ADDITIONAL GIANT DESICCATION CRACKS NEAR WINTERSBURG, MARICOPA COUNTY, ARIZONA

by
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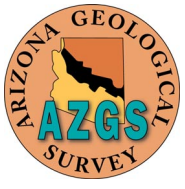

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AREAS OF ADDITIONAL GIANT DESICCATION CRACKS

Giant desiccation cracks have been discovered in two areas near the settlement of Wintersburg (Figure 1) on detailed aerial photos obtained from Maricopa County Flood Control District. One area is one mile southwest of Wintersburg. The second area is about one mile south-southeast of the intersection of Wintersburg Road (379th Ave.) and Elliot Road, about 6 miles south of Wintersburg.

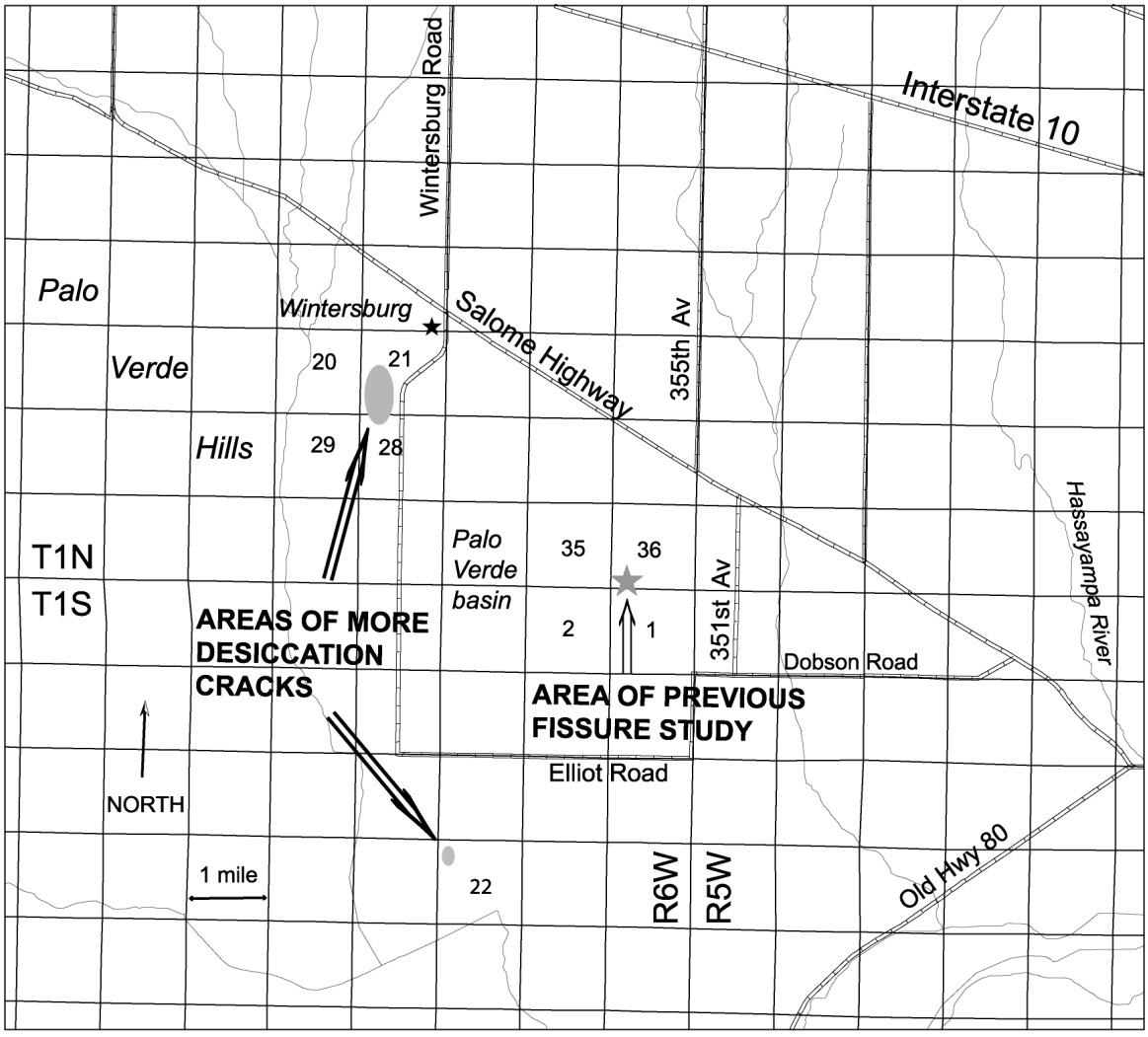

Figure 1. Location of additional giant desiccation cracks near Wintersburg.

DESICCATION CRACKS SOUTHWEST OF WINTERSBURG

Giant desiccation cracks have been discovered one mile southwest of Wintersburg (Figure 1) on detailed aerial photos obtained from Maricopa County Flood Control District. These cracks are immediately west of Wintersburg Road and south of a small hill (Figures 2 and 3). Previously, a new earth fissure and nearby giant desiccation cracks were reported three miles southeast of Wintersburg in the late Summer 2001 (Harris, 2001).

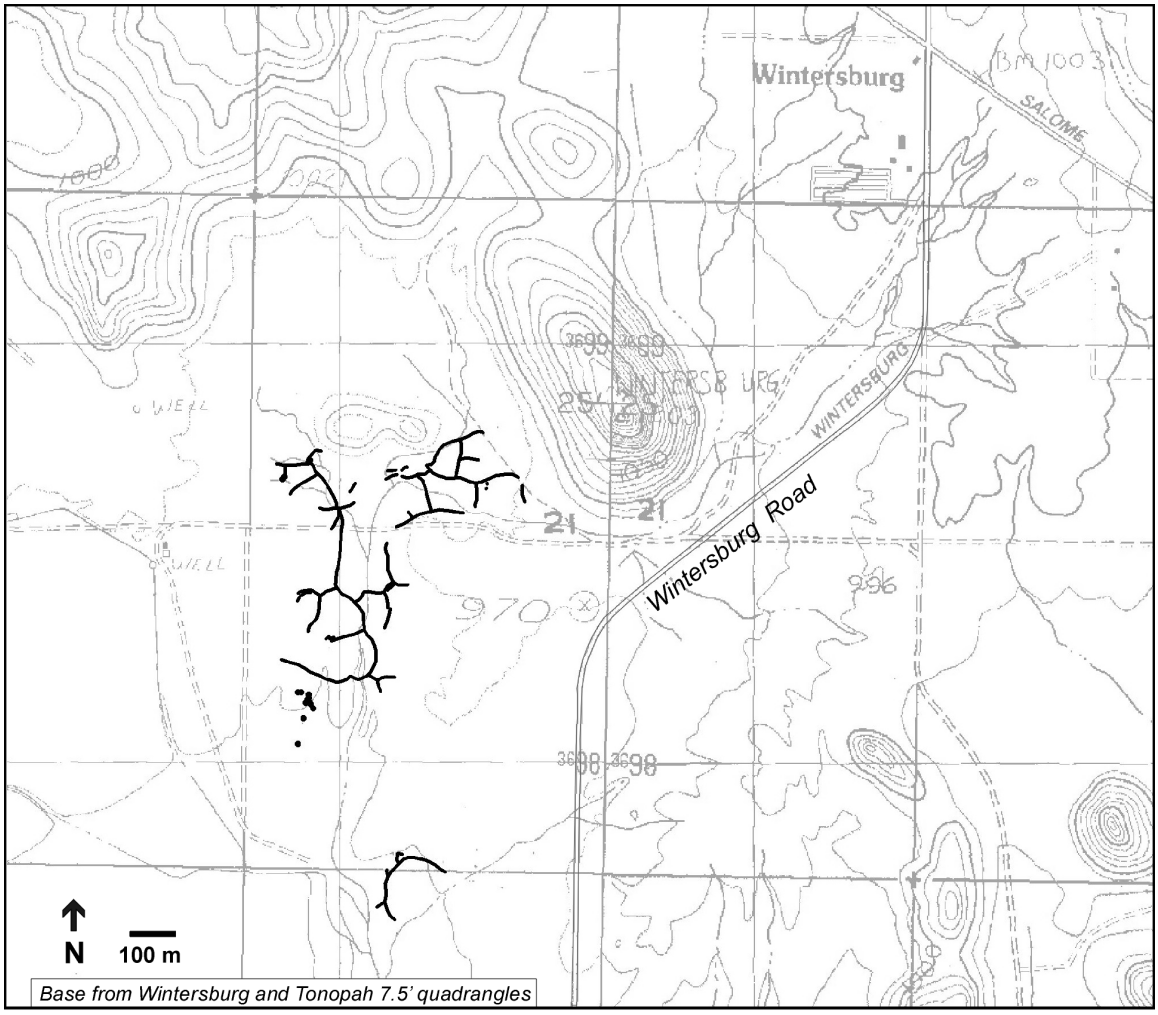

Figure 2. Location of desiccation cracks one mile southwest of Wintersburg.

Two clusters of cracks are present. The larger northern group (main cluster) extends from within a few ten of meters of a small outlier of the Palo Verde Hills southward nearly 700 meters. Another cluster, consisting of a single crack about 250 meters long, with minor splays, lies 400 meters south of the main cluster.

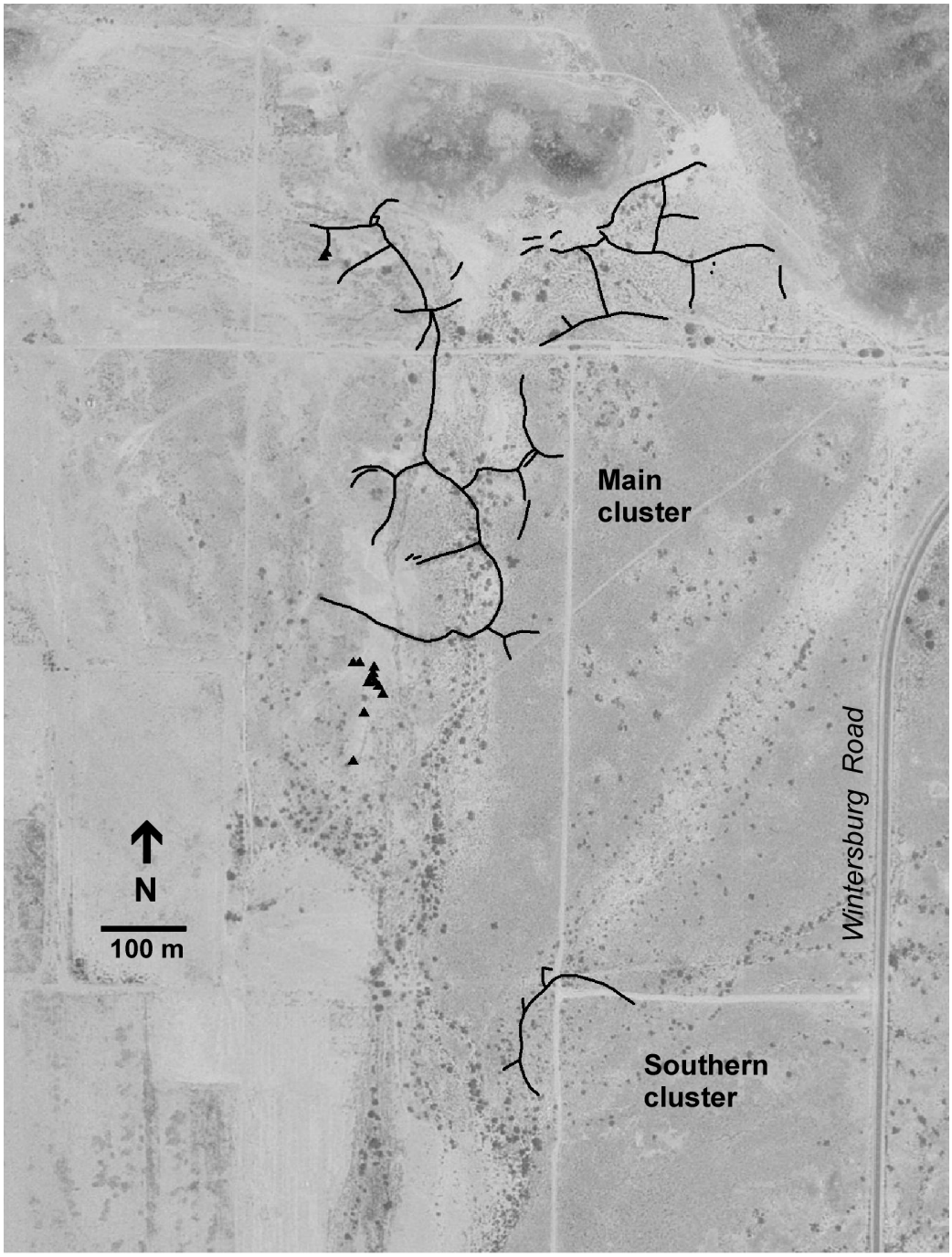

Figure 3. Aerial view of location of desiccation cracks near Wintersburg.

Main cluster

In a few segments of the northeastern most cluster the cracks themselves are large enough to be obvious on aerial photos even though they are too new to have vegetation in them. A 2000 aerial view of the northeastern area is shown in Figure 4. The nearly east-west

crack immediately north of the road is visible on the 1996 USGS Digital Orthophoto Quarter-Quadrangle (DOQQ) aerial photo and on a 1979 BLM aerial photo. The alluvium-bedrock contact is delineated by the white dashed line on Figure 4.

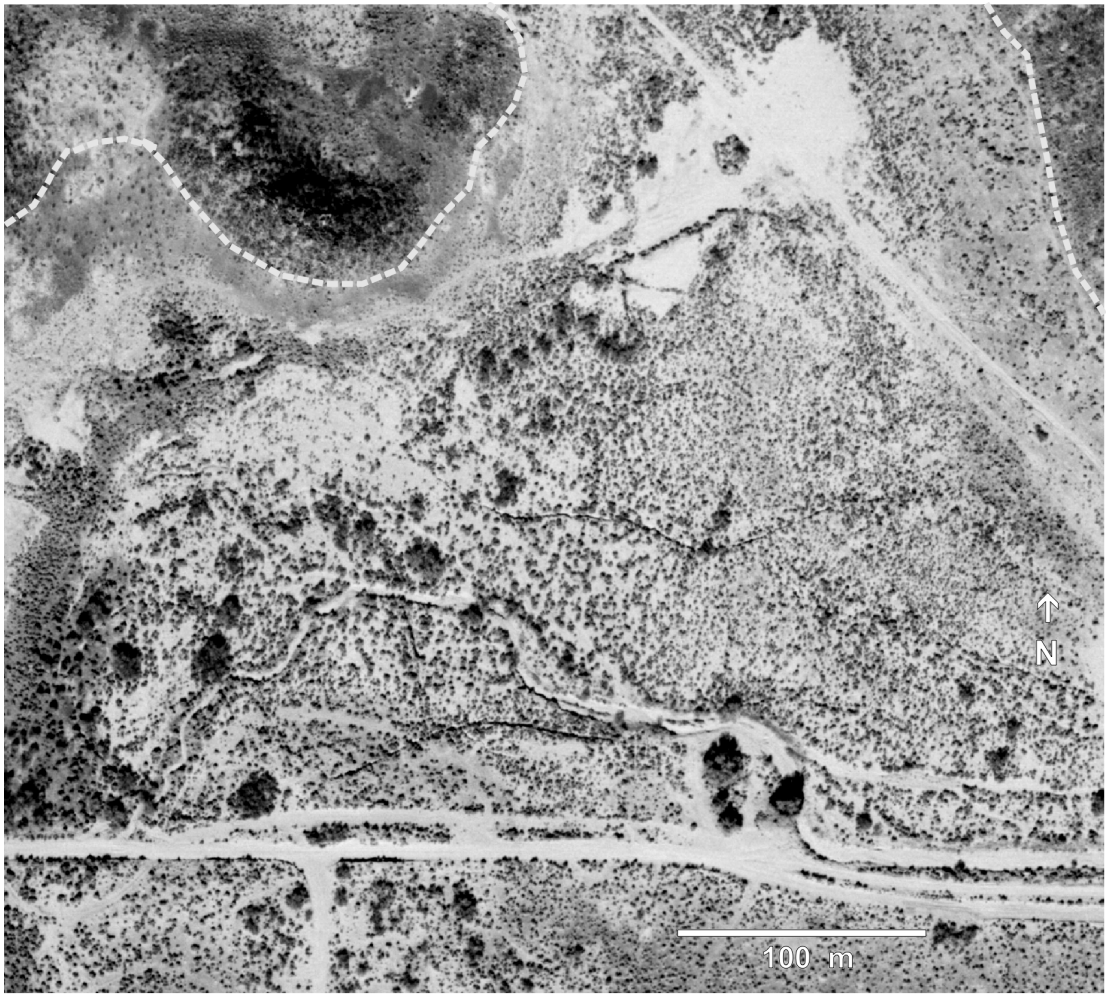

Figure 4. Aerial view of northestern part of main cluster of cracks. Photo taken 2001 by Maricopa County.

Figure 5 shows a detailed aerial view of the southern half of the main cluster. The widest and deepest cracks form a pattern similar to a '3' on the 2001 aerial photo. This segment of the cluster is visible on BLM aerial photos taken September 8, 1979 (Figure 6), but is easily missed on the 1996 USGS DOQQ because of the washed-out exposure of that photo.

The section that looks like the number '3' is the widest of the cracks in this area. By itself, this section could easily be mistaken for an earth fissure because of its width and

depth. It can be seen from mapping, however, that this section is part of a larger network of polygonal cracks. Photos of representative cracks are presented in Figures 7 through 15.

Figure 5. Close-up aerial view of the southern part of the main cluster. The section that resembles the number '3' is the largest and oldest of the cracks. The long N-S dark line is vegetation along a wash. Photo taken 2001, Maricopa County.

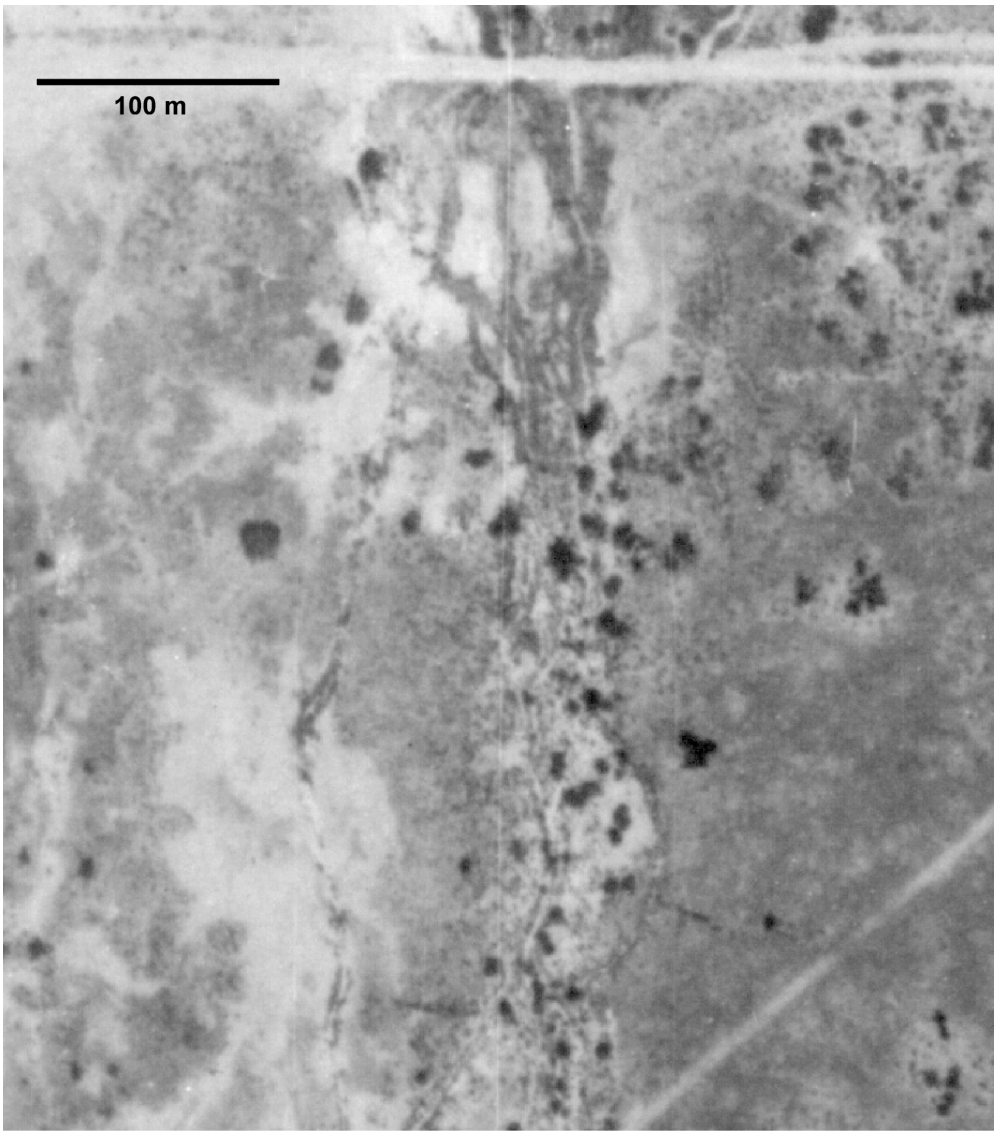

Figure 6. Southern part of main cluster as it appeared in 1979. Area same as shown in Figure 5. Part of the crack that resembles the number '3' formed some time before this 1979 photo.

Figure 7. Intersection of cracks near northwestern end of main cluster, Winter 2002.

Figure 8. Crack near outcrop at northern end of main cluster, Winter 2002. This crack has multi-stage history, as shown by older vegetation in renewed crack.

Figure 9. Crack near northwestern end of main cluster displays highly variable width and depth along its course.

Figure 10. Typical crack, near north end of main cluster.

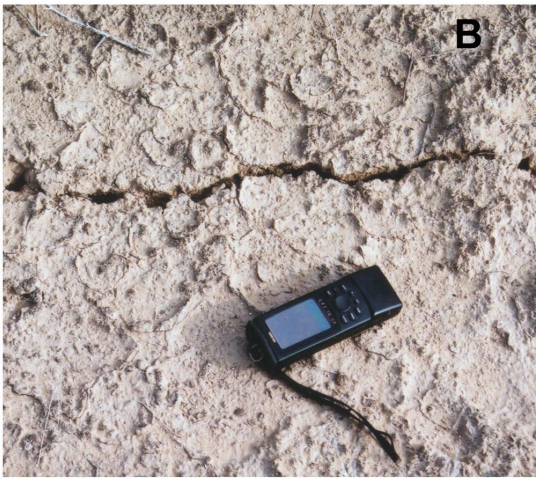

Figure 11. Changes along a crack at northwestern end of cluster. Intersection of cracks is at clipboard in center of photo A, looking east. The crack trending right (south) from the clipboard turns into a hairline crack (photo B) within 20 meters. South of (B), the crack appears suddenly as a large collapse hole (photo C), looking north.

Immediately southwest of the main cluster are numerous sinkholes and elongated depressions. Although not apparent on the ground, the sinkholes are aligned roughly in a polygonal pattern when plotted. The sinks are not obviously connected by surface cracks but look like the beginning stage of the formation of large desiccation cracks. The larger sinks are plotted as triangles in Figures 2 and 3. These depressions may evolve further and become connected into giant polygonal cracks following a heavy rain.

Figure 12. View of widest crack. This section is in southeastern part of crack that resembles a '3'. The crack here is 6-8 feet wide.

Although some of the cracks in the main cluster could be mistaken for earth fissures, the cracks are interpreted here as being caused by desiccation, given the polygonal network and the multiple episodes of formation. As with the previously described giant desiccation cracks in Arizona (Harris, 2001, 2002) these new cracks are coincident with drainages that have sheet flow. Although some segments of drainages are incised, runoff in most of the area of cracks is by sheetflow. Infiltration is great enough in the areas of sheetflow to allow the fine-grained surficial sediment to lose strength and collapse into deeper voids created by ongoing desiccation.

Southern cluster

South of the main cluster of desiccation cracks is a smaller cluster, dominated by a single main crack about 250 meters long. Nearly circular in plan, this southern-most crack has several short segments leading from it.

A short segment near the south end of the main crack is faintly visible on the 1979 BLM photos, indicating that cracking was in progress by that time. This segment has been recently re-activated (Figure 13). Most of the southern group appears to be young and active. According to local residents, the part of the crack that disrupted the road opened the previous summer, which presumably dates it to the time of opening of previously described desiccation cracks and an earth fissure 3 miles southeast of Wintersburg (Harris, 2001). Some work has been done to repair damage to the road from the crack (Figures 14 and 15).

Figure 13. North-south section of main crack in southern cluster.

Figure 14. View of southern crack where it crosses a relatively new road. An attempt has been made to fill the crack with debris.

Figure 15. View of southern-most crack near its eastern end. Crack has been partially filled next to road but is starting to open again.

GIANT DESICCATION CRACKS SIX MILES SOUTH OF WINTERSBURG

Another area of newly recognized giant desiccation cracks is about one mile south-southeast of the intersection of Wintersburg Road (379th Ave.) and Elliot Road, about six miles south of Wintersburg (Figures 1 and 16). This new cluster is visible on 2001 aerial photos from Maricopa County (Figure 17) but is not apparent on the 1996 USGS DOQQ (Arlington NW). Locations of the new cracks based on photo interpretation (no field checking) are plotted on Figure 18.

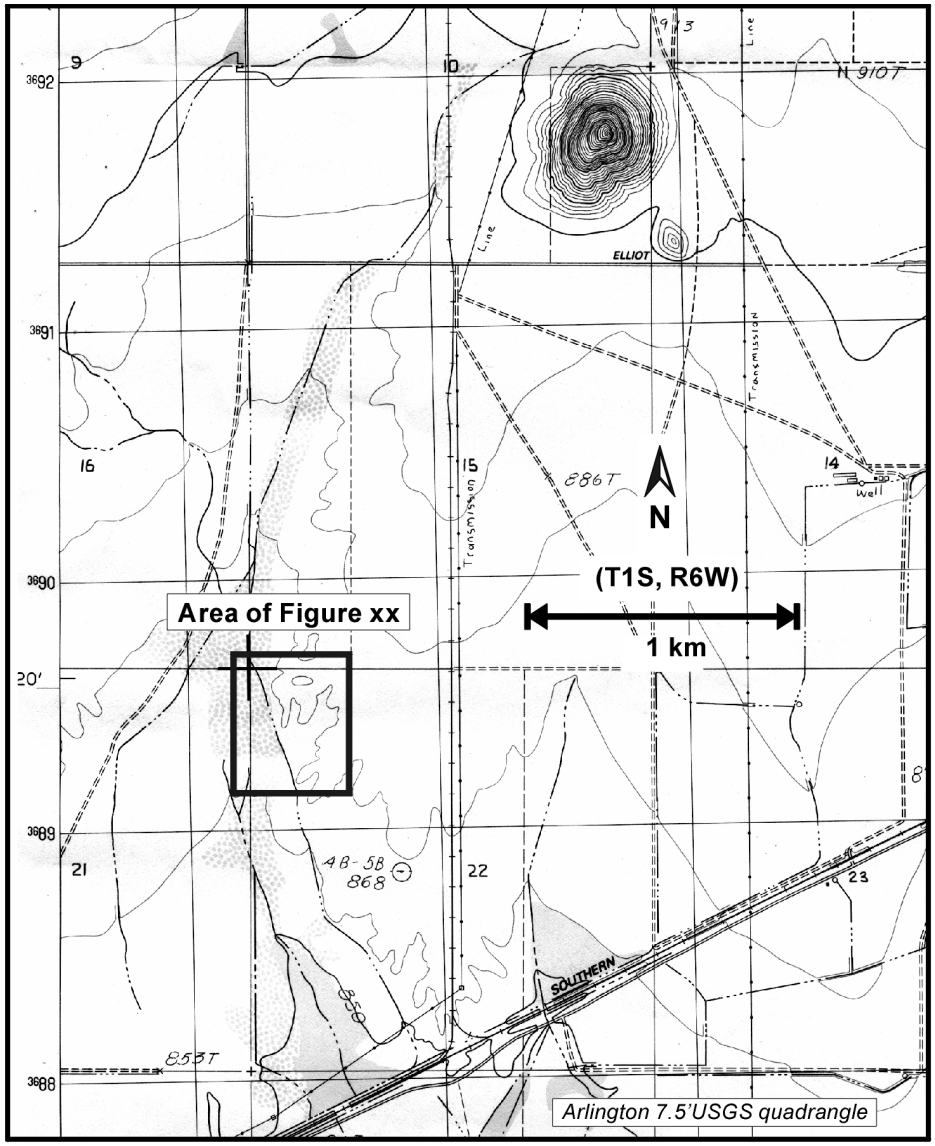

Figure 16. Location of desiccation cracks 6 miles south of Wintersburg.

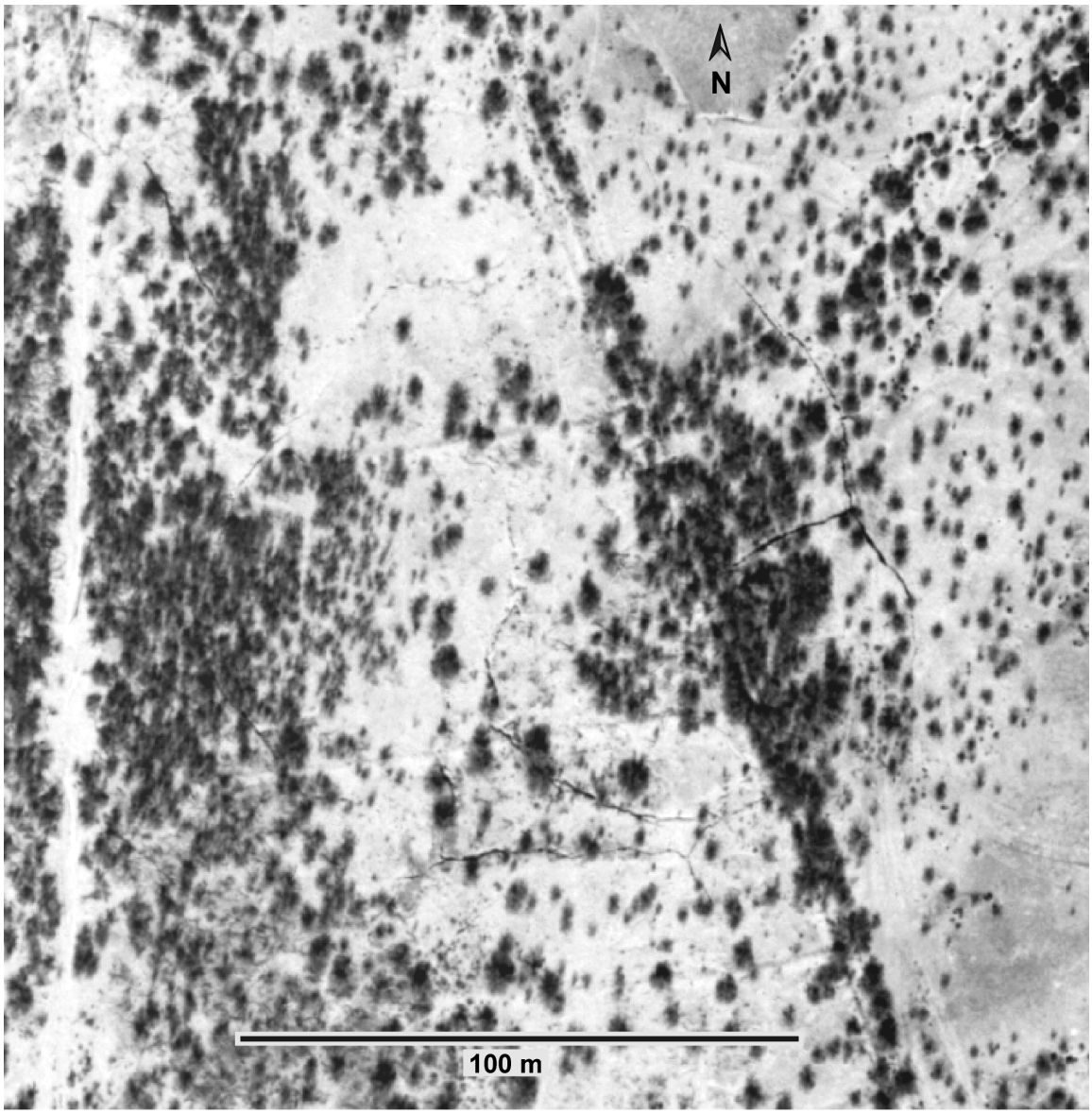

Figure 17. Aerial view of desiccation cracks 6 miles south of Wintersburg.

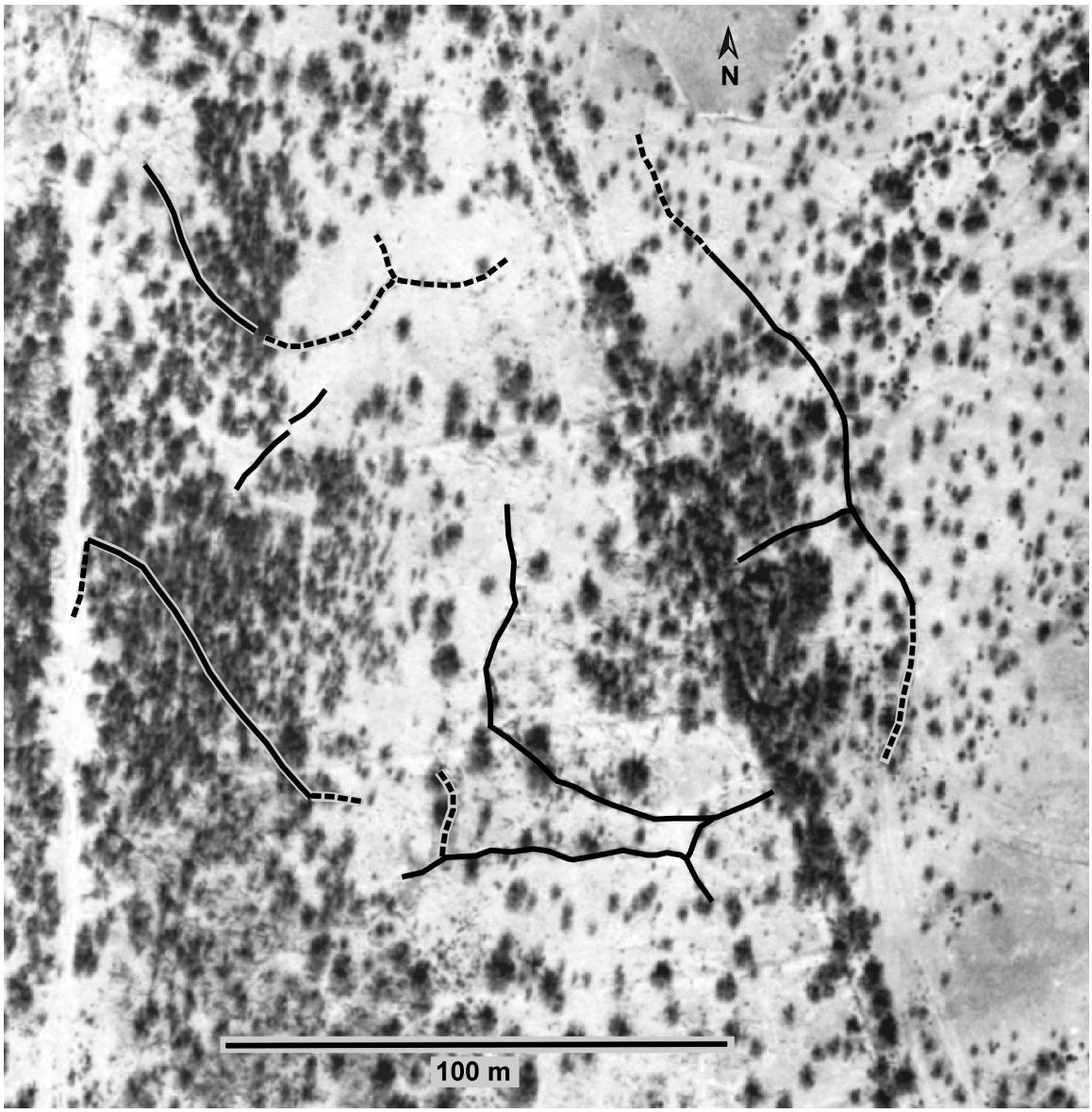

Figure 18. Interpretation of location of desiccation cracks.
Lines dashed where less certain.

HISTORY OF DEVELOPMENT

Some sections appear on older photos but most of the cracks are not visible on the 1996 photos and in the field appear to be less than two years old. The newer cracks may have opened at the surface during the same rain event that opened the earth fissure and desiccation cracks three miles southeast of Wintersburg (Harris, 2001), based on eyewitness accounts of residents, and the fresh appearance of the cracks.

The cracks show definite signs of originating at some depth rather than initiating from the surface and propagating downward. The cracks have formed by collapse or sloughing into a subsurface void of unknown width and depth. Along most of the cracks the width is highly variable. A typical crack may change suddenly from being a few inches wide to several feet wide and then back to a hairline crack. If the new cracks had formed in a fashion similar to that of ordinary shallow soil cracks, their width would be nearly constant. For giant desiccation cracks elsewhere in the Basin and Range province, it has been determined or estimated that some cracks are on the order of 15 meters or more deep (Fife, 1980).

The northern cracks are so close to the bedrock it almost precludes them being earth fissures. The wedge of sediments off the shoulder of the hills does not seem thick enough to have experienced the magnitude of compaction and subsidence required to form earth fissures. The regional water table was 200 to 270 feet below ground surface, with a perched water table 15 to 100 feet below ground surface in the central part of the basin (FUGRO, Inc., 1986; Euge and others, 1978). Therefore, the sediment wedge close to the bedrock outcrop has been above the regional water table since at least the early 1970s. The sediment above the bedrock therefore would not experience compaction because the water table decline did not affect that wedge of sediment within a few tens to hundreds meters of the outcrop.

There would have to be a sudden drop off or a steep slope of bedrock to produce a wedge of sediment thick enough to have been affected by groundwater decline. The apparent slope of the bedrock in the nearby hills does not seem steep enough to accomplish this, at least for the northern part of the main group. Gravity maps of the area (FUGRO, Inc., 1976), indicate a gentle slope of the bedrock, without any sharp drop-off of basement. Desiccation alone can account for the size, polygonal distribution, and multi-stage history of all the cracks.

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