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TRANSPRESSION-INDUCED STRAIN PARTITIONING IN THE SOUTHERN APPALACHIANS (U.S.A.)

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The formation of the southern Appalachians orogenic belt is commonly regarded as resulting from a long lasting convergenge between the Laurentia and Gondwana supercontinents during the Late Paleozoic. Several micro-plates originally situated outboard of Laurentia have been squeezed between the two continents and amalgamed with lithotectonic units of the eastern margin of the Laurentia continent to form a complex assemblage of terranes of different age and nature (e.g. see review by Dallmeyer 1991).

The southern Appalachians have been for long considered as a classic example of thrust-tectonics (e.g. Hatcher, 1981; Dallmeyer, 1991). However kinematic studies of ductile deformation carried out in various lithotectonic domains have promoted a shifting toward transpression tectonics models involving orogen-parallel transport coeval with orogen-normal shortening (Bobyarchik, 1981; Vauchez et al., 1987 ; Gates et al., 1988, Vauchez et al. 1990; Hooper & Hatcher 1991). These models consider that strain partioning occurred during the collision to accommodate an oblique convergence and/or an indentation of the american margin by the Reguibat promontory of West Africa.

Field observations suggest that the western limit of the inner Piedmont domain (fig.1) has acted during the entire tectonic evolution as a major kinematic boundary separating a western domain where transverse motions were dominant from an eastern domain where longitudinal displacement represent the main tectonic process. To correlate more easily the metamorphic and the tectonic evolutions, a late kinematics (Late Carboniferous to Early Permian) is distinguished from an early kinematics (Late Devonian to Early Carboniferous).

1) LATE KINEMATICS:

Abundant surface geology and geochronological data together give clear evidence that during the late carboniferous (Alleghanian) tectonothermal event, the Piedmont southeast of the Brevard fault zone has been shifted southwestward, in a direction parallel to the strike of the belt. Several blocks have been displaced along continental-scale ductile strike-slip faults (fig.1). In the western part of the Piedmont, the late carboniferous ductile faulting occurred under decreasing metamorphic conditions, and there is no or only an incipient internal deformation within the displaced blocks. On the opposite, in the eastern part of the Piedmont late carboniferous strike-slip faulting was initiated under prograde, amphibolite facies conditions, and this tectonothermal event was recorded in the displaced terranes. Cooling ages in the range 310 Ma for the Inner Piedmont to 270 Ma for the latest deformation within the Modoc fault zone have been obtained from mylonite samples (see review by Dalmeyer 1991).

During the same time span, tranverse motions were dominant west of the Brevard fault zone. Late Carboniferous deformation was moderate within the eastern and central Blue Ridge, consisting mostly into reactivation of older faults; but it represents the main tectonic event within the Valley and Ridge and the westermost Blue Ridge.

2) EARLY KINEMATICS:

Orogen-parallel movement coeval with Devonian to Early Carboniferous metamorphism, has been recognized in the Piedmont only recently. In the westernmost Piedmont, southeast of the low grade Brevard fault, amphibolite facies mylonites display a flat-lying mylonitic foliation bearing a well defined NE-trending stretching lineation; various kinematic indicators observed in different places along the belt, consistantly suggest tangential motion parallel to the belt. A cooling age of 349 Ma was obtained from synkinematic amphibole (Vauchez et al., 1990). In the central Piedmont, the NE-trending Ocmulgee fault is a steeply-dipping ductile strike-slip fault that consistently display evidence of dextral movement parallel to the belt (Hooper & Hatcher, 1990). The main deformation within the Ocmulgee fault is regarded as coeval with amphibolite facies metamorphism dated at *ca.* 350 Ma.

Transverse movement of the same age represents the main deformation of the central Blue Ridge. The Hayesville fault is a major thrust fault that separates the western Blue Ridge (composed by lithotectonic units repre-

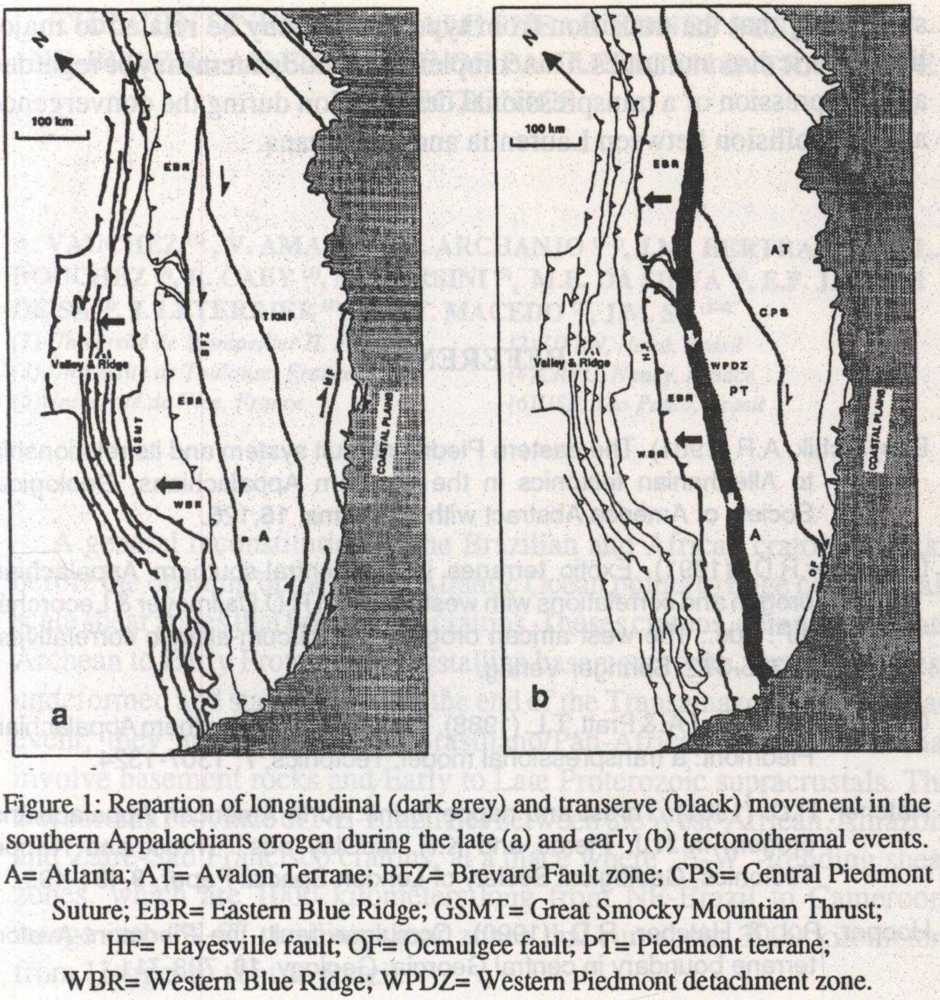

Figure 1: Repartion of longitudinal (dark grey) and transerve (black) movement in the southern Appalachians orogen during the late (a) and early (b) tectonothermal events. A= Atlanta; AT= Avalon Terrane; BFZ= Brevard Fault zone; CPS= Central Piedmont Suture; EBR= Eastern Blue Ridge; GSMT= Great Smocky Mountian Thrust; HF= Hayesville fault; OF= Ocmulgee fault; PT= Piedmont terrane; WBR= Western Blue Ridge; WPDZ= Western Piedmont detachment zone.

senting the initial continental margin) from the eastern Blue Ridge (composed by lithotectonic units representing exotic terranes). Along the sole of the Hayesville thrust, pieces of upper mantle rocks, previously incorporated into the lower crust, have been dragged up to the middle crust. This suggests that the Hayesville thrust transected the entire crust, and accomodated a large proportion of orogen-normal shortening.

Over more than 50 Ma, the tectonic evolution of the southern Appalachians is characterized by systematic strain partition resulting into contemporaneous transverse and longitudinal motions. Each component of motion was systematically dominant within a specific domain of the belt, suggesting that the transition from type to type may be related to major lithospheric discontinuities. This complex kinematic pattern may be regarded as an expression of a transpressional deformation during the convergence and the collision between Laurentia and Gondwana.

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