STRUCTURE OF THE SIDE LAKE SHEAR ZONE FROM CENTRAL KAHSHAHPIWI LAKE TO NORTHERN KEEFER LAKE, QUETICO PROVINCIAL PARK, SOUTHERN ONTARIO

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INTRODUCTION

The boundary between the Wawa (south) and Quetico (north) sub-provinces of the southern Archean province is delineated by the Burntside Lake fault system along which field evidence of dextral motion can be documented (Sims, 1976). The area is located within the Quetico sub-province of the Superior Province, a belt consisting of mainly Archean metasedimentary and metavolcanic rocks (Hoffman, 1989). The Burntside Lake fault is sub-parallel to the junction of the Quetico and Wawa belts, and trends about N30°E (Woodard and Weaver, 1990). Associated with the Burntside Lake fault is a localized, antithetic oblique-normal fault fabric, known as the Side Lake Shear Zone. As part of a research team in the 1992 Keck Geological Consortium, we focused on this structural feature in the vicinity of Kahshahpiwi and Keefer Lakes in the Quetico sub-province of the Canadian Shield.

Rock units in our area of study consisted of metasedimentary and metavolcanic rocks interlayered with quartz monzonite sills. The predominant lithologies found within the Quetico sub-province, listed from oldest to youngest are classified as: migmatic biotite schist, muscovite bearing migmatite, granitic-rich migmatite, hornblende quartz monzonite, and leucogranite (Woodard and Weaver, 1989). Along Keefer Lake, we also found one isolated outcrop of mylonite within the host Archean garnetiferous gneisses and biotite schists.

METHODS

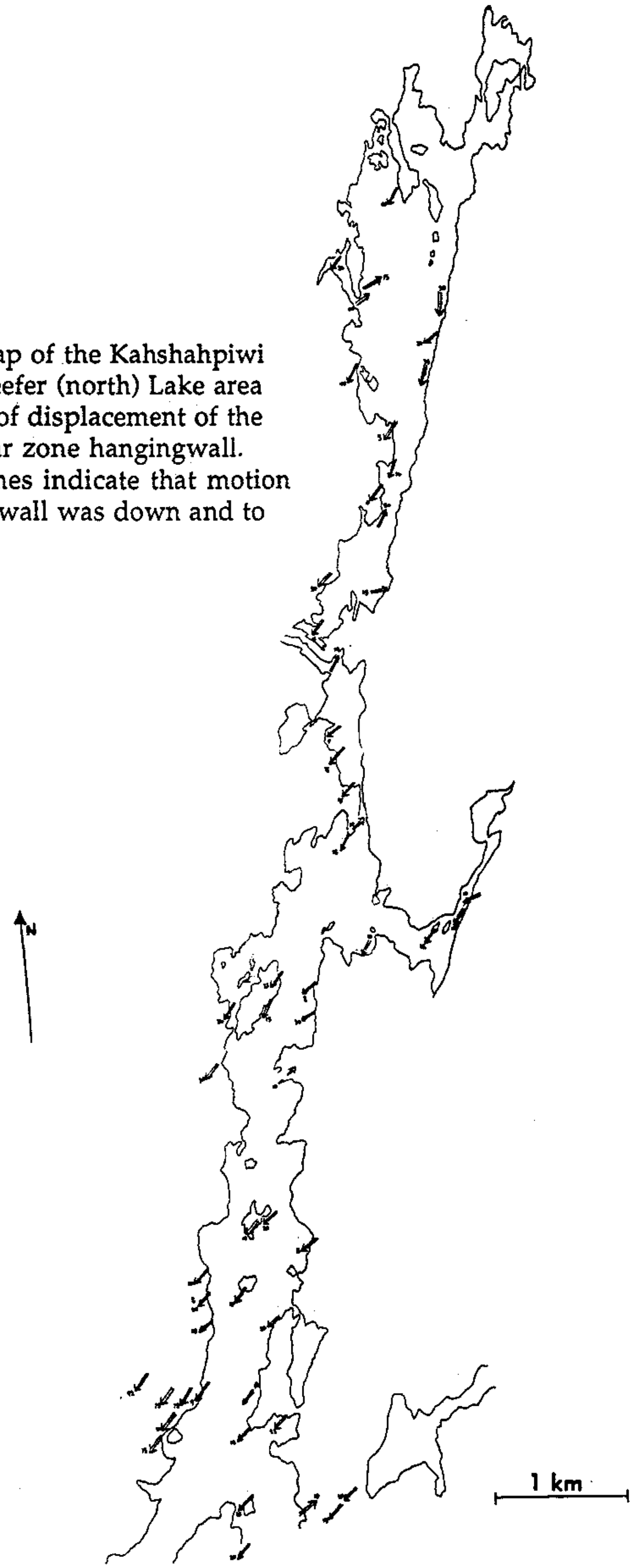
The 1992 researchers were stationed on Kahshahpiwi Lake in the Quetico Provincial Park, where canoe and foot travel are the only means of collecting geological data. The bulk of the data was collected by shoreline canoe work, inland traverses were also made in search of outcrops. Data was recorded at fault surfaces at 132 stations over an area of about 20 square miles. At each station, strike and dip of the fault surfaces were recorded as well as orientations of slickenlines, sense of shear, and foliations. All data was transferred to aerial photographs. Orientations of fault surfaces and slickenlines were plotted on stereograph projections.

DATA AND INTERPRETATIONS

Side Lake structures were most concentrated in the outcrops along the shorelines of Kahshahpiwi and Keefer Lakes, and faded out rapidly with distance inland. To the west, the last reliable Side Lake data was found 1 km in from shore, and we believe that a western boundary lies between .5 and 3 km away from the lineament that both lakes lie upon. To the east, Side Lake shear structures were not observed beyond the lineament that coincides with the Burntside Lake fault, and we hypothesize that it could be an eastern boundary. Using these distances, and tracing the lineament of the lakes along a distinct map trace, we defined the shear zone to have a narrow width of about 1.5-3.0 km and a length of 15+ km (Figure 1). We know that the shear zone extends to the south along the coincident lineament (Bastress and Schuh, 1992). If the lineament does indeed define the extent of the shear, then the total distance spanned by the Side Lake Shear Zone is about 32 km.

Intensity of development of slickenlines had a direct relationship to the lithology on which the fault surfaces were located. Slickenlines were best developed in the leucogranite units. Side Lake shear zone fault surfaces and slickenlines ranged in strike from N10°-60°E, and dip from 10°-45° NW. Slickenlines had a typical bearing of S45°W with a plunge of 0°-25°SW, averaging 15°SW (figures 1 and 2). The fabric of the striations on the fault surfaces is coincidentally the same as the regional S_1 foliation and was interpreted as an oblique, down-dip stretching lineation. Out of 132 measurements, we categorized 65 of the fault surfaces to be resulting from the Side Lake shearing event. Other measurements in the area were related to the Burntside Lake fault and 2 other joint sets with vertical dips, one bearing N60°W and another at N30°W. While a definite age relationship was never determined between the Burntside Lake fault system and the Side Lake shear zone, it was determined that the two joint sets (N60°W and N30°W) were younger, by cross cutting relationships. The orientation of the dihedral angle relative to the joint sets

FIGURE 1: Map of the Kahshahpiwi (south) and Keefer (north) Lake area and the sense of displacement of the Side Lake shear zone hangingwall. Most slickenlines indicate that motion of the hangingwall was down and to the southwest.



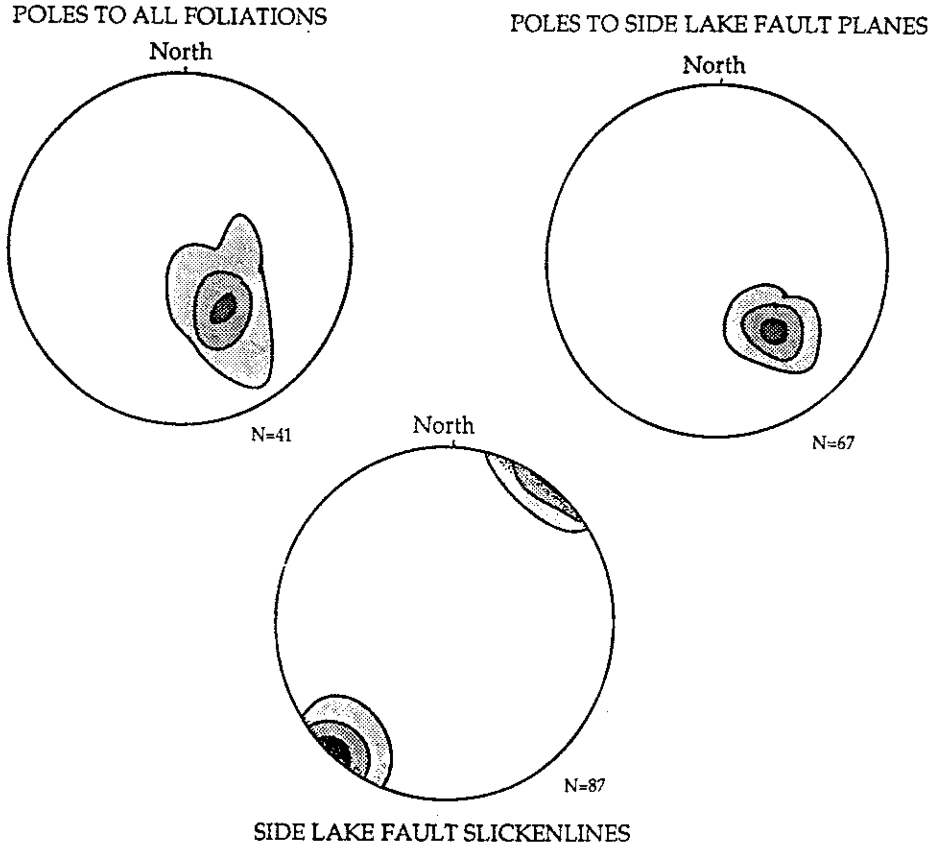


FIGURE 2: Lower hemisphere stereographic projections of field data. Contour intervals are 2% per 1% area.

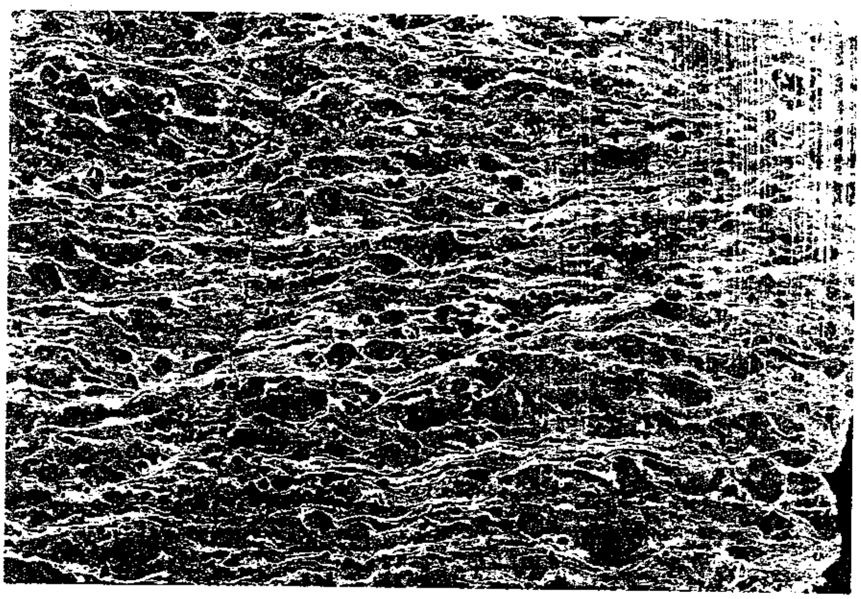


FIGURE 3: Photomicrograph of mylonite from western Keefer Lake. Photo width is 10 cm.

indicates a maximum subhorizontal compressive stress orientation of N45°W at the time of joint formation. The youngest rocks offset by the Side Lake shear zone are 2.6 Ga (Woodard, 1992).

Sense of shear was determined by examination of well developed mineral steps on the fault surfaces. The sense of displacement was movement of the hanging wall down to the southwest in nearly all of the observations. Figure 1 is a map showing this movement of the hanging wall in all observed Side Lake shear zone structures. The arrows are oriented along the bearing of the lineations, and degree of plunge is indicated in the direction of the orientation of the slickenlines. Displacement as indicated by the slickenlines exhibits shallow plunging displacement subparallel to the strike of the faults. We concluded that the total amount of displacement as a result of this particular event was small, on the order of centimeters, based on the geometry of the mineral steps.

On the western shore of central Keefer Lake, we encountered a thin zone (5 m) of mylonite. The quartz-feldspar-biotite tectonite contains sinistral delta structures which are offset along vertical, quartz filled fractures (Figure 3, photo width is 10 cm). Within the host gneisses, garnet porphyroblasts were occasionally found and preserve a dextral kinematic sense. This was the only area in which mylonitic deformation was observed. Since high temperatures and pressures are not associated with the brittle deformation of the Side Lake shear zone, we concluded that the mylonites have no relation to the Side Lake structures and were produced in a completely different Archean setting. This is a topic which could certainly be studied in greater intensity at a later date.

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