

Chapter Two

Environment

E. Charles Adams

GEOLOGY AND GEOLOGICAL RESOURCES

Homol'ovi IV sits on top and along the south and east sides of a 15 m-high butte whose cap rock is erosion-resistant Moenkopi Formation. On Homol'ovi IV and surrounding buttes, the Moenkopi Formation consists of 3-5 m of dense, fine-grained reddish-brown sandstone that is underlain by interbedded layers of silts and clays that are red, green, and yellow (Lange 1998:4). The interbedded layers are exposed on the north and west sides of the butte and are visible in a vandalized room at the base of the cap rock on the south-east side of the butte. Lange (1998:4) notes that some of the clay layers are suitable for pottery and mortar used to cement the rock walls of the village. Such a use could explain a large undercut area on the northeast side of the butte, adjacent to the pueblo's walls, where the clay has been tested and found suitable for clay or mortar. The undercut nature of the beds are identical to clay beds beneath Walpi on First Mesa that the potters dug out for their pottery clays (Stephen 1936). The color and sand-silt-clay ratios of some of the clays match the mortar and plaster recovered from excavated or stabilized walls of the village.

At the base of the butte are cobbles of chert and some quartzite that cap outcrops of Moenkopi Formation throughout the Homol'ovi area. Kolbe (1991) interpreted these as erosional remnants of the Shinarump Conglomerate that still overlies the Moenkopi Formation on the mesa west of

Homol'ovi IV and the mesa on which Homol'ovi II is situated, directly east of Homol'ovi IV. The Shinarump Conglomerate is considered by most geologists to be the basal member of the Chinle Formation (Chronic 1983). The Shinarump is variously cemented causing some sections to erode into the cobbles, such as are visible at the base of Homol'ovi IV, whereas other sections form solid caps to mesas. Many of the chert cobbles at Homol'ovi IV have been broken by the inhabitants of Homol'ovi IV and are the primary source of cores for the flaked stone industry at the village. The quartzite members have frequently been battered from their use as pecking stones to shape manos and metates, shape building stone, or peck glyphs into the boulders on the west and southwest side of the butte.

Some members of the Shinarump conglomerate were cemented with opaline silica or quartz and were the primary source of ground stone material for Homol'ovi IV occupants and subsequent generations of Homol'ovi villages, although Moenkopi Formation sandstone having quartz and calcite cement was also used (Fratt and Biancianiello 1993). A quarry for opaline silica cemented Shinarump Conglomerate used in ground stone manufacture at Homol'ovi I has been identified near Homol'ovi I (Adams 2002). The quartz and calcite cemented varieties could have been obtained from outcrops west of Homol'ovi IV. The Moenkopi Formation sandstone was derived from the Homol'ovi IV or other nearby buttes. The sandstone slabs used as flagstones on Homol'ovi

IV and other Homol'ovi village kiva floors and for various bins was obtained from a source southwest of Homol'ovi IV called Five Mountains (Fratt and Biancaniello 1993).

WATER RESOURCES

As noted in chapter 1, Homol'ovi IV is located to take advantage of two sources of water: nearby springs at the base of the Moenkopi Formation in the mesa to the west and the Little Colorado River to the east. The Moenkopi Formation underlies the floodplain to about 2 km north of Homol'ovi I causing the river to flow above ground. Beyond this point the river flows underground except during high stream flows, which usually occur in March and April due to snowmelt and in the summer from mid- to late July to mid-September from monsoon rains (Adams 2002; Lange 1998). When the river was dry near Homol'ovi IV, occupants could have accessed water by traveling upstream 4 km of walking to One Drop Spring or other springs to the west. One Drop Spring is 1 km west. According to Mike O'Haco, who has ranched the area since the 1960s, the spring was developed by ranchers in the 1920s or 1930s by building a berm around the spring to hold water for livestock. Any prehistoric development of the spring was destroyed as a result. Whether One Drop Spring or other more distant springs could have met the water needs of the Homol'ovi IV occupants is unknown, but it certainly could have complemented river water. Although it is possible the river flowed as far north as Homol'ovi IV when it was occupied, the absence of fish in the faunal remains, which are abundant at Homol'ovi I (Strand 1998), suggests this was not the case.

CLIMATE, FLORA, AND FAUNA

Winslow is located 9 km south of Homol'ovi IV and has a weather station. Average annual pre-

cipitation is just 20 cm (8 in) and is evenly divided between winter snow and summer rain (USDA, SCS, ERS, and USFS 1981). Homol'ovi IV is at 1478 m (4850 ft) elevation. Lowe (1964:36) classifies the area as Great Basin Desertscrub, a member of the Great Basin Desert within the Upper Sonoran Life Zone. Plant variety, except along the river, is severely restricted and low diversity in plants means that animal variety is similarly restricted (K. Adams 1996, 2001; Miksicek 1991; Pierce 2001; Strand 1998; Szuter 1991). At present the plant and animal resources around Homol'ovi IV are severely depleted due to grazing, but even prehistorically they were inadequate to sustain hunters and gatherers as determined by the almost total lack of archaeological sites predating the introduction of maize (Lange 1998). Even then, sustained occupation of the area was not achieved until the founding of Homol'ovi IV in the 1250s (Adams 2002; Young 1996). As Lange (1998:6) notes:

Although there are a number of wild plant species that can be used for a variety of purposes, there are relatively few in the Homol'ovi area that can provide substantial food resources. Numerous grasses have abundant, usable seeds, but their unpredictable annual production and the intensive harvesting effort required mean that grasses cannot be a staple "crop" to sustain anything but a seasonal population. Thus, any use of the region before the advent of domestic crops is expected to be only seasonal and temporary and may have continued to be seasonal even after the arrival of such crops.

As noted in Adams (2001:9-12), away from the influence of the river the vegetation can be divided into mesa, buttes, and terraces; side drainages; and sand dunes. The most ubiquitous plant in all three areas is snakeweed (*Gutierrezia sarothrae*), which is a disturbance plant and in-

dicative of domestic livestock grazing that began in the area as early as the 1860s and 1870s with the Hashknife Outfit and local Mormon communities. Other dominant plants in the vicinity of Homol'ovi IV included shadscale (*Atriplex confertifolia*), four-wind saltbush (*Atriplex canescens*), rabbit brush (*Chrysothamnus albidus*), and rice grass (*Oryzopsis hymenoides*). Dune areas to the west of Homol'ovi IV were dominated by sandsage (*Artemisia filifolia*) with ring muhly, Mormon tea, and narrow-leaf yucca also present. Toward the river, the outer floodplain is dominated by greasewood (*Sarcobatus vermiculatus*) with occasional dense stands of desert olive (*Forestiera newmexicana*), shadscale, various cheno-ams, pickleweed (*Allenrolfea occidentalis*), the introduced camelthorn (*Alhagi camelorum*), and older stands of cottonwoods. The inner, active floodplain is now dominated by the introduced tamarisk (*Tamarix pentandra*), with scattered willow (*Salix* sp.), cottonwood, various cheno-ams, beeweed (*Cleome serrulata*), and sunflower (*Helianthus annuus*).

Today and in the past the most common animals are cottontail (*Silvilagus*) and varieties of jackrabbit (*Lepus* spp.) followed by various rodents. Sitgreaves (1954:36) observed beaver and porcupine in the area, whereas Whipple (1856) noted the abundant waterfowl. Lesley (1929:201) mentioned elk, deer, and antelope as seasonal visitors to the river. Prairie dogs have now reinhabited the area, although not yet near Homol'ovi IV. Lizards are plentiful at Homol'ovi IV, especially the great basin and plains varieties, as are Great Basin rattlesnakes and gopher snakes. Red-tailed hawk, turkey buzzard, kestrel, western meadowlark, morning dove, mocking bird, raven, various owls, golden eagle, and zone-tailed hawks have been observed in the vicinity of Homol'ovi IV. Sandhill crane, blue heron, Canadian goose, teal, and various ducks are seasonal visitors in the winter, spring, and fall, with the heron spending the summer.

PALEOENVIRONMENT

As summarized in the Homol'ovi III report (Adams 2001:12-16), research since 1984 on various of the villages in the Homol'ovi cluster has resulted in a clear picture of what the environment looked like before, during, and after the occupation of Homol'ovi IV (K.Adams 1992, 1996, 1999, 2001; Kolbe 1991; Miksicek 1991; Pierce 2001; Strand 1998; Strand and McKim 1996; Szuter 1991; Van West 1996; Young 1996). Karen Adams (1997) and Jennifer Strand (1998) have summarized the plant and animal material respectively from Homol'ovi IV, which will be presented in chapters to follow.

Kolbe (1991) and Van West (1996), using correlations between the modern tree-ring record, river discharge, and depositional or erosional events, have reconstructed river discharge and alluvial events for the Little Colorado River during the Homol'ovi IV occupation. Kolbe (1991) defined three major periods between 1250 and 1400: (1) 1262-1299 when river discharge was 18 percent below average resulting in erosion of the floodplain; (2) 1300-1337 when river discharge was 20 percent above average resulting in deposition on the floodplain; and (3) 1338-1400 when river discharge fluctuated between below, above, and normal. Van West (1996) refined Kolbe's chronology with her model suggesting river discharge was low between 1250-1300 making the floodplain suitable for farming and settlement. The period 1300-1334 was wet and the floodplain would have been avoided for occupation. As with Kolbe, the period 1335-1400 was variable. Thus, both models suggest that Homol'ovi IV was settled at or near the beginning of a period of below average river discharge that made the floodplain suitable for settlement and farming. Roofing material collected from Homol'ovi IV is 59 percent cottonwood, 36 percent nonconifer, and 5 percent ponderosa pine (Adams 2002: Table 3.4). The pine is almost certainly a stray piece of driftwood,

whereas the other 21 samples could have been collected locally. Cottonwood is still locally abundant in the upper and lower floodplains today and the data suggest it could have served the earliest pueblos in the area with most of their roofing needs (Adams 2002:Figure 3.4). Sampling from nearby Homol'ovi I, II, and III deposits point to few substantial differences between either plant or animal resources during the late 1200s and today. The only exceptions are known local extinctions, especially of fish, and drastic reductions in other riparian species, such as muskrat and beaver, or alterations resulting from livestock grazing. This has resulted in local grasses being replaced by small bushes or other forbes, especially snakeweed. In addition to the effects of livestock grazing, the introductions of tamarisk, as an erosional control agent from 1900-1940, and camelthorn, after World War II as an ornamental, have been devastating to riparian and floodplain habitats of the Little Colorado River and elsewhere (Colton 1937; Graf 1978; Harris 1966; Hereford 1984; Horton 1964; Robinson 1965).

There are at least two other areas available to inhabitants of Homol'ovi IV that could add to the floral assemblage: (1) the side canyons, especially Chevelon and Clear Creek, that provide the year-round flow of water to portions of the Little Colorado River just upstream from Homol'ovi IV. Even today, these canyons are filled with black walnut, Oregon grape, hackberry, Gambel's oak, and other species not present in the modern Little Colorado River floodplain. (2) Driftwood deposited on the floodplain by periodic floods brings an abundance of plant material from all higher elevation environmental zones, including spruce, white fir, douglas-fir, ponderosa pine, pinyon, juniper, Gambel's oak, box elder, black walnut, hackberry, and others (Adams 2002; Adams and Hedberg 2002). Sampling of a modern driftwood pile deposited by January 1993 floods mirrored species distribution recovered from roofing members at Homol'ovi I, II, III, and IV (Adams 2002; Adams and Hedberg 2002). This suggests the use of driftwood by the occupants of these villages, particularly the large villages of Homol'ovi I and II.