PRELIMINARY REPORT OF THE STRATIGRAPHY OF THE 111 RANCH BEDS, GRAHAM COUNTY, ARIZONA

By

Philip Seff

The 111 Ranch area is approximately fourteen miles east of Safford, Arizona, in T 8 and 9 S, R 28 and 29 E. A sequence of Pleistocene floodplain, paludal, and lacustrine deposits is exposed in a badland topography and has been mapped in detail on aerial photo (scale 8" equals 1 mile). The stratigraphic sequences have been measured in a number of localities, and approximately 200 samples of sediments have been collected for laboratory analysis. Vertebrate fossils have been collected and located stratigraphically in several parts of the section. Two localities contained a faunal assemblage of pulmonate gastropods which will be useful in determining paleoecology of deposition. Early workers in the area include Herr (1950), Krechtel (1938) and Van Horn (1957).

In order to gain a better understanding of the sedimentary environment, the present study has been restricted to a small area. Such a "micro-area" provides an opportunity to conduct detailed sedimentary research both in the field and in the laboratory.

A stratigraphic section (Plate I) of the area shows the character of about 152 feet of sediment exposed in this basin. The sediments consist of sand, gravel, clay, marl, limestone, silt, tuffaceous silt, diatomite, and chert. In order to maintain stratigraphic continuity, field names have been used for those units which display a characteristic lithology.

The oldest exposed bed in the area is a thick diatomite (unit 1, Plate I). In the field this unit resembles a fine-grained tuff, but microscopic examination (William Mathias, personal communication) shows little or no shards present. The bulk of the unit (about 80 per cent) consists of diatoms. The material outcrops only along the extreme west end of the 111 Ranch area and continues for about one mile west along the Whitlock Hills where it dips underground. A partial section with a concealed base suggests a thickness of about 30 feet. To the north the unit thins rapidly to a thickness of a few feet in a distance of about 100 yards where it dips underground. Although not everywhere exposed, this material appears to be continuous along the flanks of the Whitlock Hills, at least throughout the 111 Ranch area. The material suggests a local lagoon-like lake which paralleled the Whitlocks, asymmetrical in outline, but much longer than wide.

Another diatomite unit with average thickness of about ten feet, (No. 10, Plate I) occurs higher in the section. It differs from the lower diatomite in that it includes thick, massive chert beds which are restricted to the vicinity of the Whitlock Hills. This chert is generally overlain and underlain by the diatomaceous material. In some places the cherts are almost twelve feet thick. As the massive cherts are found only in association with the diatomaceous unit, there is strong indication of a genetic relationship. Moreover, the cherts replace fossils which occur in them, and are found in the central parts of the diatomite, so a secondary origin is assumed. Cherts occur elsewhere in the section, but they are thin and have a limited extent; the average is about six inches thick. The younger diatomite, including the massive chert, intertongues with a thick, homogeneous limestone.

The bulk of the sediments (units 2, 4, 5, 7, 8, 9; Plate I) consist of clay, marl, silt, and tuffaceous silt. These were probably deposited in a paludal floodplain environment, as indicated by the fine-grained but poorly sorted character of the sediments. There is within these units an alternation of silt, clay, and in some cases limestone. All of the units are gradational, and unconformities are not present except between the top of the "111 Ranch beds" and the capping terrace gravels.

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Some of the clay units are more than twenty feet thick and contain silty or even sandy sediments. Commonly the clay layers contain thin limestone beds which were probably deposited in small ponds on a muddy floodplain. These small pond deposits are rarely over fifty feet in length, and the average is much less.

Three limestone units are believed to be lacustrine deposits. The lowermost (No. 3, Plate I) is exposed in the area west of the Ill Ranch. The unit continues west and south, following the outline of the Whitlock Hills for at least two miles before dipping underground. Not much of the lower unit is exposed in the Ill Ranch area because it dips underground when traced toward the east. This unit has an average thickness of about four feet and is (for the most part) a silty limestone, commonly containing interbedded thin chert lenses. This limestone was probably deposited in a shallow lake.

The middle limestone, unit 6, is the most extensive and continuous deposit in the Ill Ranch area, and excellent exposures of the limestone occur west of the area studied. In places the unit is over fifteen feet thick and appears to be a rather pure, well-indurated limestone. The thickness and purity of this limestone are quite uniform. The unit has been traced to the west a distance of nearly four miles, then south into the San Simon valley for several miles where it dips underground. Turtle shell remains are abundant in the limestone, and probably are residual, the animals having lived and died in the ancient lake waters.

The upper limestone, unit 10, is gradational into the massive chert and diatomite previously described. The limestone is about twelve feet thick in the south-central parts of the area, while to the north it thins to a few inches, where the thinner beds have been removed by erosion. The extreme eastern exposure also displays rapid thinning; moreover, well-sorted beach sands are found underlying the limestone at this locality.

A rather small bed of impure silty lime occurs in the upper part of unit 8. It is only about one-half mile long, running north to south. The width is about half the length. It contains shoreline features and includes many fossil weed stems, and a fauna of pulmonate gastropods which may be useful in determining paleoclimatology and paleoecology.

Sand and gravel are not common in the lower parts of the stratigraphic section and occur as isolated, small stream channel deposits. The sands are crossbedded and associated with imbricate conglomerates. These channel deposits are usually only a few feet wide and the general direction of transport seems to be toward the north, away from the Whitlock Hills.

The upper part of the sequence (unit II, plate I) is a major feature, consisting of massive sands and gravels up to sixty feet thick. The deposit consists mainly of rhyolitic, andesitic, and basaltic rock fragments and coarsens and thickens rapidly in the direction of the Whitlocks. The source area of this massive material was probably the Whitlock Hills.

In the III Ranch area an erosion surface separates the upper sand and gravel from the capping terrace gravel (No. 12, Plate I). The cappings are geomorphic units composed of coarse sand and gravel, well cemented by caliche. The terraces show no less than three stages of downcutting. The oldest terraces are the highest topographically, and contain the terrace gravels of greatest thickness. As most of these gravels are imbricated and thicken in the direction of the Whitlocks, they may indicate an ancient drainage pattern similar to the present drainage system.

The general strike of the strata in the area is northeast with a uniform dip from two to three degrees to the southeast. The strike of the strata prescribes a near arc around the basin, with an almost constant dip toward the basin.

Near the center of the area, a gentle dome in the strata suggests a buried hill. It is about one half mile long and less than one eighth mile wide, and probably represents a buried part of the Whitlock Hills. As this structure is small and is reflected on the surface, probably no more than 200 to 300 feet of section remains buried in this area.

The classic descriptions of intermontane basins in the arid southwest state that the coarse and thick deposits are adjacent to the bordering highlands from which they were derived. This is not the case in the III Ranch area, as fine-grained material laps against the mountains and does not thicken in that direction. It seems obvious that the bulk of the deposits were brought into the area from a source other than the Whitlock Hills. It appears that other factors must be taken into consideration to explain the sedimentation process, and the writer believes that climatic controls were significant factors. The lithology of the sediments and the fossils present indicate that, throughout deposition of the III Ranch beds, at least up to the level of the massive sands and gravels, the climate was somewhat humid. The presence of species of pulmonate gastropods such as Lymnaea reflexa and Pupilla muscorum, strongly indicate a moist climatic environment. This is substantiated by a well-preserved skull of a capybara found in the massive chert bed described earlier (Lance, 1958).

Many of the sedimentary units in the area are not lacustrine except where they change in character near the Whitlock Hills and show definite lacustrine features. This is especially true of the extreme southeastern end of the basin. Here the deposits are of true lake origin, consisting either of massive limestone or diatomite. That waters extended up to the Whitlocks is indicated by innumerable silicified or calcified plant stem fossils found in exposures of the beds against the mountains. In many places the stems are standing in upright position, indicating rapid desposition which covered plant remains before they could fall over.

It is believed that the III Ranch beds were deposited on a muddy floodplain; the paludal environment indicates that the area was poorly drained. Small to large standing bodies of water were present, and at last three times they coalesced into major lake systems. The climate was humid for the most part, or at least semi-humid. At some time during the late history of the area the climate became arid, and was accompanied by a change in the deposition cycle. The paludal environment disappeared and alluvial sediments were carried into the area directly from the Whitlock Hills and adjacent mountains forming massive fan deposits. Following this phase, a change in base level caused these deposits to be eroded down to at least three topographic levels, and each erosion cycle was accompanied or followed by deposition of alluvial material.

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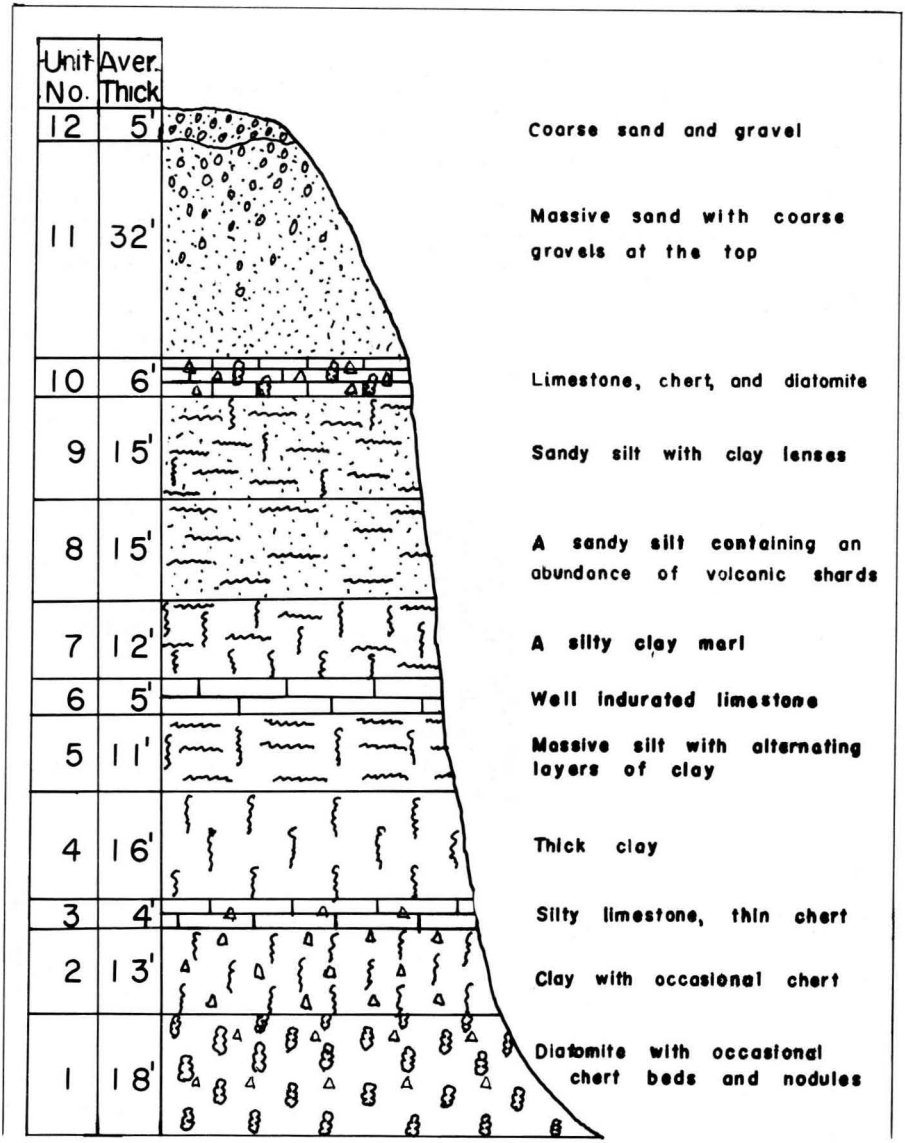

Plate I. Composite Section of the "III Ranch Beds"