Canadian Tectonics Group

Fall Virtual Workshop 2026

October 27th, 2026
1:00pm to 2:20pm EDT

Workshop Schedule: Tuesday, October 27th, 2026

Presenter	Time (EDT)	Title
Walfried Schwerdtner	1:00	Relict S-Z structures in metamorphic tectonites of southwestern Grenville Province (Ontario), natural indicators of very high cumulative strain
Yating Zhong	1:20	Thermal-Tectonic Fingerprints of the Grenville Lower-Middle Crust: Evidence from Polycyclic Mafic Lenses
Lillian Cybulski	1:40	Detection of lithospheric-scale cross-strike structures from gravity disturbance data, northern Apennines, Italy
Chance Ronemus	2:00	No allochthons allowed: Detrital zircon provenance rules out Mesozoic accretion of coastal Chile (∼28–34.5°S)

Relict S-Z structures in metamorphic tectonites of southwestern Grenville Province (Ontario), natural indicators of very high cumulative strain

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Occurring on several horizontal scales, relict S-Z structures (RSZSs), distorted pieces of competent geological units, are invariably derived from high-amplitude monoclinic buckle folds. In our recent study of the western Grenville Province, RSZSs have served as natural indicators of very high cumulative strain. Formerly misinterpreted as geological boudins or other structural features, RSZSs are instead created by the pinch-out of single, massive or thinly layered, competent units in the attenuated long limbs of evolving monoclinic buckle folds or coaxially superimposed buckle folds. Like the multi-layered rootless folds, RSZSs are found in unconsolidated volcanic deposits and loose sediments as well as metamorphic tectonites. In this presentation, we focus special attention on mega-RSZSs recently identified in two litho-structural domains of the Composite Arc Belt. In the Harvey-Cardiff domain, several 10 km-scale granitoid complexes, regarded for over 80 years as domical structures, are now interpreted as interior parts of mega-RSZSs. Similarly, structurally above the narrow, easterly dipping, extensional Bancroft Shear Zone, the geological map patterns of deformed metagabbro-metadiorite sheets, some of which exhibiting diagnostic 'tails', are now interpreted as mega-RSZSs. In the latter case, the presence of a linear chain of high-strain mega-RSZSs and its close proximity to the Bancroft Shear Zone strongly suggest that the northwestern portion of the Bancroft domain contains a 5 – 10 km wide, northeasterly trending, major tectonic feature that we provisionally term the 'York River deformation belt'.

Thermal-Tectonic Fingerprints of the Grenville Lower-Middle Crust: Evidence from Polycyclic Mafic Lenses

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The thermal structure and evolution of the lithosphere are fundamental to understanding the Mesoproterozoic Grenville Orogen, a large hot orogen that contributed to the assembly of Rodinia Supercontinent. Mafic lenses preserved at different structural levels in the southwestern Grenville Province provide critical thermal and tectonic records of the lower to middle crust.

We investigate three types of mafic lenses from the Algonquin Domain that record contrasting structural histories and preserve distinct mineral assemblages and metamorphic textures. Type 1 preserves relict ophitic textures and limited deformation within an NW-verging fold nappe associated with F_1. It contains anhedral clinopyroxene surrounded by subhedral, lath-shaped plagioclase, with atoll-shaped, chain-like garnet occurring at plagioclase-clinopyroxene contacts (Fig. 1a). Clinopyroxene was subsequently overprinted by a retrograde assemblage of orthopyroxene, secondary clinopyroxene, amphibole, plagioclase, and locally biotite. Type 2 contains a penetrative foliation associated with the first deformation phase (D_1). it consists of 5 mm-sized dark nodules of clinopyroxene-hornblende-biotite intergrowth surrounded by garnet- plagioclase coronas (Fig. 1b). The matrix consists mainly of garnet, hornblende, plagioclase, biotite, and quartz. Type 3 preserves an earlier fabric that was subsequently transposed and refolded during a second deformation phase (D_2), characterized by NW-SE-striking upright folds. Plagioclase-clinopyroxene-hornblende-biotite-quartz define the S_2 foliation. Newly grown atoll-shaped garnet occurs in association with the breakdown and replacement of pre-existing plagioclase-hornblende-clinopyroxene intergrowths.

Equilibrium phase diagrams calculated in the MnNCKFMASHO system show that garnet compositions from the three mafic-lens types define distinct clockwise cooling-decompression paths accompanied by thermal relaxation. The inferred peak pressures are approximately 16 kbar for Type 1 and 12-9 kbar for Types 2 and 3, with temperatures ranging from approximately 840 to 900 °C. U-Th-Pb dating of zircon by LA-ICP-MS indicates that all three lens types record metamorphic events at approximately 1.40 Ga and 1.08 Ga. This work suggests that refractory Pinwarian mafic fragments were incorporated into the crust and subsequently reworked during Early Ottawan orogenesis. During this evolution, deep-crustal fragments underwent decompression as they were assembled into and transported within ductile nappes, allowing them to rise into the middle crust. The hot middle crust then continued to undergo lateral flow, shearing, folding while experiencing only limited further exhumation.

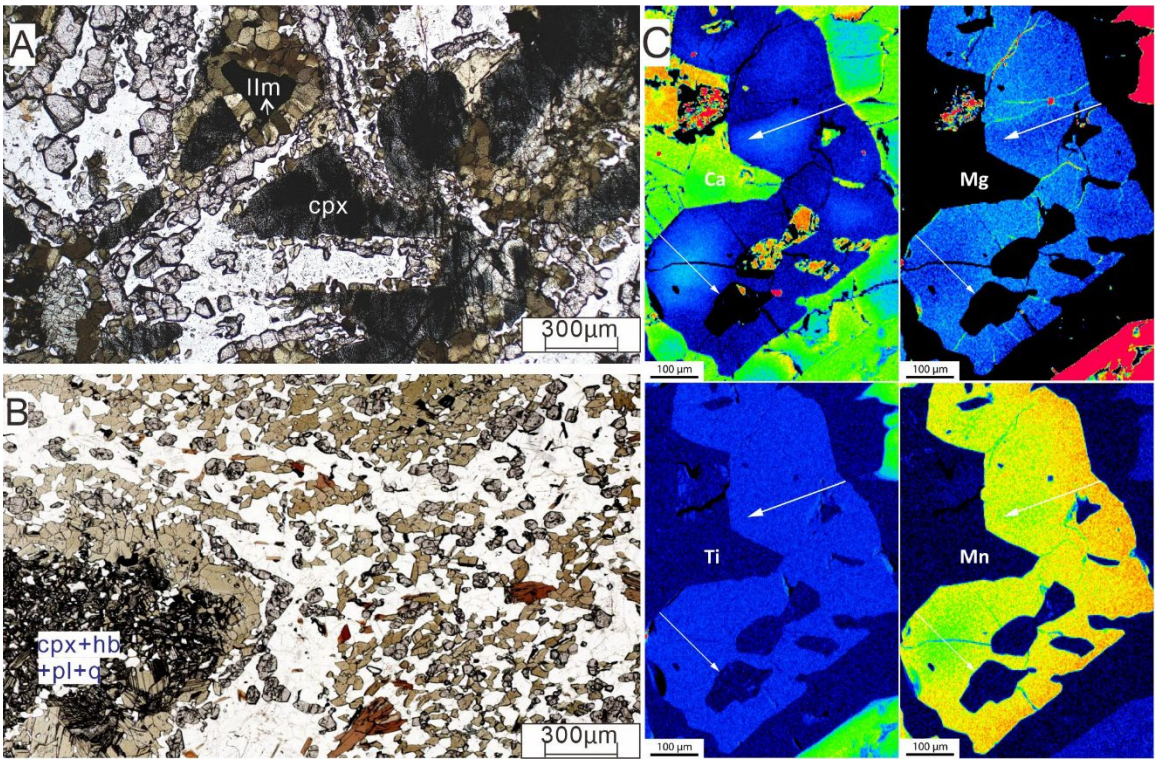

Fig. 1. Micrographs showing well-preserved relict ophitic and corona textures in Type 1 (a) and Type 2 (b) mafic lenses. (c) Compositional maps of atoll-shaped garnet in the Type 2 lens showing the relative distributions of Ca, Mg, Ti, and Mn.

Detection of lithospheric-scale cross-strike structures from gravity disturbance data, northern Apennines, Italy

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The Apennines orogen in Italy is the product of Cenozoic convergence between the Adriatic microplate and the European plate. Like many orogens worldwide, the Apennines display complex along-strike variations in topography, thickness and distribution of sedimentary basins, drainage patterns, thermal evolution, surface geology, deformation style, presence of magmatic bodies, regional and teleseismic tomography, and seismicity. Transverse lineaments at zones where such along-strike variations and discontinuities are concentrated have been documented in the Apennines, yet their lateral extent (especially offshore) and timing were previously uncertain. It has also been unclear whether these transverse lineaments represent surficial boundaries or are crustal to lithospheric in scale, and whether they can be linked to reactivated crustal basement structures or features in the subcontinental lithospheric mantle. This research uses edge-enhanced spectrally filtered World Gravity Model 2012 gravity disturbance data to highlight linear changes in gravity at different inferred depths (2.5-25 km, ~25-50 km, and >50 km), interpreted as proxies for the location of crustal to lithospheric scale geological structures.Linear trends that are defined by edges or contacts on enhanced images are interpreted from the filtered gravity disturbance images without considering geology or topography. The study area is subdivided into five domains that appear to highlight the orientation of geologic features in regions that experienced contrasting tectonic evolutions. Some lineaments vary in position and orientation at two different depth intervals (~2.5-25 km and ~25-50 km). The across-strike gravity lineaments interpreted at inferred depth slices tend to show a spatial correlation with previously documented transverse lineaments in the Northern Apennines, which correspond to zones of pronounced along-strike variations. Six of the across-strike gravity lineaments coincident with documented transverse lineaments, including the Livorno-Sillaro Line, are traced offshore into the Adriatic Microplate, supporting previous interpretations that the transverse lineaments defined by along-strike variations are delineated by pre-Apennine structures inherited from the Adriatic Microplate. Our results suggest that analysis of lineament patterns from gravity disturbance data is a powerful tool to detect crustal to lithospheric-scale structures and identify domains that can provide insight into the tectonic evolution of a complex area.

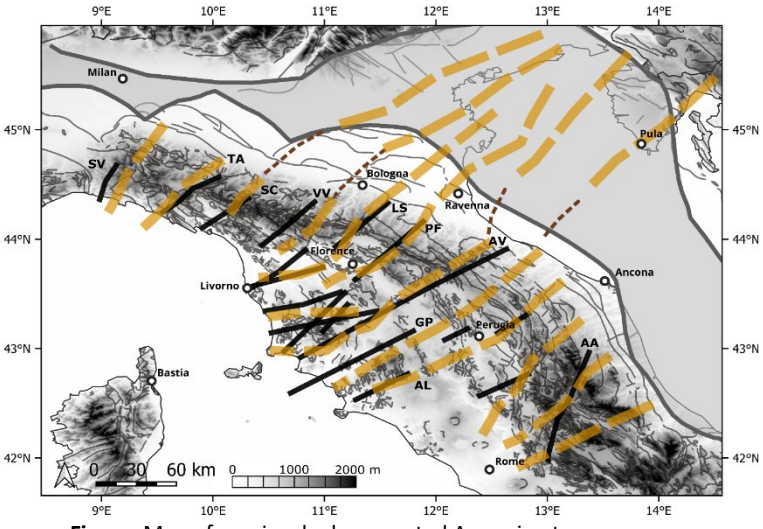

Figure: Map of previously documented Apennine transverse lineaments (black lines) and across-strike gravity lineaments (tan). Where the connection between Apennine and Adriatic across-strike lineaments is uncertain, the dark brown dotted line is used. SV, Sestri-Voltaggio Line; TA: Taro Line; SC, Seccia Line; VV, Viareggio-Val di Lima; LS, Livorno-Sillaro Line; PF, Piombino-Faenza Line; AV, Arbia-Marecchia; GP, Grosseto-Pienza Line; AL, Albegna Line; AA, Ancona-Anzio Line.

No allochthons allowed: Detrital zircon provenance rules out Mesozoic accretion of coastal Chile (~28–34.5°S)

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Western South America is widely regarded as Earth's archetypal long-lived subduction margin, thought to have been continuous beneath the continent since Paleozoic time. However, recent mantle tomography studies revive earlier speculation by Eldridge Moores and Bill Dickinson that coastal Chile is an intraoceanic arc terrane accreted along a cryptic Cretaceous suture. These divergent models make distinct predictions for the provenance of Mesozoic sedimentary rocks in coastal Chile, which should differ from that of units presently adjacent across the proposed suture if accretion occurred (Figure 1). We test these predictions using 5,068 new and 2,901 compiled detrital zircon U–Pb ages from Paleozoic–Upper Cretaceous (meta)sedimentary rocks on both sides of the proposed suture at 28–34.5°S (53 samples), compared against a continental reference suite (study total: 231 samples, 15,891 ages). We find that every formation within the postulated terrane contains diagnostic South American basement age modes, no major age mode requires a non-South American source, and no anomalous statistical dissimilarity is introduced by crossing the proposed suture in space or time. From this, we conclude that onshore coastal Chile is not an exotic terrane and likely remained fixed to the same segment of South America since at least the Carboniferous. Thus, mantle tomography-based models for west-dipping Mesozoic subduction lack the required record of accretion; their assumptions may warrant reconsideration here, and perhaps in analogous settings of North America.

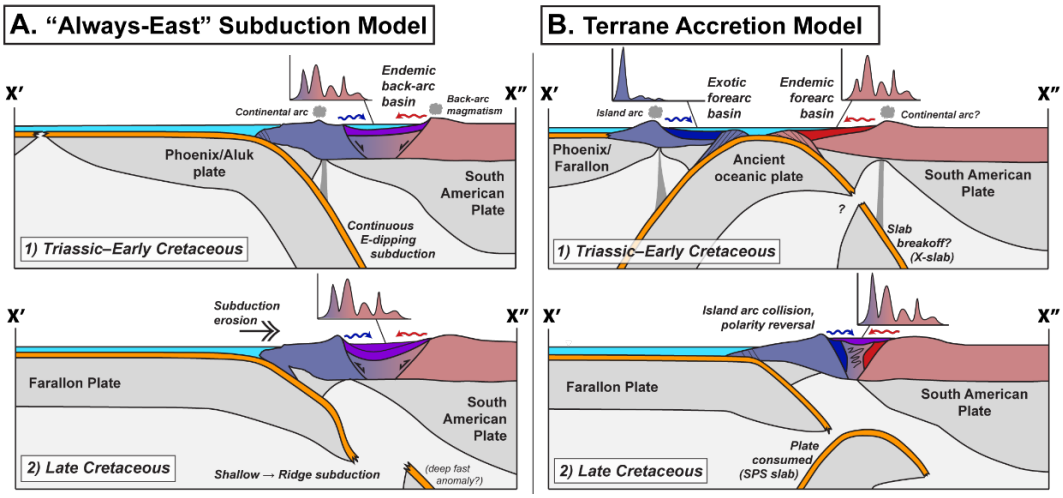

Figure 1. Models for Mesozoic Chilean margin: (c) long-lived east-dipping subduction, predicting mixed arc (blue) and continental (red) provenance within a back-arc basin; (d) Cretaceous island-arc (blue) accretion to the continent (red), yielding distinct provenance within two opposing forearc basins (inset cartoon detrital zircon age-probability curves).