
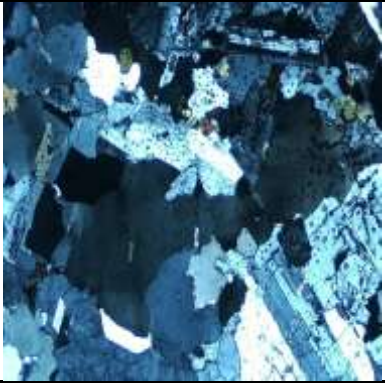
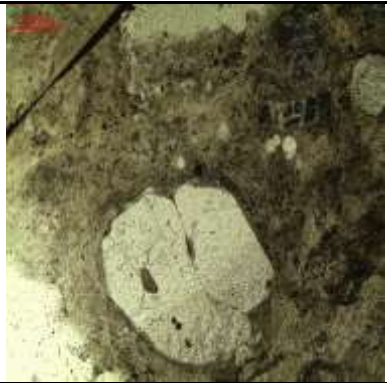
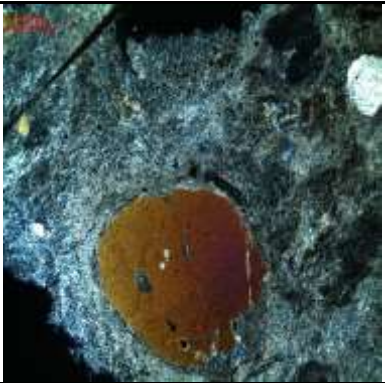




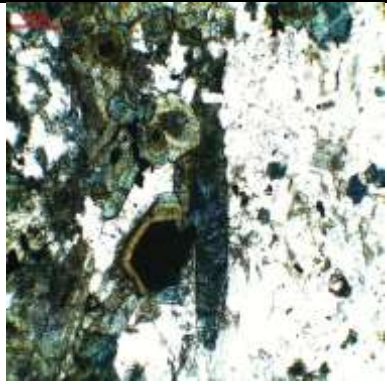
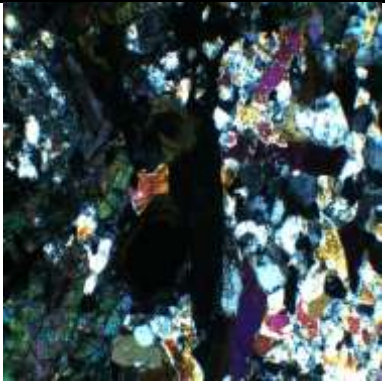
**GEO 202 – OPTICAL MINERALOGY PROPERTIES OF MINERALS**


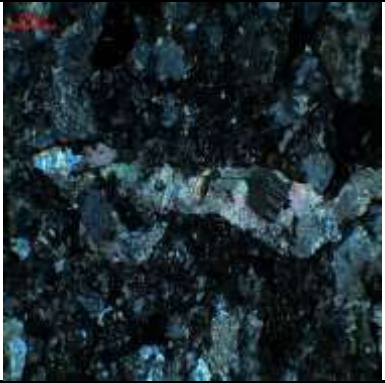
Prof. Dr. Yusuf Kagan KADIOĞLU

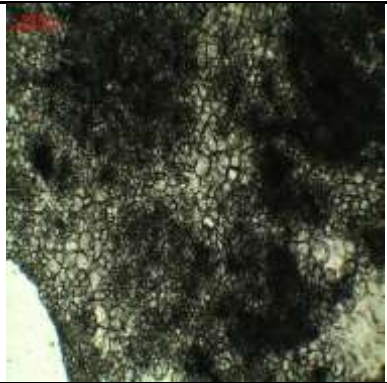
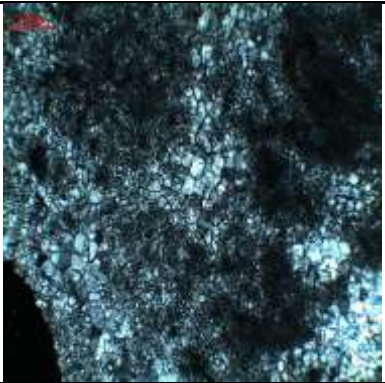
PlanePolarized	Mineral Name	Cross Polarized
	<b>QUARTZ</b>	
	Mineral Group: <b>Silicates-Tectosilicate</b>	
	Chemical Formula: <b>SiO<sub>2</sub></b>	
Color:Colorless		Birefringence-Interference color: Grey color of 1st's order. Low
Pleochroism: None		Extinction: Undulatory, parallel
Cleavage: None		Twinning: Not significant
Fracture: Irregular fractures		Alteration: None
Relief: Low, 1.54		Optical Sign: Uniaxial +
Inclusion: Possibly		Elongation Sign: +
Occurance: Magmatic, Metamorphic and Sedimentary rocks		
Distinctive Properties: No alteration, no cleavage, undulatory extinction		
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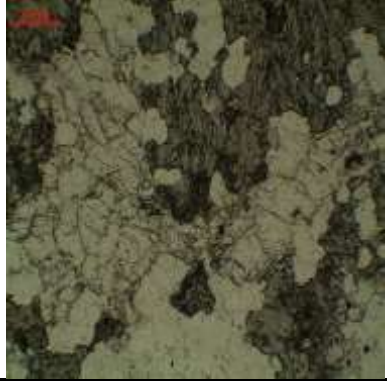
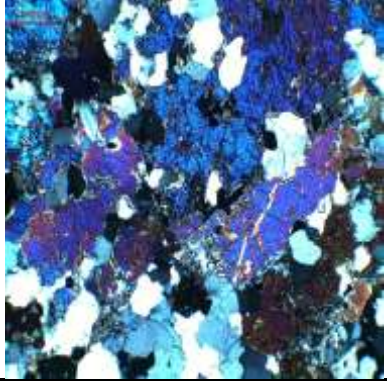
PlanePolarized	Mineral Name	Cross Polarized
	<b>QUARTZ</b> <b>(thick section)</b>	
	Mineral Group: <b>Silicates-Tectosilicate</b>	
	Chemical Formula: <b>SiO<sub>2</sub></b>	
Color:Colorless		Birefringence-Interference color: yellow or blue colors of 2nd order, moderate
Pleochroism: None		Extinction: Wavy, parallel
Cleavage: None		Twinning: Not significant
Fracture: Irregular fractures		Alteration: None
Relief: Low, 1.54		Optical Sign: Uniaxial +
Inclusion: Possibly		Elongation Sign: +
Occurance: Magmatic, Metamorphic and Sedimentary rocks		
Distinctive Properties: Resistance to alteration, clear surface, relief, extinction, interference color		
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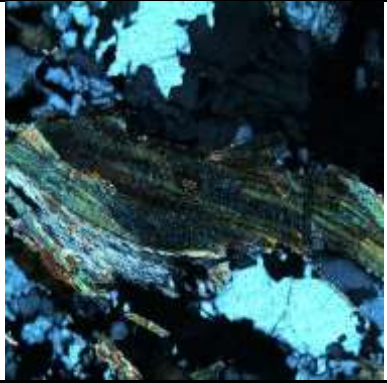
PlanePolarized	Mineral Name	Cross Polarized
	<b>APATITE</b>	
	Mineral Group: <b>Phosphates-Apatite Group</b>	
	Chemical Formula: <b>Ca<sub>5</sub>(PO<sub>4</sub>)<sub>3</sub>(F,Cl,OH)</b>	
Color: Colorless	Birefringence-Interference color: 1st order, low	
Pleochroism: None	Extinction: Parallel	
Cleavage: Poor (0001-1010)	Twinning: None	
Fracture: Possibly	Alteration: None	
Relief: 1.63-1.66, Moderate	Optical Sign: -, Uniaxial	
Inclusion: Possibly	Elongation Sign: -	
Occurrence: Magmatic, Metamorphic and Sedimentary rocks		
Distinctive Properties: Acicular shape, color, extinction		
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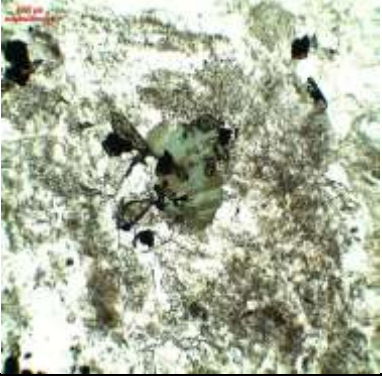
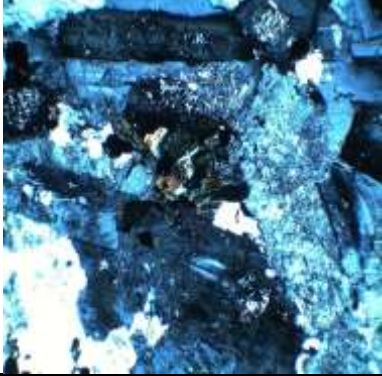
PlanePolarized	Mineral Name	Cross Polarized
	<b>TOURMALINE</b>	
	Mineral Group: <b>Silicates-Cyclosilicates</b>	
	Chemical Formula: <b>(Ca,K,Na)</b> <b>(Al,Fe,Li,Mg,Mn)<sub>3</sub>(Al,Cr, Fe,V)<sub>6</sub></b> <b>(BO<sub>3</sub>)<sub>3</sub>(Si,Al,B)<sub>6</sub>O<sub>18</sub>(OH,F)<sub>4</sub></b>	
Color: Greenish, Blue, Grayish	Birefringence-Interference color: 2nd order-moderate or strong	
Pleochroism: Strong significant- Reverse Pleochroism	Extinction: Parallel	
Cleavage: None	Twinning: None	
Fracture: Possibly	Alteration: None	
Relief: 1.63-1.69 Moderate	Optical Sign: -, Uniaxial	
Inclusion: Possibly	Elongation Sign: -	
Occurrence: Magmatic, Metamorphic and Sedimentary rocks		
Distinctive Properties: Reverse pleochroism, color and interference color, high relief		
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PlanePolarized	Mineral Name	Cross Polarized
	<b>CALCITE</b>	
	Mineral Group: <b>Carbonates-Calcite Group</b>	
	Chemical Formula: <b>CaCO<sub>3</sub></b>	
Color: Colorless	Birefringence-Interference color: 4th order-high (pastel colors)	
Pleochroism: None	Extinction: Symmetric, Shiny	
Cleavage: Possibly	Twinning: Polysynthetic	
Fracture: Rarely	Alteration: Wollastonite-Grossular	
Relief: 1.65 Moderate, relief changes if you rotate the table	Optical Sign: -, Uniaxial	
Inclusion: Possibly	Elongation Sign: +	
Occurance: Magmatic, Metamorphic and Sedimentary rocks		
Distinctive Properties: Interference color, relief changes if you rotate the table		
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PlanePolarized	Mineral Name	Cross Polarized
	<b>DOLOMITE</b>	
	Mineral Group: <b>Carbonates-Dolomite Group</b>	
	Chemical Formula: <b>(CaMg)(CO<sub>3</sub>)<sub>2</sub></b>	
Color: Colorless	Birefringence-Interference color: 4th order pearl white	
Pleochroism: None	Extinction: Maybe symmetric	
Cleavage: Excellent	Twinning:	
Fracture:	Alteration: Resistant to alteration	
Relief: Relief changes if you rotate the table	Optical Sign: -, Uniaxial	
Inclusion:	Elongation Sign:	
Occurance: Magmatic, Metamorphic and Sedimentary rocks		
Distinctive Properties: Interference color, structure, euhedral		
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PlanePolarized	Mineral Name	Cross Polarized
	<b>SCAPOLITE</b>	
	Mineral Group: <b>Scapolite Group</b>	
	Chemical Formula: <b>Ca<sub>4</sub>Al<sub>6</sub>Si<sub>6</sub>O<sub>24</sub>CO<sub>3</sub></b>	
Color: Colorless	Birefringence-Interference color: 1st and 2nd-High	
Pleochroism: None	Extinction: Parallel	
Cleavage: Perfect in two direction	Twinning: None	
Fracture: None	Alteration: Sericite, Zeolite, Calcite	
Relief: 1.53-1.59 Low	Optical Sign: -, Uniaxial	
Inclusion: Possibly	Elongation Sign: -	
Occurance: Metamorphic rocks		
Distinctive Properties: color, Na scapolite:low birefringence, Ca scapolite:high birefringence, low relief compared to pyx		
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PlanePolarized	Mineral Name	Cross Polarized
	<b>ZIRCON</b>	
	Mineral Group: <b>Zircon Group</b>	
	Chemical Formula: <b>ZrSiO<sub>4</sub></b>	
Color: Colorless	Birefringence-Interference color: 4th order very high	
Pleochroism: None	Extinction: Parallel	
Cleavage: Poor	Twinning: None	
Fracture: None	Alteration: Radioactive decay	
Relief: 1.84-1.92 Very high	Optical Sign: +, Uniaxial	
Inclusion: Possibly	ElongationSign: +	
Occurance: Magmatic, Metamorphic and Sedimentary rocks		
Distinctive Properties: Interference color, radiative halo		
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PlanePolarized	Mineral Name	Cross Polarized
	<b>TITANITE SPHENE</b>	
	Mineral Group: <b>Rutile Group</b>	
	Chemical Formula: <b>TiO<sub>2</sub></b>	
Color: Colorless, Brownish due to Fe content	Birefringence-Interference color: 2nd order moderate	
Pleochroism: None, Possible if contains Fe	Extinction: Mostly symmetric	
Cleavage: Good	Twinning:	
Fracture: Possibly	Alteration: Rutile, anatase	
Relief: 1.80-1.90 very high	Optical Sign: +, Biaxial	
Inclusion: Possibly	Elongation Sign: +	
Occurance: Magmatic, metamorphic, sedimentary		
Distinctive Properties: Crystal shape, similarity between color and interference color, high relief		
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