Interference fold patterns in regional unidirectional stress fields: A result of local kinematic interactions

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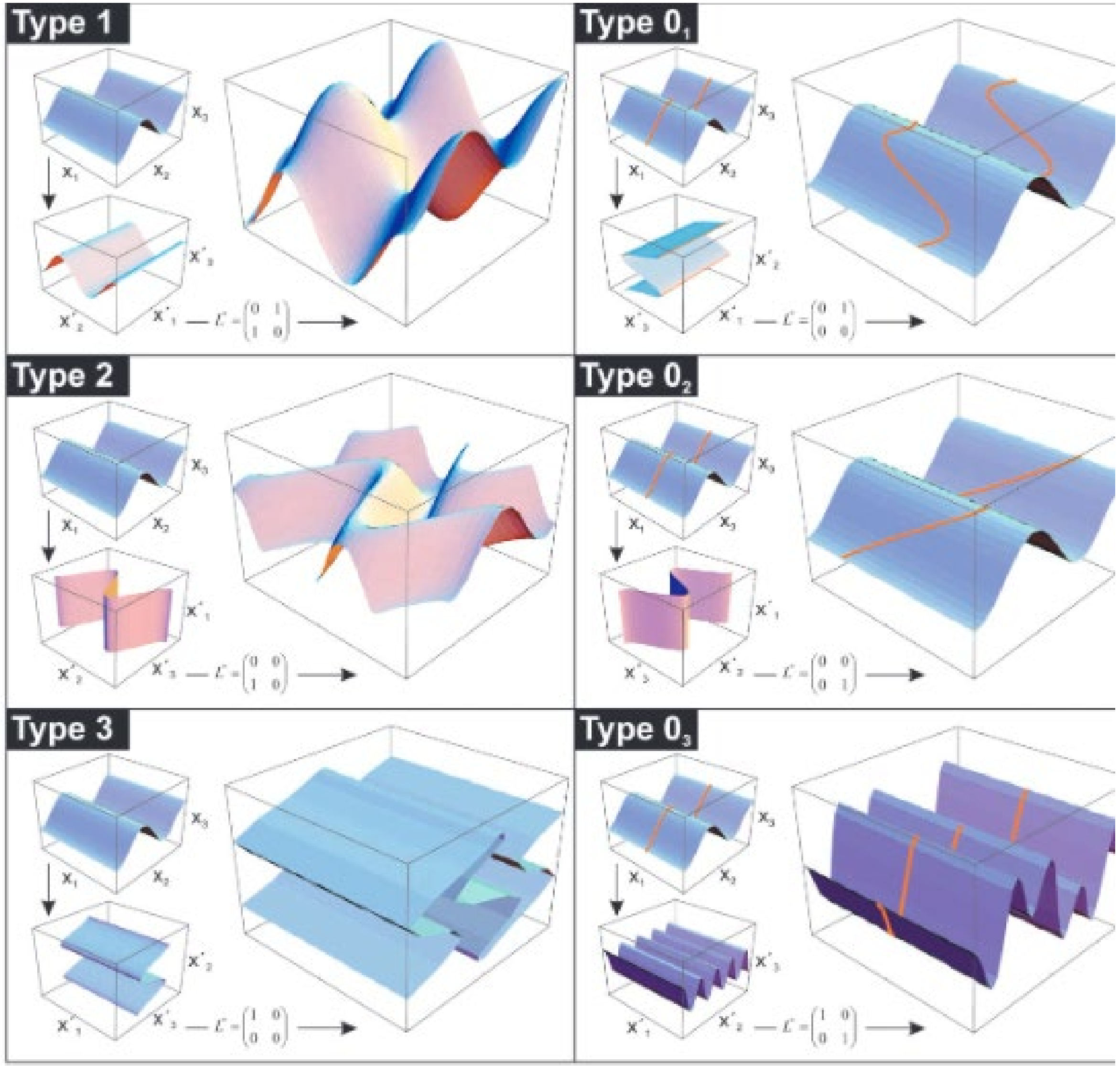
Background information

- Refolded structures are commonly divided into types 1,2,and 3 according to the relative orientations of the two folding phases, which produce interference patterns in horizontal surfaces referred to as "dome-and Basin", "crescent" and "coaxial" or "hook" respectively

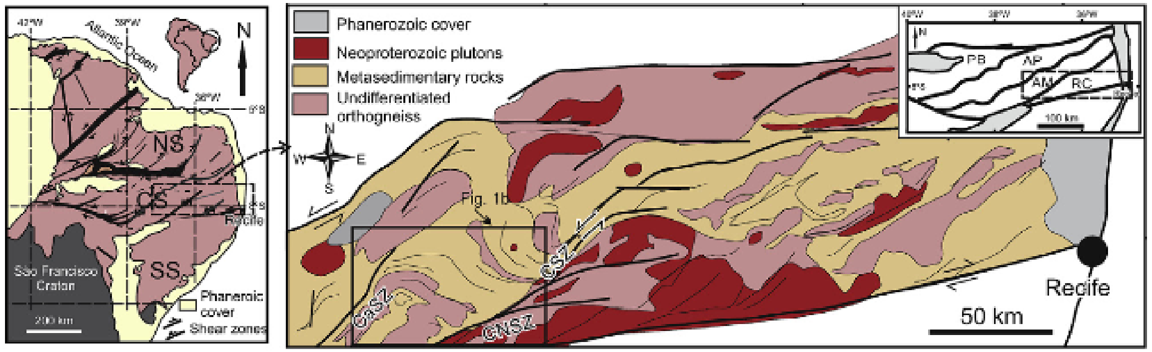


Background information and the problem

- Types 1 and 2 polyphase deformation results from different orientations of the main stress axes. The variation may occur by rotation of the stress axes or may reflect different boundary conditions.
- There is an association of folds with ductile shear zones, however, superposed folding contemporaneous with shearing is rarely reported.
- Borborema Providence is an ideal place to ***<u>study the connection between folding and strike-slip shearing</u>*** since is contains a complex network of ductile transcurrent shear zones.

The study:

- Wanted to ***describe a macroscopic fold interference pattern with geometry intermediate between types 1 and 2***, referred to as the Caroalina fold Interference structure. (cfis)
- Borborema Province is divided into four tectonic domains(fig.1a)
- The Caroalina fold interface structure is located in the Alto Moxoto Domain, which is separated from the Rio Capibaribe domain in the east by the Congo-Cruzeiro do Nordesta shear zone. (fig 1b)


Phanerozoic cover
Neoproterozoic plutons
Metasedimentary rocks
Undifferentiated orthogneiss
NS
SS
São Francisco Craton
Atlantic Ocean
Phanerozoic cover
Shear zones
Fig. 1b
CSZ
CaSZ
CNSZ
Recife
50 km
PB
AP
AM
RC

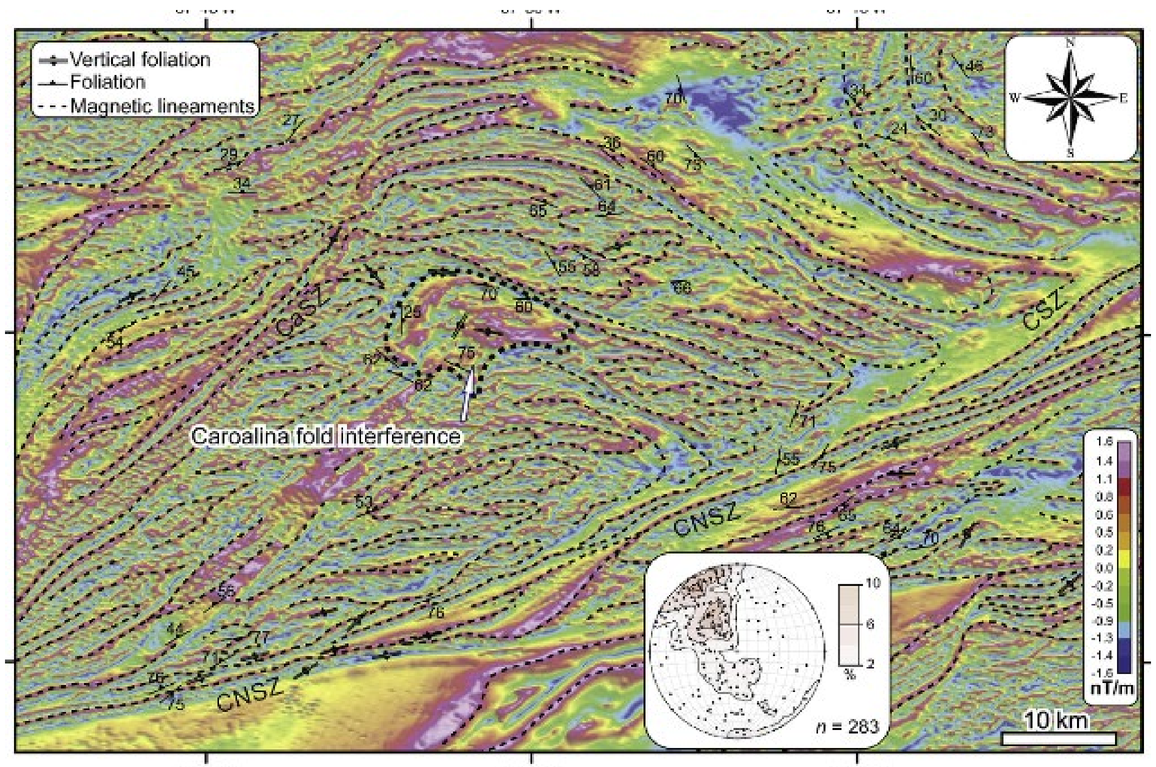
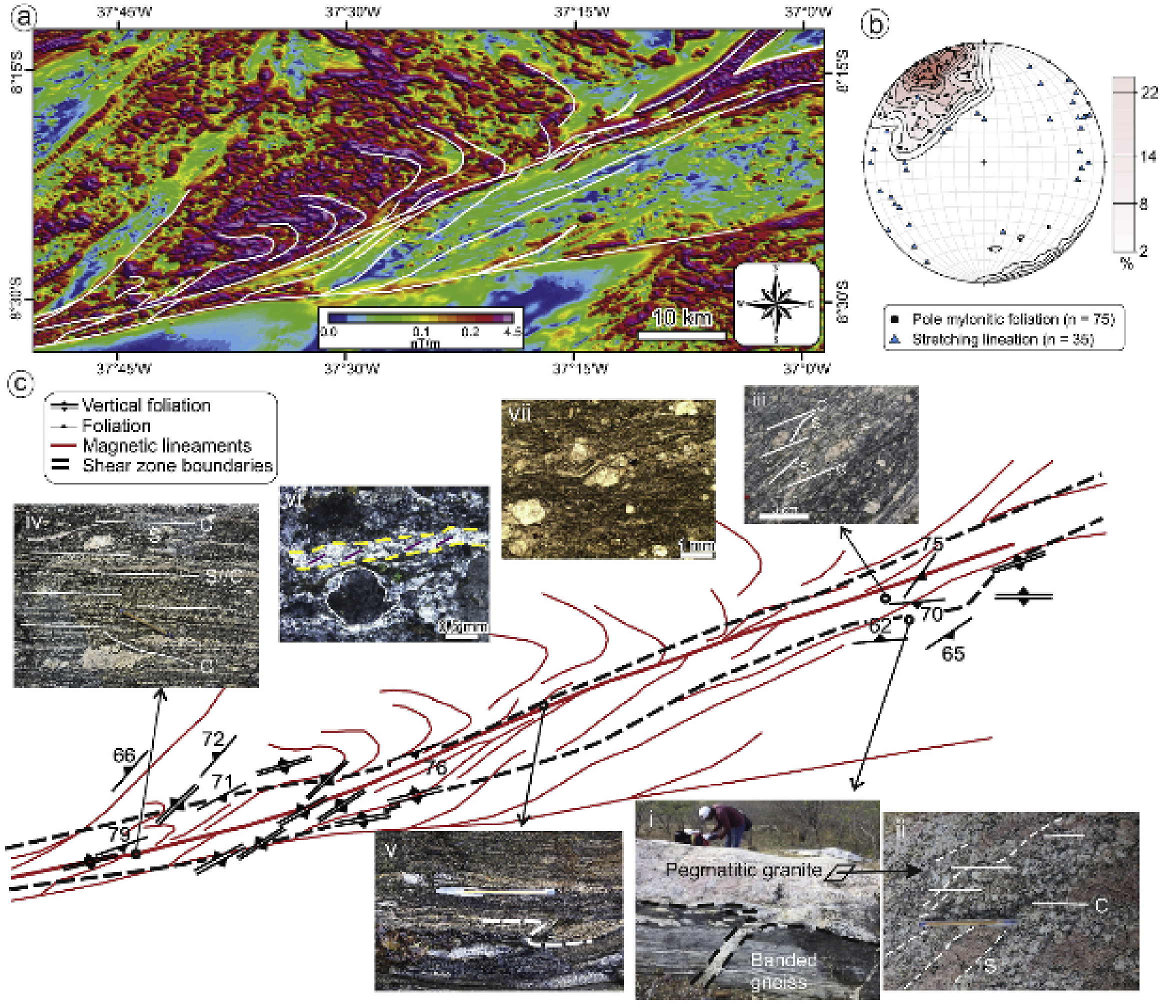

Vertical foliation
Foliation
Magnetic lineaments
CaSZ
CSZ
CNSZ
Caroalina fold interference
n = 283
nT/m
10 km

Fig 1a &1b

Shear zones

- The CFIS is located between the Congo-Crezeiro Nordesta shear zones and the Calicara shear zone (CSZ) fig 1b
- Previous works considered the congo and cruzeiro shear zones as a single sinistral shear zone
- Interpretation of aeromagnetic data and field microstructural work demonstrate that the Cruzeiro shear zone is dextral

Fig 3 a-c



3a shows magnetic lineaments at the western terminus of the CNSZ, defining folds with a south-facing concavity, consistent with dextral shear

3b shows the lower hemisphere projection of poles to mylonitic foliation and stretching lineations

3(c) Representative photographs of shear sense criteria indicating dextral shear in the CNSZ. Boundaries of the CNSZ as determined from the first appearance of mylonitic foliation in the field. (i, ii) Banded orthogneiss with sub-horizontal foliation capped by protomylonitic pegmatitic granite, which shows (ii) S-C fabric. (iii) Granitic S-C mylonite. (iv) Mylonitic gneiss with S-C fabric (top of photo), C′-type shear band (parallel to pencil) and sigmoid of quartz-feldspar aggregate (base of photo). (v) Asymmetric Z fold. (vi) Quartz ribbon with oblique foliation and δ-type porphyroclast (photo-micrograph in crossed polarized light). (vii) σ-type porphyroclasts (photomicrograph in plain polarized light)

Caroalina fold interference structure

- The main architecture is that of a large, south-verging synform. NE-SW-striking folds affected the orientation of this early formed fold, causing the curvature of its axial trace and forming an intermediate 1-2f old interference pattern.
- Two sets of inclined to upright folds are also observed at outcrop scale. E-W to NW-SE striking folds have axial planes steeply dipping northwards.

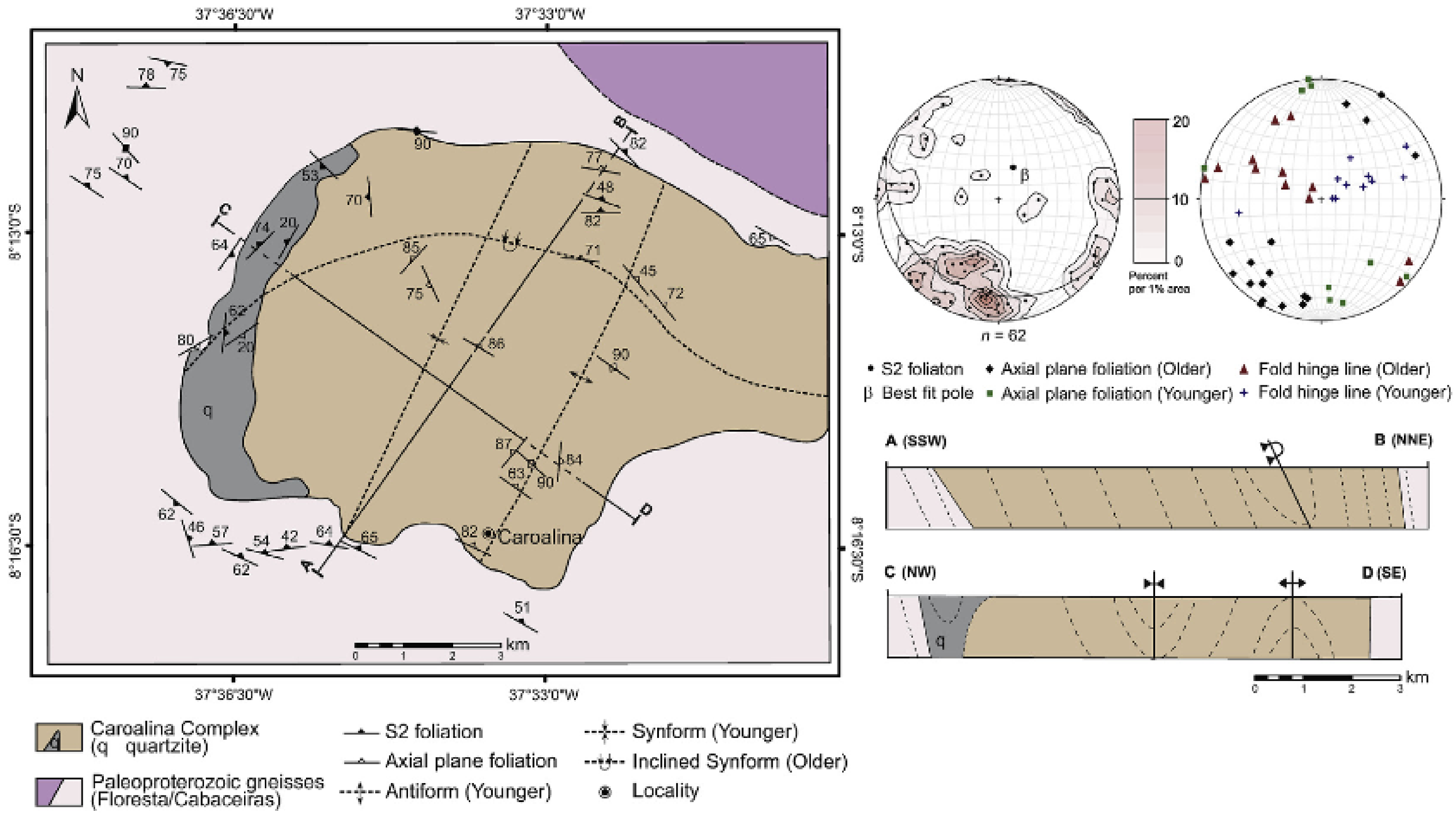
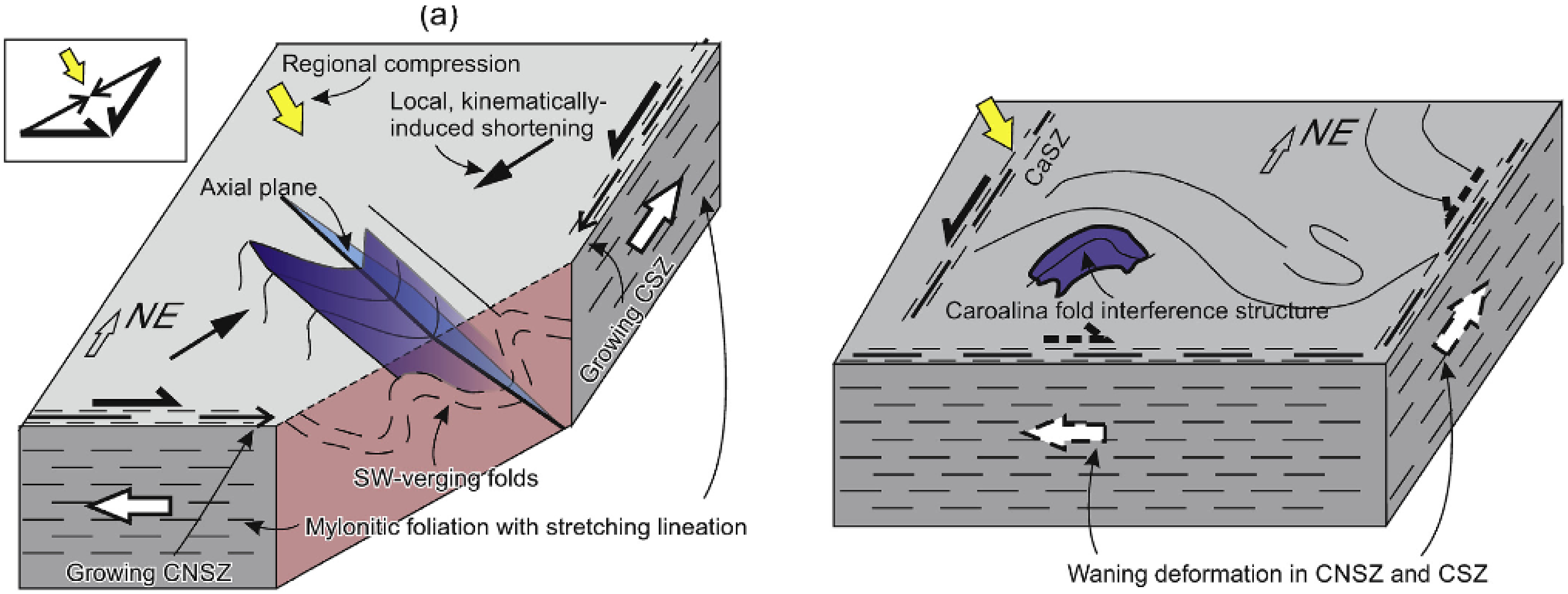


Fig. 4. Geological map of the Caroalina fold interference structure. Lower hemisphere stereographic plots show poles to foliations, with calculated β axis, and fold orientation data.

Conclusion

- Congo and Cruzeiro shear zones form a conjugate pair of transcurrent shear zones with sinistral and dextral kinematics
- Relative displacements at their junction attests their contemporaneous development and induced contractional strain which formed the nw trending inclined folds
- NE trending folds coeval with a new sinistral shear zone, resulting in a macroscopic fold interference pattern
- Caroalina folds were ***controlled by nearby shear zones, requiring no rotation of the regional stress axis***



Schematic block diagrams showing the proposed sequential development of structures in the study area. Inset in (a) shows the shortening direction resulting from the opposed kinematics of the Congo (CSZ) and Cruzeiro do Nordeste (CNSZ) shear zones. The actual angle between the shear zones is greater than shown in the block diagrams, where it was diminished to facilitate visualization. (a) Interference between the growing CSZ and CNSZ induces a local contractional strain field at their northwestern side, promoting development of SW-verging inclined folds. Depicted folds are not meant to represent real structures, only to illustrate the style of meso- and macroscale SW-verging folds. (b) After they intersect, movement is blocked in the CSZ and CNSZ; NW-SE regional compression leads to nucleation of the Caiçara shear zone (CaSZ),refolding of NW-trending folds by NE-trending folds, and development of the Caroalina fold interference structure. Between (a) and (b) the direction of re-gional compression remains unchanged