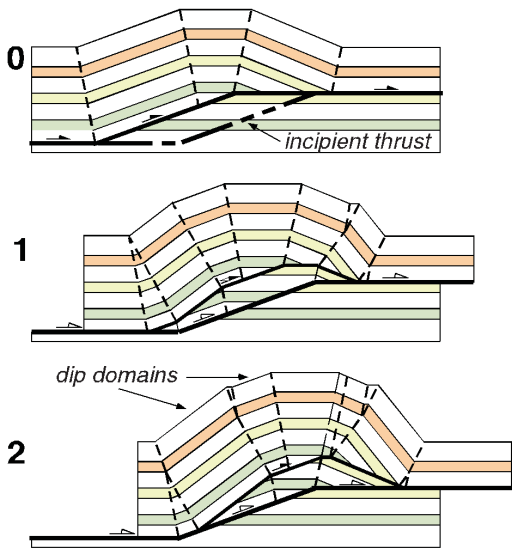


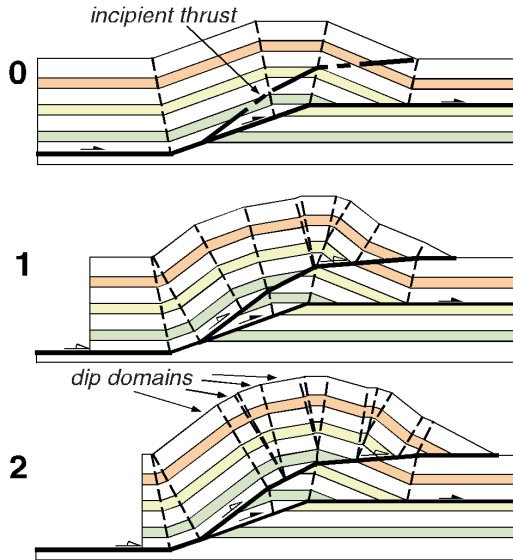
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## ***Kinematic Models***

### **Break-forward imbricate**



### **Break-backward imbricate**



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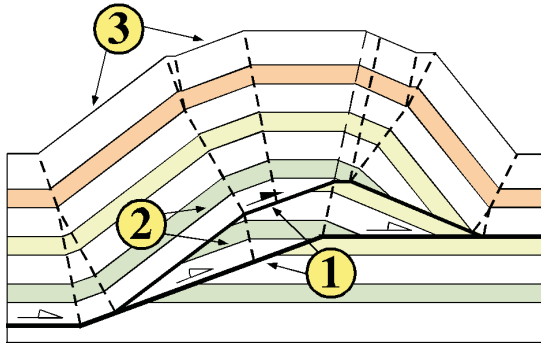
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## ***Common characteristics***

Imbricate fault-bend folds typically contain:

- 1) Two or more vertically stacked thrust ramps;
- 2) Bedding dips that change across thrust ramps; and
- 3) Fold limbs at high structural levels with multiple dip domains, reflecting refolding caused by multiple ramps. (Note: multiple dip domains may also be produced by multi-bend fault-bend folds, see section 1B-1).

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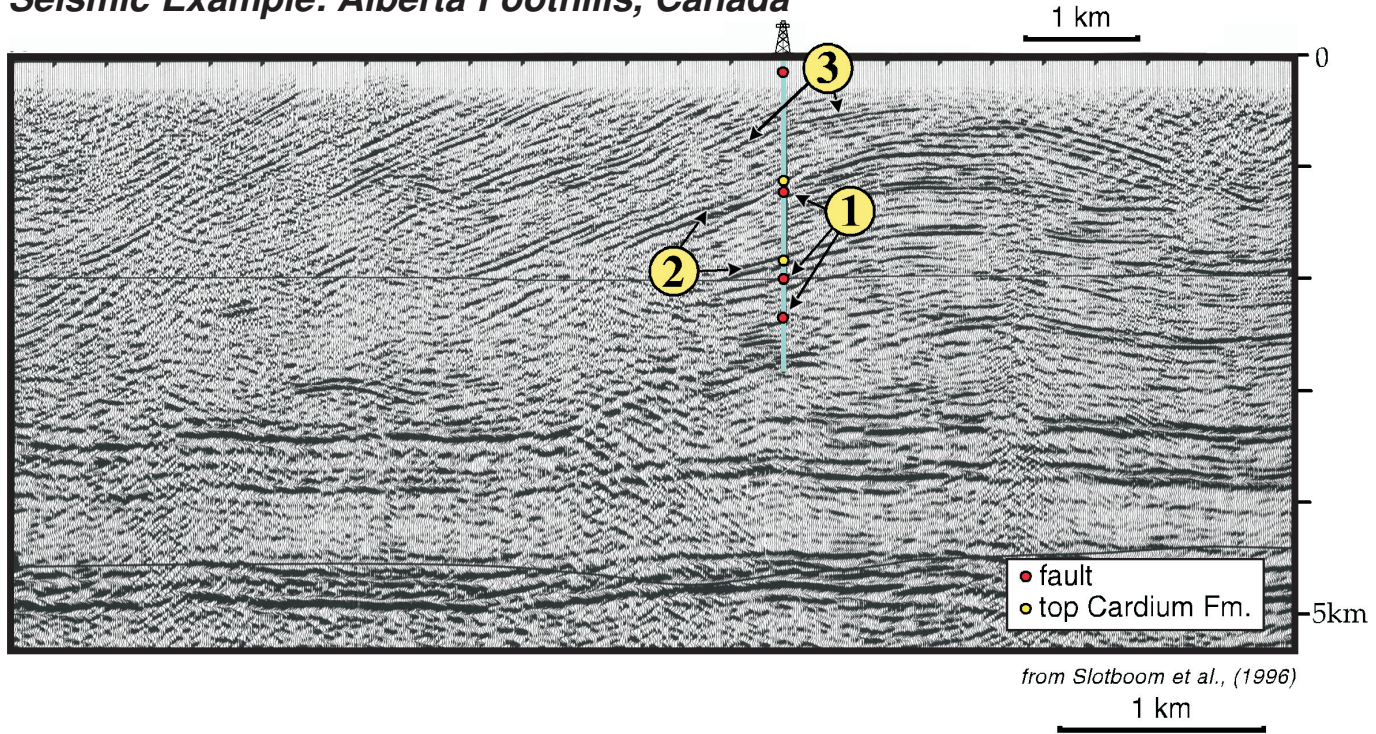
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## *Seismic Example: Alberta Foothills, Canada*



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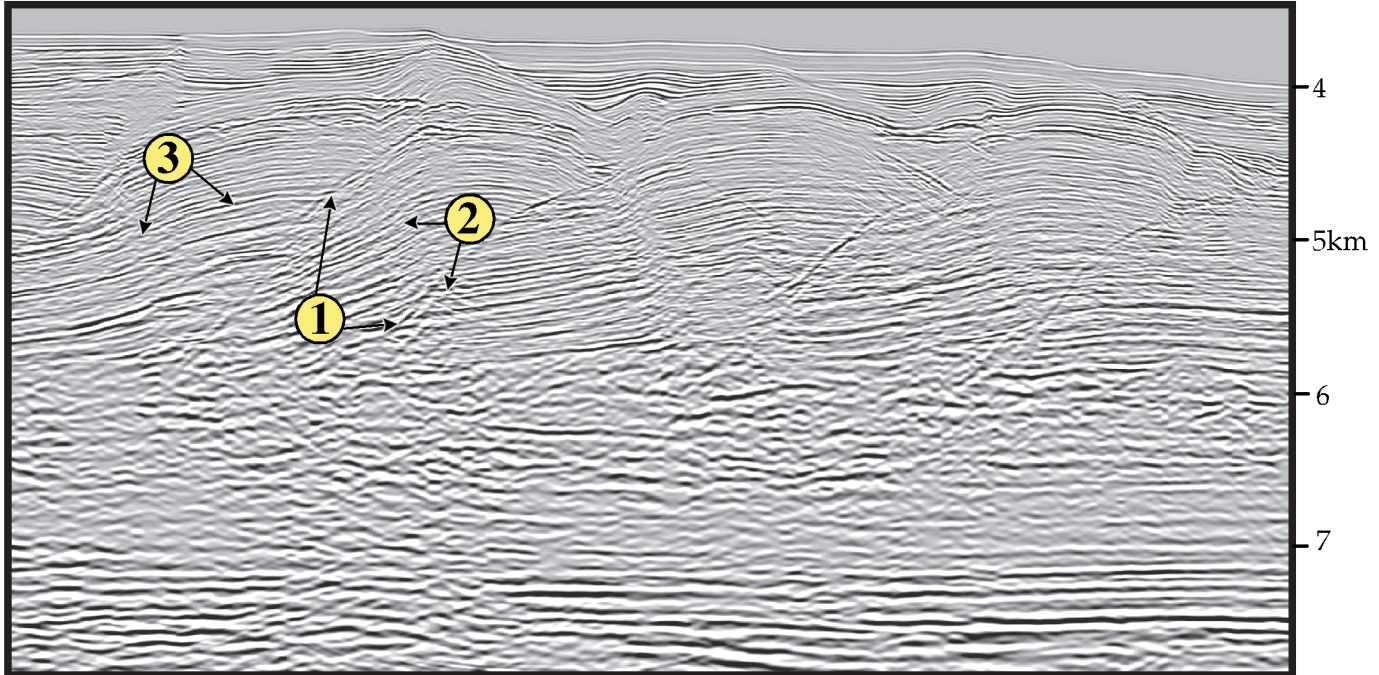
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## *Seismic Example: Niger Delta, Nigeria*



VE is 1.35:1

Data courtesy of VERITAS

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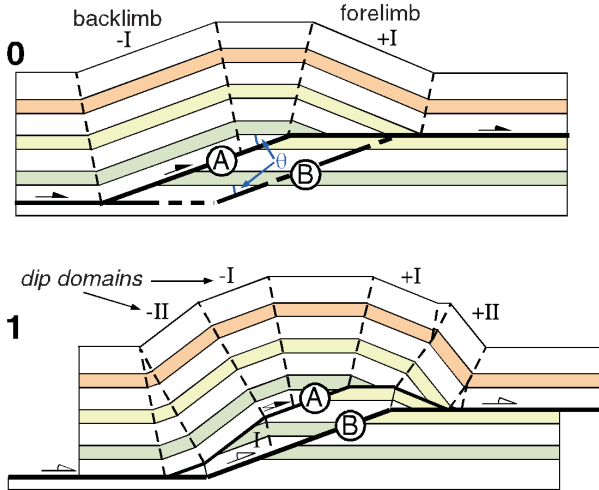
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# Interpreting break-forward imbricate structures using fault-bend fold theory

## Theory



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# Interpreting break-forward imbricate structures using fault-bend fold theory

Forelimb Dips (+)							<i>Fundamental Cut-off Angle<sup>o</sup> θ</i>	Backlimb Dips (-)						
VII	VI	V	IV	III	II	I		I	II	III	IV	V	VI	VII
61.6°	52.5°	43.0°	34.0°	25.2°	16.6°	8.2°	8°	8°	15.9°	23.4°	30.6°	37.3°	43.5°	49.3°
70.2°	59.2°	48.6°	38.3°	28.3°	18.6°	9.2°	9°	9°	17.8°	26.2°	34.0°	41.3°	47.9°	53.9°
80.6°	67.6°	55.2°	43.3°	31.9°	20.9°	10.3°	10°	10°	19.7°	28.9°	37.4°	45.1°	52.0°	58.2°
93.1°	77.3°	62.6°	48.8°	35.7°	23.3°	11.4°	11°	11°	21.6°	31.5°	40.6°	48.7°	55.9°	62.2°
109°	88.8°	71.0°	54.8°	39.8°	25.8°	12.6°	12°	12°	23.5°	34.1°	43.7°	52.1°	59.5°	65.9°
128°	102°	80.5°	61.5°	44.3°	28.5°	13.8°	13°	13°	25.4°	36.7°	46.7°	55.4°	62.9°	69.4°
160°	119°	91.3°	68.6°	48.9°	31.2°	15.0°	14°	14°	27.2°	39.1°	49.5°	58.4°	66.1°	72.5°
-*	146°	104°	76.3°	53.6°	33.9°	16.2°	15°	15°	29.1°	41.5°	52.3°	61.4°	69.0°	75.5°
	-*	124°	85.9°	59.0°	36.8°	17.4°	16°	16°	30.9°	43.9°	54.9°	64.1°	-*	
		-*	99.2°	65.6°	40.2°	18.8°	17°	17°	32.7°	46.2°	57.5°	-*		
		-*	123°	73.1°	43.7°	20.2°	18°	18°	34.4°	48.4°	59.9°	-*		
			-*	82.2°	47.4°	21.6°	19°	19°	36.2°	50.6°	-*			
			-*	97.6°	52.0°	23.2°	20°	20°	37.9°	52.7°	-*			
				-*	57.0°	24.8°	21°	21°	39.6°	-*				
				-*	63.6°	26.6°	22°	22°	41.3°	-*				
				-*	72.0°	28.4°	23°	23°	42.9°	-*				
					-*	30.4°	24°	24°	-*					

\* bed thinning required

from Suppe (1983)

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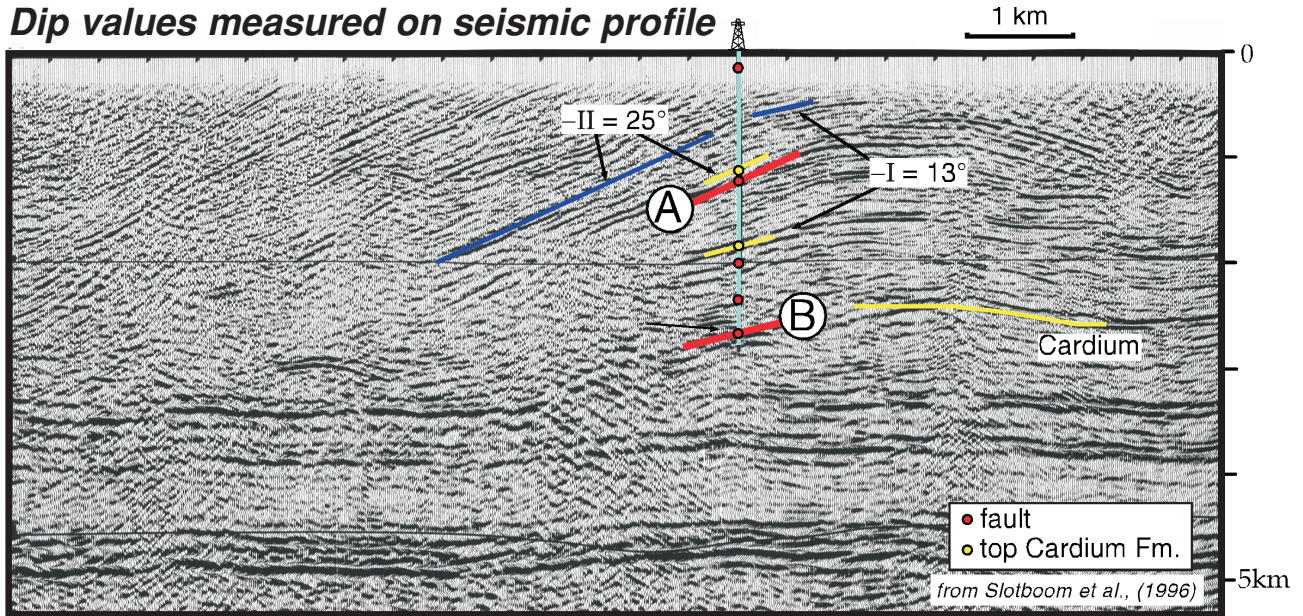
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*Dip values measured on seismic profile*



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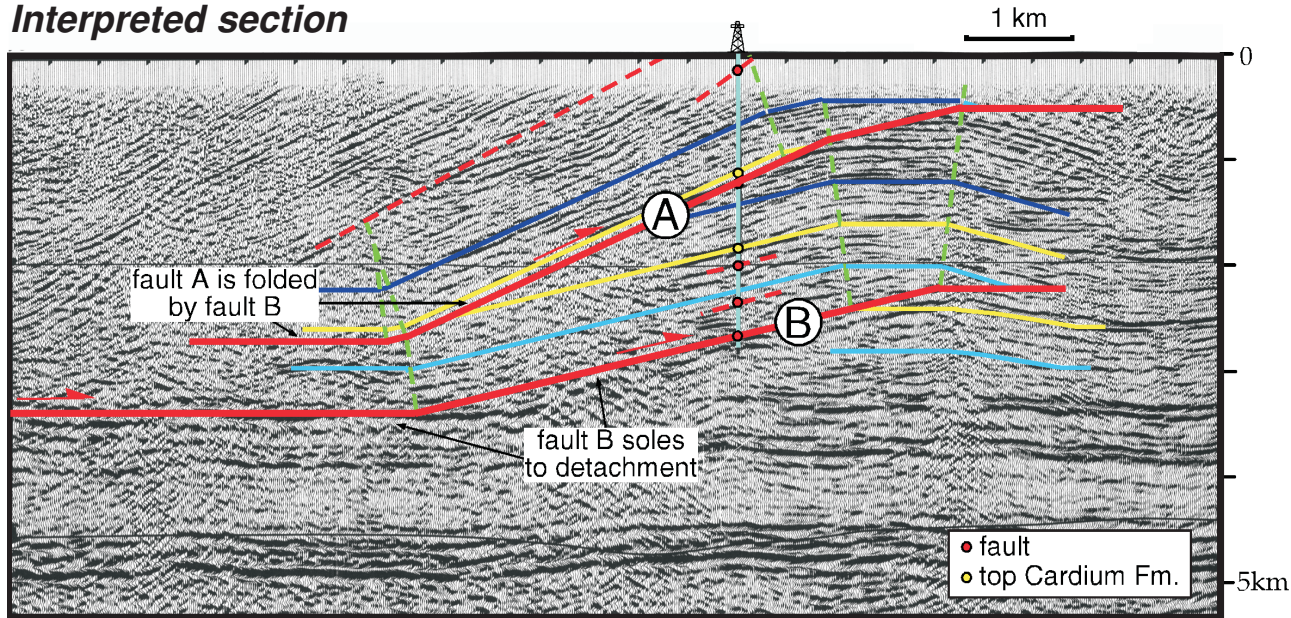
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## *Interpreted section*



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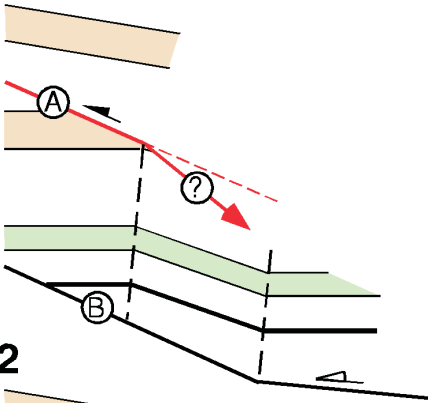
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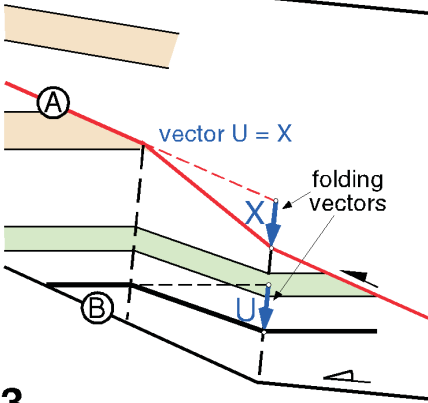
# Interpreting break-forward imbricate structures using folding vectors

## Using folding vectors

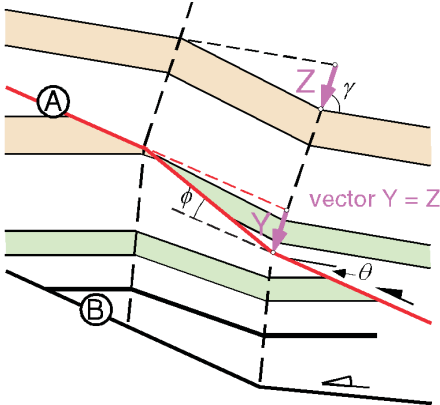
1



2



3



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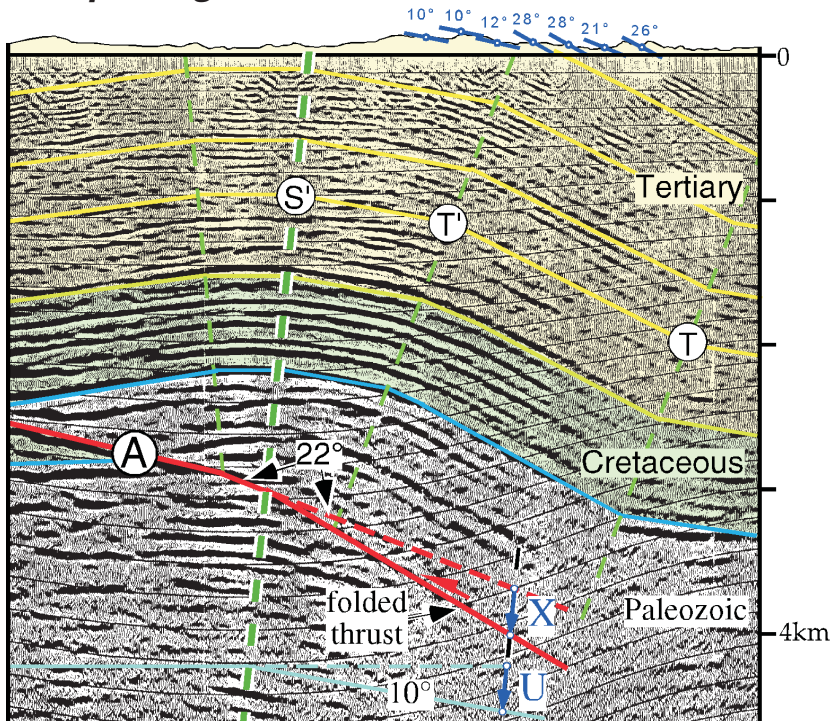
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# Interpreting break-forward imbricate structures using folding vectors

## *Interpreting a folded thrust*



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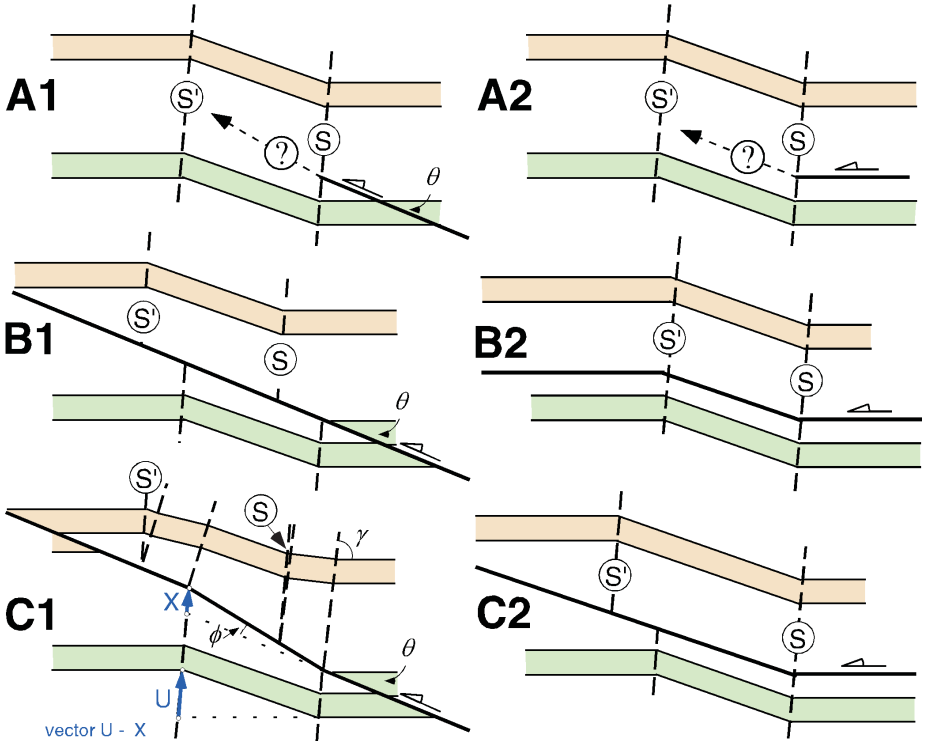
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# Recognizing break-back thrusting

## Patterns of fault cutting older fold limbs



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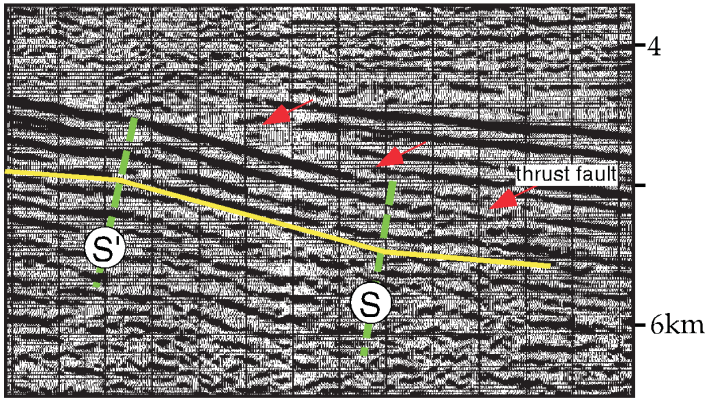
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# Recognizing break-back thrusting

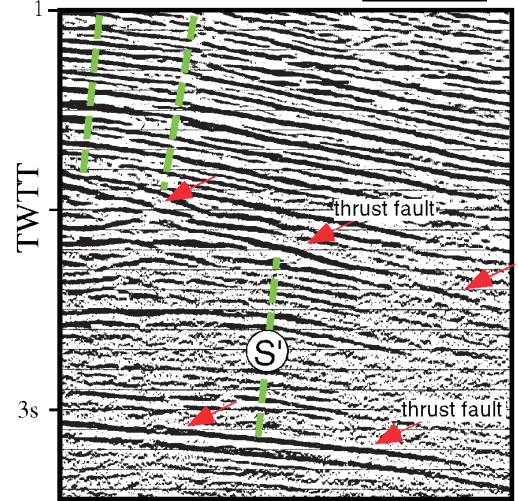
## Patterns of break-backward thrusting in seismic data

**A: Permian Basin, Texas, U.S.A.** 1 km



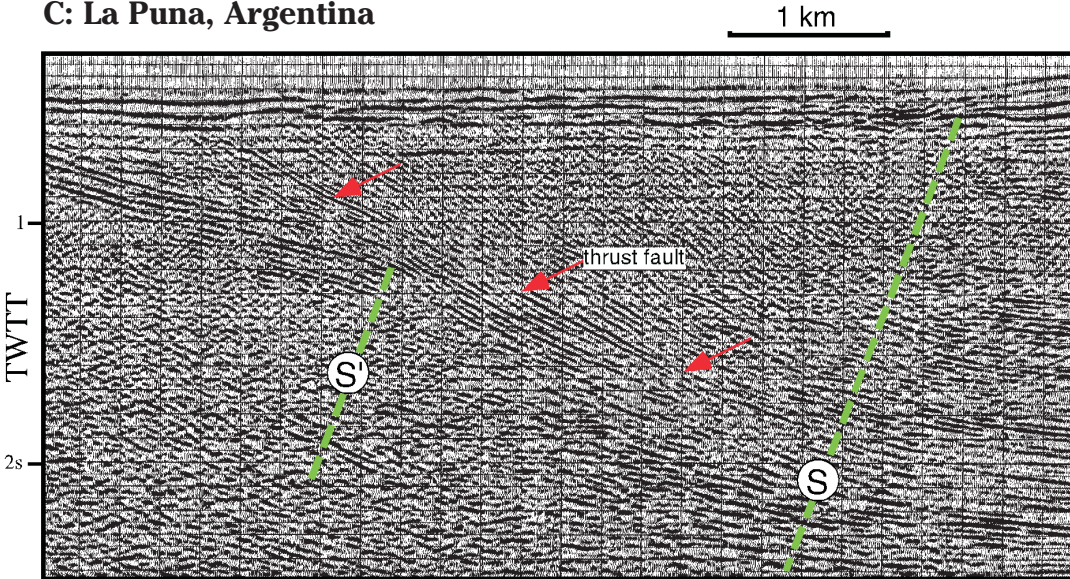
Data courtesy of Texaco, Inc.

**B: Peruvian Andes** 1 km



from Shaw et al., (1999), Data courtesy of PERUPETRO S.A

**C: La Puna, Argentina**



from Shaw et al., (1999), Data courtesy of Texaco, Inc.

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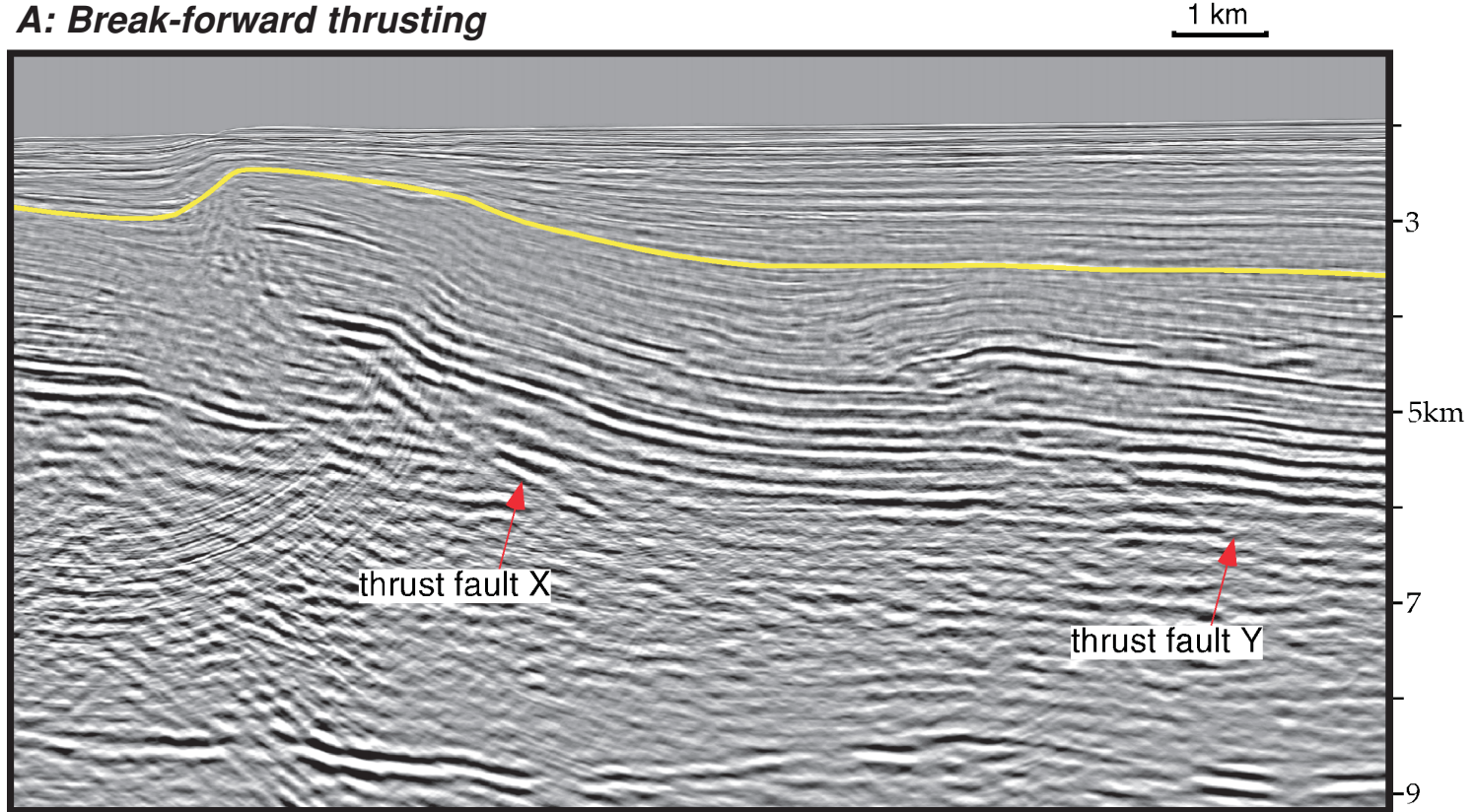
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# Determining thrusting sequence using growth strata

## A: Break-forward thrusting



from Corredor et al., (2002). Data courtesy of VERITAS

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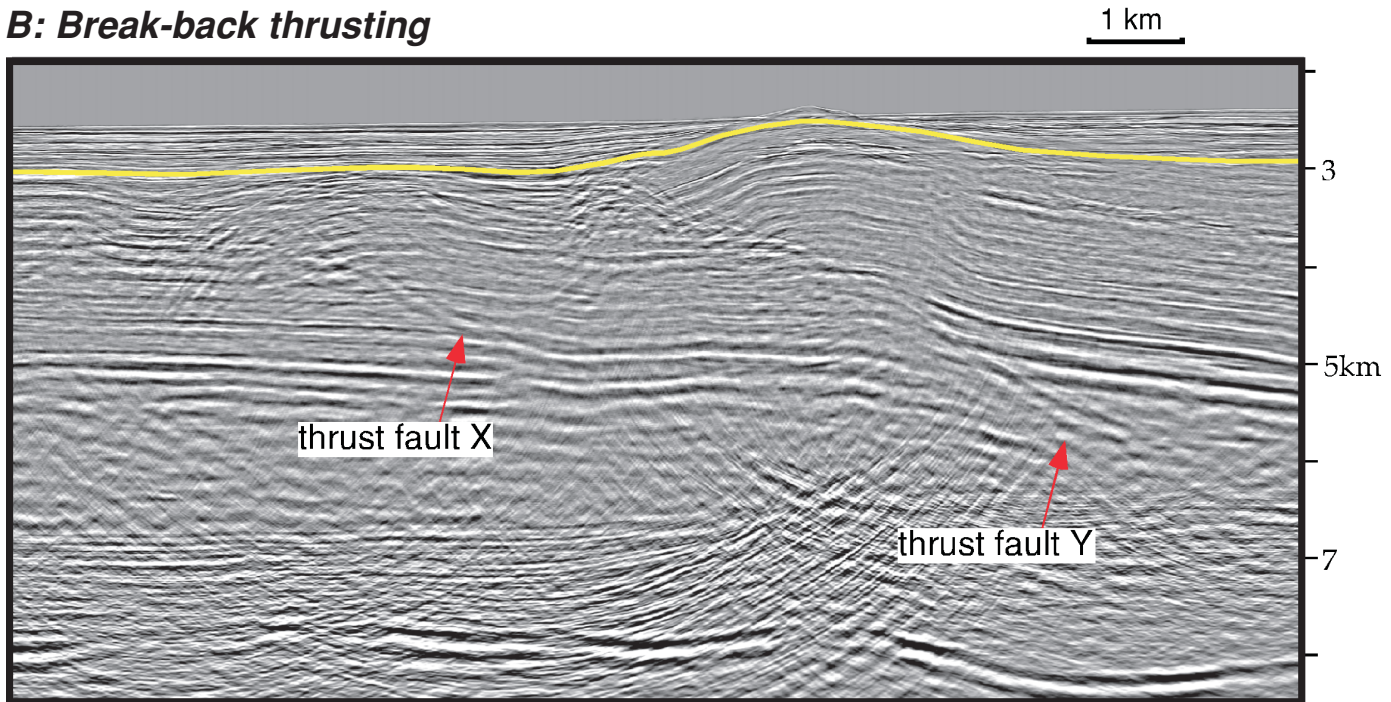
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# Determining thrusting sequence using growth strata

## ***B: Break-back thrusting***



*from Corredor et al., (2002). Data courtesy of VERITAS*

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