 | 11 | 110 | 20 | 77 | 56 | 0 | 20 | 17 | 190 | 15 | 68 | 16 | 10 | 30 | 1 | 140 | 44 |
| Ricegrass (Oryzopsis) | 22 | 9 | 6 | 2 | 47 | 3 | 20 | 11 | 120 | 20 | 77 | 56 | 56 | 20 | 17 | 246 | 15 | 68 | 16 | 10 | 24 | 0 | 133 | 28 |
| Nightshade (Solanum) | 22 | 9 | 6 | 2 | 47 | 3 | 20 | 11 | 120 | 20 | 77 | 56 | 0 | 20 | 17 | 190 | 15 | 68 | 16 | 10 | 30 | 0 | 139 | 44 |
| Dropseed (Sporobolus) | 22 | 9 | 6 | 2 | 47 | 3 | 112 | 11 | 212 | 20 | 77 | 56 | 0 | 20 | 17 | 190 | 15 | 68 | 16 | 10 | 30 | 0 | 139 | 44 |
| Ephedra, Jointfir (Mormon Tea) | 12 | 9 | 0 | 0 | 28 | 3 | 20 | 11 | 83 | 20 | 77 | 56 | 59 | 20 | 17 | 249 | 15 | 68 | 16 | 10 | 24 | 0 | 133 | 44 |
| Sphaeralcea (Globemallow) | 12 | 9 | 0 | 0 | 28 | 3 | 20 | 11 | 83 | 20 | 77 | 56 | 59 | 20 | 17 | 249 | 15 | 68 | 16 | 3 | 24 | 0 | 126 | 44 |
| Juniper | 12 | 9 | 0 | 0 | 28 | 3 | 20 | 11 | 83 | 20 | 77 | 56 | 59 | 37 | 17 | 266 | 15 | 68 | 16 | 10 | 30 | 0 | 139 | 44 |
| Celtis (Hackberry) | 12 | 9 | 0 | 0 | 28 | 3 | 30 | 11 | 93 | 20 | 77 | 56 | 59 | 20 | 17 | 249 | 15 | 68 | 16 | 3 | 24 | 0 | 126 | 44 |
| Mesquite | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 11 | 20 | 77 | 56 | 0 | 20 | 17 | 190 | 15 | 68 | 16 | 3 | 24 | 1 | 127 | 0 |
| Onion | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 11 | 20 | 77 | 56 | 0 | 20 | 17 | 190 | 15 | 68 | 16 | 3 | 24 | 0 | 126 | 0 |
| Prunus (inc. Chokecherry) | 0 | 0 | 0 | 0 | 47 | 0 | 0 | 11 | 58 | 20 | 77 | 56 | 56 | 20 | 17 | 246 | 15 | 68 | 16 | 3 | 24 | 0 | 126 | 0 |
| Goosefoot | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 11 | 20 | 77 | 56 | 56 | 20 | 17 | 246 | 15 | 68 | 16 | 3 | 24 | 0 | 126 | 28 |
| Rhus (Skunkbush, Squawbush, Sumac) | 0 | 0 | 0 | 0 | 47 | 0 | 30 | 11 | 88 | 20 | 77 | 56 | 56 | 20 | 17 | 246 | 15 | 68 | 16 | 10 | 24 | 0 | 133 | 0 |
| Rosaceae | 0 | 0 | 0 | 0 | 47 | 0 | 0 | 11 | 58 | 20 | 77 | 56 | 56 | 20 | 17 | 246 | 15 | 68 | 16 | 3 | 24 | 0 | 126 | 0 |
| Atriplex (saltbush) | 0 | 0 | 0 | 0 | 0 | 3 | 112 | 11 | 126 | 20 | 77 | 56 | 56 | 20 | 17 | 246 | 15 | 68 | 16 | 10 | 24 | 0 | 133 | 28 |
| Artemesia (Sagebrush, mugwort, wormwood) | 0 | 0 | 0 | 0 | 47 | 0 | 20 | 11 | 78 | 20 | 77 | 56 | 56 | 20 | 17 | 246 | 15 | 68 | 16 | 10 | 24 | 0 | 133 | 28 |
| Physalis (Groundcherry) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 11 | 20 | 77 | 56 | 56 | 20 | 17 | 246 | 15 | 68 | 16 | 10 | 24 | 0 | 133 | 0 |
| Shepherdia (Buffaloberry) | 0 | 0 | 0 | 0 | 47 | 0 | 0 | 11 | 58 | 20 | 77 | 56 | 56 | 20 | 17 | 246 | 15 | 68 | 16 | 3 | 24 | 0 | 126 | 28 |
| Long spine Composite | 12 | 9 | 0 | 0 | 28 | 0 | 0 | 11 | 60 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Short spine composite | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| H.S. composite - Asteraceae | 12 | 9 | 0 | 0 | 28 | 0 | 30 | 0 | 79 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 90 | 16 | 0 | 0 | 0 | 106 | 0 |
| Ambrosia | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 30 | 0 | 40 | 0 |
| Liliaceae | 12 | 9 | 0 | 0 | 0 | 0 | 30 | 0 | 51 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Elymus (wild rye) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 56 | 0 | 0 | 56 | 0 | 90 | 16 | 10 | 30 | 0 | 146 | 0 |
| Wild buckwheat | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 | 77 | 0 | 0 | 0 | 0 | 97 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |



Supplemental Figure 1 (SF1). Frequency of coprolites with pollen/macrofossils by site.

Supplemental Table 3. Sites where individuals included in Figure 5 are from. Number of individuals scored for cribra orbitalia (CO) and porotic hyperostosis (PH) here are presented for studies who reported PCLs for children (less than 15 years of age). This table also provides a range for the number of coprolites per site and study, but see ST 2 for more detailed sample sizes of coprolites by site and food item. These data are not exhaustive.

| **Site or Region** | **State** | **Period and Site Dates** | **CO n** | **PH n** | **CO or PH** | **Coprolite n**  **(range)** | **Data Sources** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Antelope House** | AZ | BMII-BMIII (400-700)  PII/PIII (900-1300) |  |  | 50  17 | PII: 15-20  PII: 68-90 | El-Najjar (1986); Fry and Hall (1986); Stiger (1977) Reinhard (1988, Table 5); Stiger (1977); Sutton and Reinhard (1995); (Williams-Dean & Bryant Jr, 1975) |
| Canyon de Chelly | AZ | BM (300-700)  PII/PIII (700-1300) | 36  15 | 36  15 | 50  17 |  | El-Najjar, Ryan, Turner, and Lozoff (1976) |
| Canyon del Muerto | AZ | Early Basketmaker  (700 – 1500 BC) |  |  | 38 |  | Zaino (1967) |
| Carter Ranch | AZ | PIII (1100-1225) | 5 |  |  |  | Danforth, Cook, and III (1994) |
| Grasshopper Pueblo | AZ | PIII/PIV (1225-1450) | 271 | 331 |  |  | East (2008, Table 100) |
| Houck | AZ | PI/PII (900-1350) |  |  | 34 |  | Zaino (1967) |
| **Inscription House** | AZ | PIII (1250-1300) | 7 | 7 | 11 | 16 | El-Najjar et al. (1976)  Brand (1994); Reinhard (1988, Tables 9 and 22); Stiger (1977) |
| Kayenta | AZ | PII; PIII |  | 17 |  |  | Stodder (1989, Table 42) |
| Navajo Reservoir | AZ | PI-PIII (700-1100) | 7 | 7 | 44 |  | El-Najjar et al. (1976) |
| Oak Creek Pueblo | AZ | PII- PIV (1125-1400) | 8 | 6 |  |  | Taylor (1985) |
| Point of Pines | AZ | PII-PIV (1240-1450) | 31 | 42 |  |  | East (2008, Table 100) |
| Sundown | AZ |  | 13 | 13 | 13 |  | (Merbs & Vestergaard, 1985) |
| Turkey Creek Pueblo | AZ | PIII (1225-1286) | 33 | 52 |  |  | East (2008, Table 100) |
| **Ventana Cave** | AZ | PII/PIII (1000-1450) |  |  |  | 1 | Reinhard and Hevly (1991) |
| Arizona, all sites |  |  | 426 | 528 | 274 |  |  |
| Animas La-Plata | CO | PI (750-900) | 22 | 21 |  |  | Bollong (2010) |
| Black Mesa | CO | BM-PII (700-1100) |  |  | 55 |  | (Stodder & Martin, 1992) |
| **Hoy House** | CO | PII (1090-1150)  PIII (1250) |  |  |  | PII: 56  PIII:56-59 | Reinhard (1988, Table 5); Scott (1979); Stiger (1977) |
| **Lion House** | CO | PIII (1240) |  |  | 4 |  | Stiger (1977, p. 26, Table III) |
| **Mesa Verde** | CO | PI-PIII |  | 116 |  | BMIII: 20  PIII: 77 | Stodder (1984); (Stodder, 1989); Stodder (1990); Stodder and Martin (1992, Tables 2 and 3)  Stiger (1979) |
| Sand Canyon Pueblo | CO | PIII (1240s-1280s) | 15 | 18 |  |  | Kuckelman and Martin (2007) |
| **Step House** | CO | BMIII (500-750)  PIII (1150-1300) |  |  |  | BMIII: 20-47  PIII: 17 | Brand (1994); Reinhard (1988, Table 5); Stiger (1977) |
| Colorado, all sites |  |  | 37 | 155 | 55 |  |  |
| **Atlatl Cave** | NM | 2900 BC |  |  |  | 2 | Clary (1983) |
| **Bat Cave** | NM | BMII-PII (200-1000) |  |  |  | 11 | Trigg, Ford, and Moore (2000) |
| **Chaco Canyon\*\*** | NM | PII (700-1100) | 10 | 10 | 12 | 6-47 | (El-Najjar et al., 1976)  Clary (1983) |
| **Pueblo Bonito** | NM | PII (850-1100) | 24 | 24 | 24 | 9 | Harrod (2012) Marden (2011) Clary (1983) |
| Chaco Small Sites | NM | PII/PIII (900-1178) | 10 | 12 |  |  | O’Donnell |
| Kin Kletso | NM | PIII (1125-1300) |  | 1 |  | 6 | O’Donnell; Clary (1983) |
| **Pueblo Alto** | NM | PII (1020-1100) | 1 | 1 |  | 9 | Akins (1987) Clary (1983); (Clary, 1987) |
| Kin Bineola | NM | PII (940-1120) | 14 | 14 | 14 |  | Harrod (2012) |
| **Salmon Ruin** | NM | PII (900-1100);  Coprolites:  PII (1090-1150) |  |  | 26 | 20-112 | (Berry, 1983; Shipman, 2006; Stodder & Martin, 1992, Table 5) Reinhard (1988, Table 5; 2006) |
| **Aztec Ruin** | NM | PII (1090-1105) (West Ruin) | 14 | 14 | 14 | 3 | Harrod (2012) Cummings, Yost, Puseman, and Logan (2009); Stiger (1977) |
| Arroyo Hondo | NM | PIII-PV (1300-1600) | 58 | 58 | 54 |  | (Palkovich, 1980); Palkovich (1985) |
| Casamero | NM | PII (900-1150) | 1 | 1 |  |  | O’Donnell |
| Gran Quivira | NM | PIII-PV (1300-1600) | 16 | 12 | 66 |  | (El-Najjar, Lozoff, & Ryan, 1975; Stodder & Martin, 1992) |
| Hawikku | NM | PIII-PV (1300-1600) | 37 | 39 | 40 |  | (Stodder, 1984, Table 5.2) |
| La Plata Highway | NM | PII/PIII (1000-1300) | 15 | 16 |  |  | O’Donnell |
| Pa’ako | NM | PII-PV (1100-1600) |  |  | 18 |  | Ferguson (1980) |
| Pecos Pueblo | NM | PIII-PV (1200-Historic) | 218 |  |  |  |  |
| San Cristobal | NM | PIII-PV (1300-1600) | 64 | 66 | 66 |  | Stodder (1984, Table 5.2) |
| Northern Rio Grande | NM | PII-PV (1050-Historic) | 18 | 23 |  |  | O’Donnell (2019) |
| Middle Rio Grande | NM | PIII/PIV (1260-1400) | 60 | 82 |  |  | O’Donnell (2019) |
| Gallina District | NM | PII/PIII (900-1300) | 10 | 10 |  |  | O’Donnell (2019) |
| Jornada Mogollon | NM | Basketmaker-PIV (700-1375) | 7 | 9 |  |  | O’Donnell (2019) |
| Mimbres Mogollon | NM | PII/PIII (1000-1325) | 3 | 10 |  |  | O’Donnell (2019) |
| New Mexico, all individuals |  |  | 583 | 406 | 336 |  |  |
| Total individuals |  |  | 1046 | 1089 | 665 |  |  |
| Turkey Pen Ruin | UT | BMII (1-400) |  |  |  | 4-28 | Battillo (2017, 2019) |
| Number of Individuals by Time Period | | | | | | | |
| Basketmaker |  |  | 0 | 0 | 88 |  | |
| PI |  |  | 22 | 21 | 0 |  | |
| PII |  |  | 67 | 68 | 91 |  | |
| PIII |  |  | 24 | 33 | 17 |  | |
| PIV |  |  | 31 | 45 | 0 |  | |

\*\* likely Bc 59