APPENDIX 20b

CLASSIFICATION AND REGRESSION TREE (CART) SENSITIVITY ANALYSIS
PREDICTING LITHOLOGY USING SECTION AND WELL DATA

Baeline Conceptual Model

Table of Contents

List of Tables

Baeline Conceptual Model

1. INTRODUCTION

This analysis was performed to understand the predictive powers and relationships between seven key geoscience parameters using Classification and Regression Tree Analysis (CART, see Section 7 of the main report). This statistical method used JMP Pro 9.0, part of the SAS Predictive Analytics Suite.

The following series of tables document the CART sensitivity analysis exploring all possibilities of the indicated parameters (Table 20a.1) for predicting lithology type using section and well data. Each parameter (response variable) is systematically removed from the analysis starting with one variable removed and ending with six out of the seven variables removed, Tables 20a.2 to 20a.7 for the section data and theTables 20a.8 to 20a13 for the well data. Parameters considered in the analysis are labeled in light purple, while if. parameter was used, the cell also has a X. The parameter that the analysis first splits on contains a red X. Parameters that have been removed from the analysis are blank (highlighted white).

The R^2 value corresponds to the accuracy of CART to predict lithology type along the key cross-sections (Section Data) and by wells (Well Data) according to the divisions of the data used. All values over **0.6** are bolded. A color scheme (green-yellow-orange-red) distinguishes the relative range of R^2 values per individual analysis, with red representing high values, and green representing low values. The # of splits was recorded as each analysis was terminated due to the split history curve "leveling out" and the R^2 value not increasing substantially as the analysis continued to split on the remaining data. The analysis was also terminated if the cross-validation curve (a seperate automatic analysis performed with a sub-set of the remaining data) was not in agreement with the expressed R^2 value.

Table 20a.1. Geoscience parameters considered in the CART sensitivity analysis

Parameter	Description
Lith	Lithology, specifically referring to a lithologic unit
Vp	Seismic parameter: P-wave velocity
Resistivity	Magneto-telluric data
CSC	Coulomb Stress Change derived from modeled stress data
Dilatation	Dilatation derived from modeled stress data
VertStress	Vertical Stress: calculated parameter
Grav_Mag	Combined Gravity and Magnetic inferred Lithologic Unit
Temp	Temperature derived from thermal models

Table 20b.2. CART Sensitivity Analysis for Prediction of Lithology Using Section Data and Removing One Variable for Each Case Analyzed. The Base Case Is where No Variable is Removed.

	Variable Considered
	Variable Removed

Predictor	**Response Variables** (**X** Used, **X** First Split)							R^2 Value	Splits
Lith.	Vp	Resistivity	CSC	Dilatation	VertStress	Grav_Mag	Temp		
Case 1: All Variables Considered with each parameter systematically removed									
---				X	X			**0.631**	6
---				X	X			**0.627**	6
---				X	X			**0.655**	7
---	X	X		X		X		0.438	6
---		X			X	X		0.613	7
---				X	X			**0.647**	7
---				X	X			**0.627**	6
---				X	X			0.632	6

Table 20b.3. CART Sensitivity Analysis for Prediction of Lithology Using Section Data and Removing Two Variables for Each Case Analyzed.

	Variable Considered
	Variable Removed
	Baseline Case

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilatation	VertStress	Grav_Mag	Temp		
Case 1. All Variables excluding Temperature (Temp) + one variable									
				X	X			**0.627**	6
				X	X			**0.628**	6
	X	X		X		X		0.443	6
		X			X	X		0.594	6
				X	X			**0.630**	6
				X	X			**0.628**	6
				X	X			**0.631**	6
Case 2. All Variables excluding Gravity and Magnetic inferred Lithology (Grav_Mag) + one variable									
				X	X			**0.655**	7
				X	X			**0.628**	6
	X	X		X			X	0.453	8
		X			X			0.541	5
				X	X			**0.634**	6
				X	X			**0.652**	7
				X	X			**0.634**	6
Case 3. All Variables excluding Vertical Stress (VertStress) + one variable									
	X	X		X		X		0.438	6
	X	X		X		X		0.413	4
	X	X		X			X	0.453	8
	X	X				X		0.384	4
	X	X		X		X	X	0.449	6
	X			X		X		0.420	4
		X		X		X	X	0.401	6
Case 4. All Variables excluding Dilatation + one variable									
		X			X	X		**0.613**	7
		X			X	X		0.594	6
		X			X			0.541	5
	X	X				X		0.384	4
		X			X	X		0.590	6
					X	X		0.559	5
		X			X	X		0.592	6
Case 5. All Variables excluding Coulomb Stress Change (CSC) + one variable									
				X	X			**0.647**	7
				X	X			**0.630**	6
				X	X			**0.634**	6
	X	X		X		X	X	0.449	6
		X			X	X		0.590	6
				X	X			**0.651**	7
				X	X			**0.630**	6

Table 20b.3. CART Sensitivity Analysis for Prediction of Lithology Using Section Data and Removing Two Variables for Each Case Analyzed. The Base Case Is where only One Variable Is Removed.

	Variable Considered
	Variable Removed
	Baseline Case

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilatation	VertStress	Grav_Mag	Temp		
Case 6. All Variables excluding Resistivity + one variable									
				X	X			**0.627**	6
				X	X			**0.628**	6
				X	X			**0.652**	7
	X			X		X		0.420	4
					X	X		0.559	5
				X	X			**0.651**	7
				X	X			**0.653**	7
Case 7. All Variables excluding P-wave velocity (Vp) + one variable									
				X	X			**0.632**	6
				X	X			**0.631**	6
				X	X			**0.634**	6
		X		X		X	X	0.401	6
		X			X	X		0.592	6
				X	X			**0.630**	6
				X	X			**0.653**	7

Table 20b.4 CART Sensitivity Analysis for Prediction of Lithology Using Section Data and Removing Three Variables for Each Case Analyzed. The Base Case Is where Three Variables Are Removed

Variable Considered

Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilat	VertStress	Grav_Mag	Temp		
Case 1. Removal of Temperature (Temp) plus two variables									
---	X	X	X	X				0.384	5
---		X	X		X			**0.604**	8
---		X		X	X			**0.665**	8
---				X	X			**0.664**	8
---				X	X			**0.663**	8
---	X	X				X		0.403	5
---	X	X		X		X		0.433	6
---	X			X		X		0.368	6
---		X		X		X		0.376	6
---		X			X	X		**0.635**	8
---			X		X	X		**0.621**	8
---		X			X	X		**0.636**	8
---				X	X			**0.662**	8
---		X		X	X			**0.663**	8
---				X	X			**0.664**	8
Case 2. Removal of Gravity and Magnetic inferred Lithology (Grav_Mag) plus two variables									
---	X	X	X	X				0.384	5
---		X	X		X			**0.604**	8
---		X		X	X			**0.665**	8
---				X	X			**0.664**	8
---				X	X			**0.663**	8
---	X	X					X	0.365	4
---	X	X		X				0.383	4
---	X			X				0.407	6
---		X		X			X	0.408	7
---		X			X			**0.611**	8
---			X		X			0.578	7
---		X	X		X			**0.615**	8
---				X	X			**0.653**	7
---				X	X			**0.629**	6
---				X	X			**0.654**	7
Case 3. Removal of Vertical Stress (VertStress) plus two variables									
---	X	X	X	X				0.384	5
---	X	X				X		0.403	5
---	X	X		X		X		0.433	6
---	X			X		X		0.368	6
---		X		X		X		0.376	6
---	X	X					X	0.365	4
---	X	X		X				0.383	4

Table 20b.4 CART Sensitivity Analysis for Prediction of Lithology Using Section Data and Removing Three Variables for Each Case Analyzed. The Base Case Is where Three Variables Are Removed

Variable Considered

Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilat	VertStress	Grav_Mag	Temp		
---	X			X				0.407	6
---		X		X			X	0.408	7
---	X	X				X	X	0.423	7
---	X		X			X		0.385	4
---		X				X	X	0.367	5
---	X			X		X		0.416	4
---		X		X		X	X	0.388	5
---				X		X	X	0.393	5
Case 4. Removal of Dilatation plus two variables									
---		X	X		X			**0.604**	8
---	X	X				X		0.403	5
---		X			X	X		**0.635**	8
---			X		X	X		**0.621**	8
---		X			X	X		**0.636**	8
---	X	X					X	0.365	4
---		X			X			**0.611**	8
---			X		X			0.578	7
---		X	X		X			**0.615**	8
---	X	X				X	X	0.423	7
---	X		X			X		0.385	4
---		X				X	X	0.367	5
---					X	X		0.555	5
---		X			X	X		0.553	4
---					X	X		0.523	4
Case 5. Removal of Coulomb Stress Change (CSC) plus two variables									
---		X		X	X			**0.665**	8
---	X	X		X		X		0.433	6
---		X			X	X		**0.635**	8
---				X	X			**0.662**	8
---		X		X	X			**0.663**	8
---	X	X		X				0.383	4
---		X			X			**0.611**	8
---				X	X			**0.653**	7
---				X	X			**0.629**	6
---	X	X				X	X	0.423	7
---	X			X		X		0.416	4
---		X		X		X	X	0.388	5
---					X	X		0.555	5
---		X			X	X		0.553	4
---				X	X			**0.654**	7
Case 6. Removal of Resisitivity plus two variables									
---				X	X			**0.664**	8
---	X			X		X		0.368	6

Table 20b.4 CART Sensitivity Analysis for Prediction of Lithology Using Section Data and Removing Three Variables for Each Case Analyzed. The Base Case Is where Three Variables Are Removed

Variable Considered

Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilat	VertStress	Grav_Mag	Temp		
---			X		X	X		**0.621**	8
---				X	X			**0.662**	8
---				X	X			**0.664**	8
---	X			X				0.407	6
---			X		X			0.578	7
---				X	X			**0.653**	7
---				X	X			**0.654**	7
---	X		X			X		0.385	4
---	X			X		X		0.416	4
---				X		X	X	0.393	5
---					X	X		0.555	5
---					X	X		0.523	4
---				X	X			**0.654**	7
Case 7. Removal of P-wave velocity (Vp) plus two variables									
---				X	X			**0.663**	8
---		X		X		X		0.376	6
---		X			X	X		**0.636**	8
---		X		X	X			**0.663**	8
---				X	X			**0.664**	8
---		X		X			X	0.408	7
---		X	X		X			**0.615**	8
---				X	X			**0.629**	6
---				X	X			**0.654**	7
---		X				X	X	0.367	5
---		X		X		X	X	0.388	5
---				X		X	X	0.393	5
---		X			X	X		0.553	4
---					X	X		0.523	4
---				X	X			**0.654**	7

Table 20b.5. CART Sensitivity Analysis for Prediction of Lithology Using Section Data and Removing Four Variables for Each Case Analyzed.

Variable Considered

Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilat	VertStress	Grav_Mag	Temp		
Case 1. Removal of Temperature plus three other variables									
---	X	X	X					0.369	5
---	X	X		X				0.397	5
---	X			X				0.391	5
---		X	X	X				0.318	5
---		X			X			0.563	6
---			X		X			0.558	6
---		X			X			0.586	7
---				X	X			**0.660**	8
---				X	X			**0.653**	7
---				X	X			**0.650**	7
---	X	X				X		0.406	5
---	X		X			X		0.406	5
---		X	X			X		0.334	4
---	X			X		X		0.421	4
---		X		X		X		0.384	7
---			X	X		X		0.413	7
---	X				X	X		0.588	7
---		X			X	X		**0.625**	8
---			X		X	X		**0.601**	7
---				X	X			**0.653**	7
Case 2. Removal of Grav_Mag plus three other variables									
---	X	X	X					0.369	5
---	X	X		X				0.397	5
---	X			X				0.391	5
---		X	X	X				0.318	5
---		X			X			0.563	6
---			X		X			0.558	6
---		X			X			0.586	7
---				X	X			**0.660**	8
---				X	X			**0.653**	7
---				X	X			**0.650**	7
---	X	X					X	0.382	5
---	X		X				X	0.344	5
---		X	X				X	0.333	4
---	X			X			X	0.412	6
---		X		X			X	0.396	6
---			X	X			X	0.402	7
---					X			0.484	4
---		X			X			0.563	6
---			X		X			0.577	7
---				X	X			**0.654**	7

Table 20b.5. CART Sensitivity Analysis for Prediction of Lithology Using Section Data and Removing Four Variables for Each Case Analyzed.

Variable Considered

Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilat	VertStress	Grav_Mag	Temp		
Case 3. Removal of Vertical Stress plus three other variables									
---	X	X	X					0.369	5
---	X	X		X				0.397	5
---	X			X				0.391	5
---		X	X	X				0.318	5
---	X	X				X		0.406	5
---	X		X			X		0.406	5
---		X	X			X		0.334	4
---	X			X		X		0.421	4
---		X		X		X		0.384	7
---			X	X		X		0.413	7
---	X	X					X	0.382	5
---	X		X				X	0.344	5
---		X	X				X	0.333	4
---	X			X			X	0.412	6
---		X		X			X	0.396	6
---			X	X			X	0.402	7
---	X					X	X	0.375	5
---		X				X	X	0.371	6
---			X			X	X	0.384	6
---				X		X	X	0.409	6
Case 4. Removal of Dilatation plus three other variables									
---	X	X	X					0.369	5
---		X			X			0.563	6
---			X		X			0.558	6
---		X			X			0.586	7
---	X	X				X		0.406	5
---	X		X			X		0.406	5
---		X	X			X		0.334	4
---	X				X	X		0.588	7
---		X			X	X		**0.625**	8
---			X		X	X		**0.601**	7
	X	X					X	0.382	5
---	X		X				X	0.344	5
---		X	X				X	0.333	4
---					X			0.484	4
---		X			X			0.563	6
---			X		X			0.577	7
---	X					X	X	0.375	5
---		X				X	X	0.371	6

Table 20b.5. CART Sensitivity Analysis for Prediction of Lithology Using Section Data and Removing Four Variables for Each Case Analyzed.

Variable Considered

Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilat	VertStress	Grav_Mag	Temp		
---			X			X	X	0.384	6
---					X	X		**0.606**	8
Case 5.Removal of CSC and three other variables									
---	X	X		X				0.397	5
---		X			X			0.563	6
---				X	X			**0.660**	8
---				X	X			**0.653**	7
---	X	X				X		0.406	5
---	X			X		X		0.406	5
---		X		X		X		0.334	4
---	X				X	X		0.588	7
---		X			X	X		**0.625**	8
---				X	X			**0.653**	7
---	X	X					X	0.382	5
---	X			X			X	0.412	6
---		X		X			X	0.396	6
---					X			0.484	4
---		X			X			0.563	6
---				X	X			**0.654**	7
---	X					X	X	0.375	5
---		X				X	X	0.371	6
---				X		X	X	0.409	6
---					X	X		**0.606**	8
Case 6. Removal of Resistivity plus three other variables									
---	X			X				0.391	5
---			X		X			0.558	6
---				X	X			**0.660**	8
---				X	X			**0.650**	7
---	X		X			X		0.406	5
---	X			X		X		0.421	4
---			X	X		X		0.413	7
---	X				X	X		0.588	7
---			X		X	X		**0.601**	7
---				X	X			**0.653**	7
---	X		X				X	0.344	5
---	X			X			X	0.412	6
---			X	X			X	0.402	7
---					X			0.484	4
---			X		X			0.577	7
---				X	X			**0.654**	7

Table 20b.5. CART Sensitivity Analysis for Prediction of Lithology Using Section Data and Removing Four Variables for Each Case Analyzed.

Variable Considered
Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilat	VertStress	Grav_Mag	Temp		
---	X					X	X	0.375	5
---			X			X	X	0.384	6
---				X		X	X	0.409	6
---					X	X		**0.606**	8
Case 7. Removal of Vp plus three other variables									
---		X	X	X				0.318	5
---		X			X			0.586	7
---				X	X			**0.653**	7
---				X	X			**0.650**	7
---		X	X			X		0.334	4
---		X		X		X		0.384	7
---			X	X		X		0.413	7
---		X			X	X		**0.625**	8
---			X		X	X		**0.601**	7
---				X	X			**0.653**	7
---		X	X				X	0.333	4
---		X		X			X	0.396	6
---			X	X			X	0.402	7
---		X			X			0.563	6
---			X		X			0.577	7
---				X	X			**0.654**	7
---		X				X	X	0.371	6
---			X			X	X	0.384	6
---				X		X	X	0.409	6
---					X	X		**0.606**	8

Table 20b.6. CART Sensitivity Analysis for Prediction of Lithology Using Section Data and Removing Five Variables for Each Case Analyzed.

Variable Considered

Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilat	VertStress	Grav_Mag	Temp		
Case 1. Removal of Temperature plus four other variables									
---	X	X						0.314	3
---	X		X					0.325	4
---		X	X					0.255	3
---	X			X				0.406	6
---		X		X				0.312	5
---			X	X				0.303	5
---	X				X			0.525	6
---		X			X			0.586	7
---			X		X			0.579	7
---				X	X			**0.656**	7
---	X					X		0.376	4
---		X				X		0.32	3
---			X			X		0.31	4
---				X		X		0.374	5
---					X	X		0.569	6
Case 2. Removal of Grav_Mag plus four other variables									
---	X	X						0.314	3
---	X		X					0.325	4
---		X	X					0.255	3
---	X			X				0.406	6
---		X		X				0.312	5
---			X	X				0.303	5
---	X				X			0.525	6
---		X			X			0.586	7
---			X		X			0.579	7
---				X	X			**0.656**	7
---	X						X	0.278	3
---		X					X	0.357	5
---			X				X	0.307	4
---				X			X	0.38	6
---					X			0.505	5
Case 3. Removal of Vertical Stress plus four other variables									
---	X	X						0.314	3
---	X		X					0.325	4
---		X	X					0.255	3
---	X			X				0.406	6
---		X		X				0.312	5
---			X	X				0.303	5
---	X					X		0.376	4
---		X				X		0.32	3
---			X			X		0.31	4
---				X		X		0.374	5
---	X						X	0.278	3
---		X					X	0.357	5
			X				X	0.307	4

Table 20b.6. CART Sensitivity Analysis for Prediction of Lithology Using Section Data and Removing Five Variables for Each Case Analyzed.

	Variable Considered
	Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilat	VertStress	Grav_Mag	Temp		
---				X			X	0.38	6
---						X	X	0.344	4
Case 4. Removal of Dilatation plus four other variables									
---	X	X						0.314	3
---	X		X					0.325	4
---		X	X					0.255	3
---	X				X			0.525	6
---		X			X			0.586	7
---			X		X			0.579	7
---	X					X		0.376	4
---		X				X		0.32	3
---			X			X		0.31	4
---					X	X		0.569	6
---	X						X	0.278	3
---		X					X	0.357	5
---			X				X	0.307	4
---					X			0.505	5
---						X	X	0.344	4
Case 5. Removal of CSC plus four other variables									
---	X	X						0.314	3
	X			X				0.406	6
---		X		X				0.312	5
---	X				X			0.525	6
---		X			X			0.586	7
---				X	X			**0.656**	7
---	X					X		0.376	4
---		X				X		0.32	3
---				X		X		0.374	5
---					X	X		0.569	6
---	X						X	0.278	3
---		X					X	0.357	5
---				X			X	0.38	6
---					X			0.505	5
---						X	X	0.344	4
Case 6. Removal of Resistivity plus four other variables									
---	X		X					0.325	4
---	X			X				0.406	6
---			X	X				0.303	5
---	X				X			0.525	6
---			X		X			0.579	7
---				X	X			**0.656**	7
---	X					X		0.376	4
---			X			X		0.31	4

Table 20b.6. CART Sensitivity Analysis for Prediction of Lithology Using Section Data and Removing Five Variables for Each Case Analyzed.

Variable Considered

Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilat	VertStress	Grav_Mag	Temp		
---				X		X		0.374	5
---					X	X		0.569	6
---	X						X	0.278	3
---			X				X	0.307	4
---				X			X	0.38	6
---					X			0.505	5
---						X	X	0.344	4
Case 7. Removal of Vp plus four other variables									
---		X	X					0.255	3
---		X		X				0.312	5
---			X	X				0.303	5
---		X			X			0.586	7
---			X		X			0.579	7
---				X	X			**0.656**	7
---		X				X		0.32	3
---			X			X		0.31	4
				X		X		0.374	5
---					X	X		0.569	6
---		X					X	0.357	5
---			X				X	0.307	4
---				X			X	0.38	6
---					X			0.505	5
---						X	X	0.344	4

Table 20b.7. CART Sensitivity Analysis for Prediction of Lithology Using Section Data and Removing Six Variables for Each Case Analyzed.

	Variable Considered
	Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilat	VertStress	Grav_Mag	Temp		
Case 1. Removal of six variables systematically									
---							X	0.254	3
---						X		0.263	2
---					X			0.507	5
---				X				0.277	4
---			X					0.181	4
---		X						0.234	4
---	X							0.283	3

Table 20b.8. CART Sensitivity Analysis for Prediction of Lithology Using Well Data and Removing One Variable for Each Case Analyzed

	Variable Considered
	Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilat	VertStress	Grav_Mag	Temp		
Case 1: All Variables Considered with each parameter systematically removed									
---	X			X	X			**0.611**	6
---	X			X	X			**0.611**	6
---	X			X	X			**0.611**	6
---	X	X	X			X		0.521	7
---	X	X			X			0.593	6
---	X			X	X			**0.611**	6
---	X			X	X			**0.611**	6
---				X	X			0.577	5

Table 20b.9. CART Sensitivity Analysis for Prediction of Lithology Using Well Data and Removing Two Variables for Each Case Analyzed.

	Variable Considered
	Variable Removed
	Base Case

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilatation	VertStress	Grav_Mag	Temp		
Case 1. All Variables excluding Temperature + one variable									
	X			X	X			**0.611**	6
	X			X	X			**0.611**	6
	X	X				X		0.491	6
		X			X			0.562	5
	X			X	X			**0.611**	6
	X			X	X			**0.611**	6
				X	X			0.580	5
Case 2. All Variables excluding Grav_Mag + one variable									
	X			X	X			**0.611**	6
	X			X	X			**0.611**	6
	X		X	X			X	0.463	5
	X	X			X			0.593	6
	X			X	X			**0.611**	6
	X			X	X			**0.611**	6
				X	X			0.577	5
Case 3. All Variables excluding Vertical Stress + one variable									
	X	X	X			X		0.521	7
	X	X				X		0.491	6
	X		X	X			X	0.463	5
	X	X	X			X		0.529	7
	X	X		X		X		0.494	6
	X		X	X		X		0.481	6
		X	X			X	X	0.447	6
Case 4. All Variables excluding Dilatation + one variable									
	X	X			X			0.593	6
		X			X			0.562	5
	X	X			X			0.593	6
	X	X	X			X		0.529	7
	X	X			X			0.594	6
	X				X	X		**0.602**	6
		X			X			0.562	5
Case 5. All Variables excluding Coulomb Stress Change (CSC) + one variable									
	X			X	X			**0.611**	6
	X			X	X			**0.611**	6
	X			X	X			**0.611**	6
	X	X		X		X		0.494	6
	X	X			X			0.594	6
	X			X	X			**0.609**	6
				X	X			0.597	6

Table 20b.9. CART Sensitivity Analysis for Prediction of Lithology Using Well Data and Removing Two Variables for Each Case Analyzed.

	Variable Considered
	Variable Removed
	Base Case

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilatation	VertStress	Grav_Mag	Temp		
Case 6. All Variables excluding Resistivity + one variable									
	X			X	X			**0.611**	6
	X			X	X			**0.611**	6
	X			X	X			**0.611**	6
	X		X	X		X		0.481	6
	X				X	X		**0.602**	6
	X			X	X			**0.609**	6
				X	X			0.580	5
Case 7. All Variables excluding P-wave velocity (Vp) + one variable									
				X	X			0.577	5
				X	X			0.580	5
				X	X			0.577	5
		X	X			X	X	0.447	6
		X			X			0.562	5
				X	X			0.597	6
				X	X			0.580	5

Table 20b.10. CART Sensitivity Analysis for Prediction of Lithology Using Well Data and Removing Three Variables for Each Case Analyzed

Variable Considered

Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilatation	VertStress	Grav_Mag	Temp		
Case 1. Removal of Temperature plus two variables									
---	X	X	X	X				0.518	7
---	X	X			X			0.593	6
---	X			X	X			**0.611**	6
---	X			X	X			**0.611**	6
---				X	X			0.577	5
---	X	X				X		0.517	7
---	X	X		X		X		0.518	7
---	X		X			X		0.469	5
---		X	X			X		0.412	5
---	X	X			X			0.593	6
---	X				X	X		**0.621**	7
---		X			X			0.562	5
---	X			X	X			**0.611**	6
---				X	X			**0.613**	7
---				X	X			0.577	5
Case 2. Removal of Gravity and Magnetic inferred Lithology (Grav_Mag) plus two variables									
---	X	X	X	X				0.518	7
---	X	X			X			0.593	6
---	X			X	X			**0.611**	6
---	X			X	X			**0.611**	6
---				X	X			0.577	5
---	X		X				X	0.435	5
---	X	X		X			X	0.548	8
---	X		X	X			X	0.511	7
---		X	X	X			X	0.314	7
---	X	X			X			0.593	6
---	X		X		X			0.599	6
---		X			X			0.562	5
---	X			X	X			**0.644**	8
---				X	X			**0.618**	7
---			X	X	X			0.589	6
Case 3. Removal of Vertical Stress (VertStress) plus two variables									
---	X	X	X	X				0.518	7
---	X	X				X		0.517	7
---	X	X		X		X		0.518	7
---	X		X			X		0.469	5
---		X	X			X		0.412	5
---	X		X				X	0.435	5
---	X	X		X			X	0.548	8
---	X		X	X			X	0.511	7

Table 20b.10. CART Sensitivity Analysis for Prediction of Lithology Using Well Data and Removing Three Variables for Each Case Analyzed

Variable Considered

Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilatation	VertStress	Grav_Mag	Temp		
---		X	X	X			X	0.314	7
---	X	X				X		0.515	7
---	X		X			X		**0.600**	5
---		X	X			X	X	0.444	6
---	X			X		X		0.531	7
---		X		X		X	X	0.400	7
---			X	X		X		0.398	5
Case 4. Removal of Dilatation plus two variables									
---	X	X			X			0.593	6
---	X	X				X		0.517	7
---	X	X			X			0.593	6
---	X				X	X		**0.621**	7
---		X			X			0.562	5
---	X		X				X	0.435	5
---	X	X			X			0.593	6
---	X		X		X			0.599	6
---		X			X			0.562	5
---	X	X				X		0.515	7
---	X		X			X		**0.600**	5
---		X	X			X	X	0.444	6
---	X				X	X		**0.620**	7
---		X			X			0.562	5
---					X	X		0.570	5
Case 5. Removal of Coulomb Stress Change (CSC) plus two variables									
---	X			X	X			**0.611**	6
---	X	X		X		X		0.518	7
---	X	X			X			0.593	6
---	X			X	X			**0.611**	6
---				X	X			**0.613**	7
---	X	X		X			X	0.548	8
---	X	X			X			0.593	6
---	X			X	X			**0.611**	6
---				X	X			**0.618**	7
---	X	X				X		0.515	7
---	X			X		X		0.531	7
---		X		X		X	X	0.400	7
---	X				X	X		**0.620**	7
---		X			X			0.562	5
Case 6. Removal of Resisitivity plus two variables									
---	X			X	X			**0.611**	6
---	X		X			X		0.469	5
---	X				X	X		**0.621**	7
---	X			X	X			**0.611**	6
---				X	X			0.577	5

Table 20b.10. CART Sensitivity Analysis for Prediction of Lithology Using Well Data and Removing Three Variables for Each Case Analyzed

Variable Considered

Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilatation	VertStress	Grav_Mag	Temp		
---	X		X	X			X	0.511	7
---	X		X		X			0.599	6
---	X			X	X			**0.611**	6
---			X	X	X			0.589	6
---	X		X			X		**0.600**	5
---	X			X		X		0.531	7
---			X	X		X		0.398	5
---	X				X	X		**0.620**	7
---					X	X		0.570	5
---				X	X			**0.616**	7
Case 7. Removal of P-wave velocity (Vp) plus two variables									
---				X	X			0.577	5
---		X	X			X		0.412	5
---		X			X			0.562	5
---				X	X			**0.613**	7
---				X	X			0.577	5
---		X	X	X			X	0.314	7
---		X			X			0.562	5
---				X	X			**0.618**	7
---			X	X	X			0.589	6
---		X	X			X	X	0.444	6
---		X		X		X	X	0.400	7
---			X	X		X		0.398	5
---		X			X			0.562	5
---					X	X		0.570	5
---				X	X			**0.616**	7

Table 20b.11. CART Sensitivity Analysis for Prediction of Lithology Using Well Data and Removing Four Variables for Each Case Analyzed

Variable Considered

Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilatation	VertStress	Grav_Mag	Temp		
Case 1. Removal of Temperature plus three other variables									
---	X	X	X					0.475	7
---	X	X		X				0.542	8
---	X		X	X				0.522	7
---		X	X	X				0.341	7
---	X	X			X			**0.613**	7
---	X		X		X			0.599	6
---		X			X			0.562	5
---	X			X	X			**0.611**	6
---				X	X			**0.620**	7
---			X	X	X			0.597	7
---	X	X				X		0.518	7
---	X		X			X		0.550	9
---		X	X			X		0.422	5
---	X			X		X		0.514	7
---		X		X		X		0.376	6
---			X	X		X		0.472	8
---	X				X	X		**0.615**	7
---		X			X			0.562	5
---					X	X		0.584	6
---				X	X			0.597	6
Case 2. Removal of Grav_Mag plus three other variables									
---	X	X	X					0.475	7
---	X	X		X				0.542	8
---	X		X	X				0.522	7
---		X	X	X				0.341	7
---	X	X			X			**0.613**	7
---	X		X		X			0.599	6
---		X			X			0.562	5
---	X			X	X			**0.611**	6
---				X	X			**0.620**	7
---			X	X	X			0.597	7
---	X	X					X	0.398	4
---	X		X				X	0.448	6
---		X	X					0.276	6
---	X			X			X	0.549	8
---		X		X			X	0.294	7
---			X	X			X	0.341	9
---	X				X			0.570	5
---		X			X			0.562	5
---			X		X			0.567	5

Table 20b.11. CART Sensitivity Analysis for Prediction of Lithology Using Well Data and Removing Four Variables for Each Case Analyzed

Variable Considered

Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilatation	VertStress	Grav_Mag	Temp		
---				X	X			0.577	5
Case 3. Removal of Vertical Stress plus three other variables									
---	X	X	X					0.475	7
---	X	X		X				0.542	8
---	X		X	X				0.522	7
---		X	X	X				0.341	7
---	X	X				X		0.518	7
---	X		X			X		0.550	9
---		X	X			X		0.422	5
---	X			X		X		0.514	7
---		X		X		X		0.376	6
---			X	X		X		0.472	8
	X	X					X	0.398	4
---	X		X				X	0.448	6
---		X	X					0.276	6
---	X			X			X	0.549	8
---		X		X			X	0.294	7
---			X	X			X	0.341	9
---	X					X		0.530	8
---		X				X		0.336	4
---			X			X	X	0.442	7
---				X		X	X	0.445	7
Case 4. Removal of Dilatation plus three other variables									
---	X	X	X					0.475	7
---	X	X			X			**0.613**	7
---	X		X		X			0.599	6
---		X			X			0.562	5
---	X	X				X		0.518	7
---	X		X			X		0.550	9
---		X	X			X		0.422	5
---	X				X	X		**0.615**	7
---		X			X			0.562	5
---					X	X		0.584	6
	X	X					X	0.398	4
---	X		X				X	0.448	6
---		X	X					0.276	6
---	X				X			0.570	5
---		X			X			0.562	5
---			X		X			0.567	5
---	X					X		0.530	8
---		X				X		0.336	4

Table 20b.11. CART Sensitivity Analysis for Prediction of Lithology Using Well Data and Removing Four Variables for Each Case Analyzed

Variable Considered

Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilatation	VertStress	Grav_Mag	Temp		
---			X			X	X	0.442	7
---					X	X		0.570	5
Case 5. Removal of CSC plus three other variables									
---	X	X		X				0.542	8
---	X	X			X			**0.613**	7
---	X			X	X			**0.611**	6
---				X	X			**0.620**	7
---	X	X				X		0.518	7
---	X			X		X		0.514	7
---		X		X		X		0.376	6
---	X				X	X		**0.615**	7
---		X			X			0.562	5
---				X	X			0.597	6
---	X	X			X			**0.613**	7
---	X			X		X		0.514	7
---		X		X		X		0.376	6
---	X				X	X		**0.615**	7
---		X			X			0.562	5
---				X	X			0.597	6
---	X					X		0.530	8
---		X				X		0.336	4
---				X		X	X	0.445	7
---					X	X		0.570	5
Case 6. Removal of Resistivity plus three other variables									
---	X		X	X				0.522	7
---	X		X		X			0.599	6
---	X			X	X			**0.611**	6
---			X	X	X			0.597	7
---	X		X			X		0.550	9
---	X			X		X		0.514	7
---			X	X		X		0.472	8
---	X				X	X		**0.615**	7
---					X	X		0.584	6
---				X	X			0.597	6
---	X		X			X		0.550	9
---	X			X		X		0.514	7
---			X	X		X		0.472	8
---	X				X			0.570	5
---			X		X			0.567	5
---				X	X			0.577	5
---	X					X		0.530	8

Table 20b.11. CART Sensitivity Analysis for Prediction of Lithology Using Well Data and Removing Four Variables for Each Case Analyzed

Variable Considered

Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilatation	VertStress	Grav_Mag	Temp		
---			X			X	X	0.442	7
---				X		X	X	0.445	7
---					X	X		0.570	5
Case 7. Removal of Vp plus three other variables									
---		X	X	X				0.341	7
---		X			X			0.562	5
---				X	X			**0.620**	7
---			X	X	X			0.597	7
---		X	X			X		0.422	5
---		X		X		X		0.376	6
---			X	X		X		0.472	8
---		X			X			0.562	5
---					X	X		0.584	6
---				X	X			0.597	6
---		X	X					0.276	6
---		X		X			X	0.294	7
---			X	X			X	0.341	9
---		X			X			0.562	5
---			X		X			0.567	5
---				X	X			0.577	5
---		X				X		0.336	4
---			X			X	X	0.442	7
---				X		X	X	0.445	7
---					X	X		0.570	5

Table 20b.12. CART Sensitivity Analysis for Prediction of Lithology Using Well Data and Removing Five Variables for Each Case Analyzed

Variable Considered

Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilatation	VertStress	Grav_Mag	Temp		
Case 1. Removal of Temperature plus four other variables									
---	X	X						0.415	6
---	X		X					0.518	8
---		X	X					0.310	7
---	X			X				0.550	8
---		X		X				0.305	5
---			X	X				0.366	8
---	X				X			0.583	6
---		X			X			0.562	5
---			X		X			0.567	5
---				X	X			**0.615**	7
---	X					X		0.532	8
---		X				X		0.340	5
---			X			X		0.463	8
---				X		X		0.418	7
---					X	X		**0.600**	7
Case 2. Removal of Grav_Mag plus four other variables									
---	X	X						0.415	6
---	X		X					0.518	8
---		X	X					0.310	7
---	X			X				0.550	8
---		X		X				0.305	5
---			X	X				0.366	8
---	X				X			0.583	6
---		X			X			0.562	5
---			X		X			0.567	5
---				X	X			**0.615**	7
---	X						X	0.352	4
---		X					X	0.174	4
---			X				X	0.133	3
---				X			X	0.266	5
---					X			0.552	5
Case 3. Removal of Vertical Stress plus four other variables									
---	X	X						0.415	6
---	X		X					0.518	8
---		X	X					0.310	7
---	X			X				0.550	8
---		X		X				0.305	5
---			X	X				0.366	8
---	X					X		0.532	8
---		X				X		0.340	5
---			X			X		0.463	8
---				X		X		0.418	7

Table 20b.12. CART Sensitivity Analysis for Prediction of Lithology Using Well Data and Removing Five Variables for Each Case Analyzed

Variable Considered

Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilatation	VertStress	Grav_Mag	Temp		
---	X						X	0.352	4
---		X					X	0.174	4
			X				X	0.133	3
---				X			X	0.266	5
---						X	X	0.309	3
Case 4. Removal of Dilatation plus four other variables									
---	X	X						0.415	6
---	X		X					0.518	8
---		X	X					0.310	7
---	X				X			0.583	6
---		X			X			0.562	5
---			X		X			0.567	5
---	X					X		0.532	8
---		X				X		0.340	5
---			X			X		0.463	8
---					X	X		**0.600**	7
---	X						X	0.352	4
---		X					X	0.174	4
---			X				X	0.133	3
---					X			0.552	5
---						X	X	0.309	3
Case 5. Removal of CSC plus four other variables									
---	X	X						0.415	6
	X			X				0.550	8
---		X		X				0.305	5
---	X				X			0.583	6
---		X			X			0.562	5
---				X	X			**0.615**	7
---	X					X		0.532	8
---		X				X		0.340	5
---				X		X		0.418	7
---					X	X		**0.600**	7
---	X						X	0.352	4
---		X					X	0.174	4
---				X			X	0.266	5
---					X			0.552	5
---						X	X	0.309	3
Case 6. Removal of Resistivity plus four other variables									
---	X		X					0.518	8
---	X			X				0.550	8
---			X	X				0.366	8
---	X				X			0.583	6
---			X		X			0.567	5

Table 20b.12. CART Sensitivity Analysis for Prediction of Lithology Using Well Data and Removing Five Variables for Each Case Analyzed

Variable Considered

Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilatation	VertStress	Grav_Mag	Temp		
---				X	X			**0.615**	7
---	X					X		0.532	8
---			X			X		0.463	8
---				X		X		0.418	7
---					X	X		**0.600**	7
---	X						X	0.352	4
---			X				X	0.133	3
---				X			X	0.266	5
---					X			0.552	5
---						X	X	0.309	3
Case 7. Removal of Vp plus four other variables									
---		X	X					0.310	7
---		X		X				0.305	5
---			X	X				0.366	8
---		X			X			0.562	5
---			X		X			0.567	5
---				X	X			**0.615**	7
---		X				X		0.340	5
---			X			X		0.463	8
				X		X		0.418	7
---					X	X		**0.600**	7
---		X					X	0.174	4
---			X				X	0.133	3
---				X			X	0.266	5
---					X			0.552	5
---						X	X	0.309	3

Table 20b13. CART Sensitivity Analysis for Prediction of Lithology Using Well Data and Removing Six Variables for Each Case Analyzed

	Variable Considered
	Variable Removed

Predictor	**Response Variables** (X Used, **X** First Split)							R^2 Value	Splits
Lithology	Vp	Resistivity	CSC	Dilatation	VertStress	Grav_Mag	Temp		
Case 1. Removal of six variables systematically									
---							X	0.089	4
---						X		0.284	2
---					X			0.552	5
---				X				0.279	5
---			X					0.254	6
---		X						0.204	5
---	X							0.408	5