ACCRETION OF THE ARCHEAN SLAVE PROVINCE

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The Slave Province is an Archean "granite-greenstone" terrane located in the northwestern portion of the Canadian Shield. Its history spans the interval from 3.5 Ga, the age of 'old gray gneisses' exposed in an anticlinal culmination in the Wopmay Orogen, to 2.6 - 2.5 Ga, the age of major granitic plutonism throughout the province. Most of the volcanic and sedimentary rocks formed in the 2.7 - 2.6 Ga interval. Traditional tectonic models for the Slave treat the Province as one recording continental extension, with the volcanics and sediments filling normal fault bounded linear troughs developed on pre-existing sialic crust (eg., 1-6). Hoffman (7,8) and Kusky (9,10,11) have recently pointed out major problems with applying a continental rift model to the Slave Province. The regional geology is described here in the light of a collisional tectonic model in which different belts in the province are regarded as accreted terranes whose suturing formed the Archean Slave Province. Although the model is preliminary and largely speculative, it explains many aspects of the geology of the province that are ignored or contradicted by the continental rift model, and it serves as a testable hypothesis on which future field efforts may be focused.

Figure 1 is a cartoon terrane map of the Slave Province; it was constructed by first taking lithological maps of the province (2, 12, 13), graphically removing relatively young granitic intrusive rocks, and then extrapolating contacts between regions that have not been removed by granites. Field work in the 1985, 1986, and 1987 seasons concentrated on determining the nature of terrane boundaries (particularly in the western and central terranes), kinematics of major movement zones, and characterizing rock suites of different terranes. Extrapolation was aided by SEASAT orbital radar images processed in the Laboratory for Terrestrial Physics at NASA's Goddard Space Flight Center and by maps prepared by the Geological Survey of Canada and the Geology Division of the Department of Indian and Northern Affairs, Canada. On the terrane map the Slave is divided into four major tectonic zones with different characteristics and ages; from west to east these are here named the Anton Terrane, the Sleepy Dragon Terrane, The Contwoyto Terrane, and the Hackett River Terrane. The characteristics of and differences between the terranes is discussed in more detail elsewhere (14).

The Anton Terrane stretches from Yellowknife in the southern portion of the province to Anialiak River in the north (Figure 1), and it hosts some of the oldest ages reported from the Slave Province. Included is a 3.48 Ga tonalitic gneiss exposed in an anticlinal culmination in the Wopmay Orogen west of Point Lake (S. Bowring, pers. comm.), and a 3.1 Ga age on granitoid rocks from a diatreme near Yellowknife (15). Quartzofeldspathic gneisses are widely distributed throughout the Anton Terrane, and these are worthy of intensive geochronologic studies to determine if even older rocks are present. To the northwest of Yellowknife and southwest of Point Lake a series of mafic volcanic and metasedimentary rocks are preserved; their relationships to surrounding rocks are not clearly understood, although a similar suite of rocks immediately southwest of Point Lake is bounded on all sides by mylonites and is clearly a klippe. The Anton Terrane is interpreted as the remnants of an older Archean continent or microcontinent.

The Sleepy Dragon Terrane includes quartzofeldspathic gneissic complexes such as the 2.8-2.7 Ga Sleepy Dragon Complex in the south, and a 3.1 Ga chloritic granite on Point Lake. The gneisses are locally

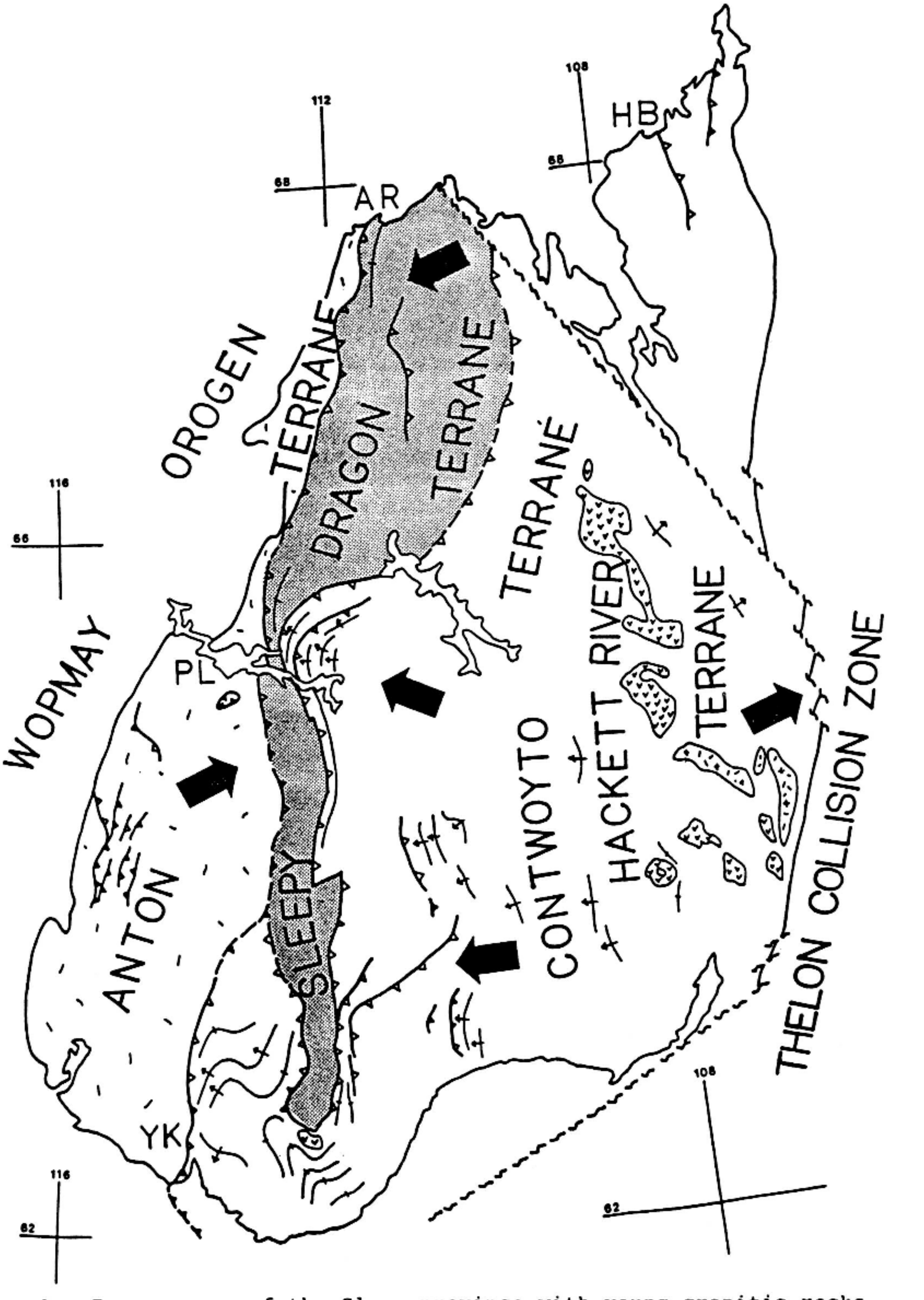

Figure 1. Terrane map of the Slave province with young granitic rocks removed. Bold arrows indicate approximate transport directions, thin lines with arrows show fold axial planes and vergence. YK = Yellowknife, PL = Point Lake, AR = Anialiak River, HB = Hope Bay.

overlain by shallow water sedimentary sequences with strong affinities to Phanerozoic passive margin sequences (19). The gneisses together with mafic greenstone belts of oceanic affinity (11) are presently disposed in a westward verging fold and thrust belt. The Sleepy Dragon Terrane could thus simply be an imbricated and westward transported section of the Anton Terrane, or it could be a separate accreted microcontinent.

Rocks of the Contwoyto Terrane consist almost entirely of graywacke turbidites (disregarding the intrusive granites), disposed in a series of westward verging folds and thrusts (15,16). At Point Lake these grade down into a flexural loading sequence related to westward directed thrusting (19). Greenstone belts within the accretionary complex are interpreted as oceanic material scraped off an eastward dipping subduction zone.

The Hackett River Terrane consists of a series of northwest striking intermediate, felsic and mafic volcanic belts along with some granitic and gneissic rocks in the south. Caldera complexes and transitions from subaerial to subaqueous volcanic deposits are locally preserved (15). These volcanic belts differ significantly from greenstone belts to the west which consist primarily of mafic volcanic and plutonic rocks (12). The Hackett River Terrane is interpreted as an island arc formed above an east dipping subduction zone, with the Contwoyto Terrane representing an accretionary complex located in the forearc position.

The formation of the Slave Province can thus be simply explained by an island arc (Hackett River Terrane) and forearc accretionary prism (Contwoyto Terrane) moving westward above an east dipping subduction zone, which collided with and partially overrode an older continent (Anton Terrane).

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