

Albino leaves in *Sequoia sempervirens* show altered anatomy and accumulation of heavy metals

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Coast redwood (*Sequoia sempervirens*) occasionally produces chlorophyll-deficient "albino" branches and coppice shoots with white tissues presumably receiving photosynthate from the nearby green tissues. How might white foliage compare with adjacent green foliage anatomically and chemically? Paired white and green leaves were fixed, embedded in resin, sectioned, and stained with toluidine blue to assess anatomical variation. Live leaves were sectioned and stained with iodine to detect the presence of starch in plastids. ICP spectrometry was conducted to determine the chemical concentrations of eleven elements. White tissues had plastids that were more variable in size and shape than green tissues. Plastids in both green and white tissues contained starch. In green leaves, palisade parenchyma cells were longer and epidermal and hypodermal cell walls were thicker than in white leaves. Concentrations of seven elements differed significantly between green and white leaves: white leaves had significantly higher levels of cadmium, copper, nickel, phosphorus, potassium, and sulfur, and significantly lower levels of manganese in green leaves. Contrary to expectations, magnesium concentrations did not differ significantly between green and white leaves. In white leaves, cadmium, copper, and nickel were especially elevated, with more than double their concentrations in green leaves. These heavy metals are accumulated in the white leaves, and anatomical abnormalities observed in white leaves may be related to the high concentrations of these heavy metals, perhaps especially due to elevated nickel.