Thermal Conductivity Test Cell

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Test Methods

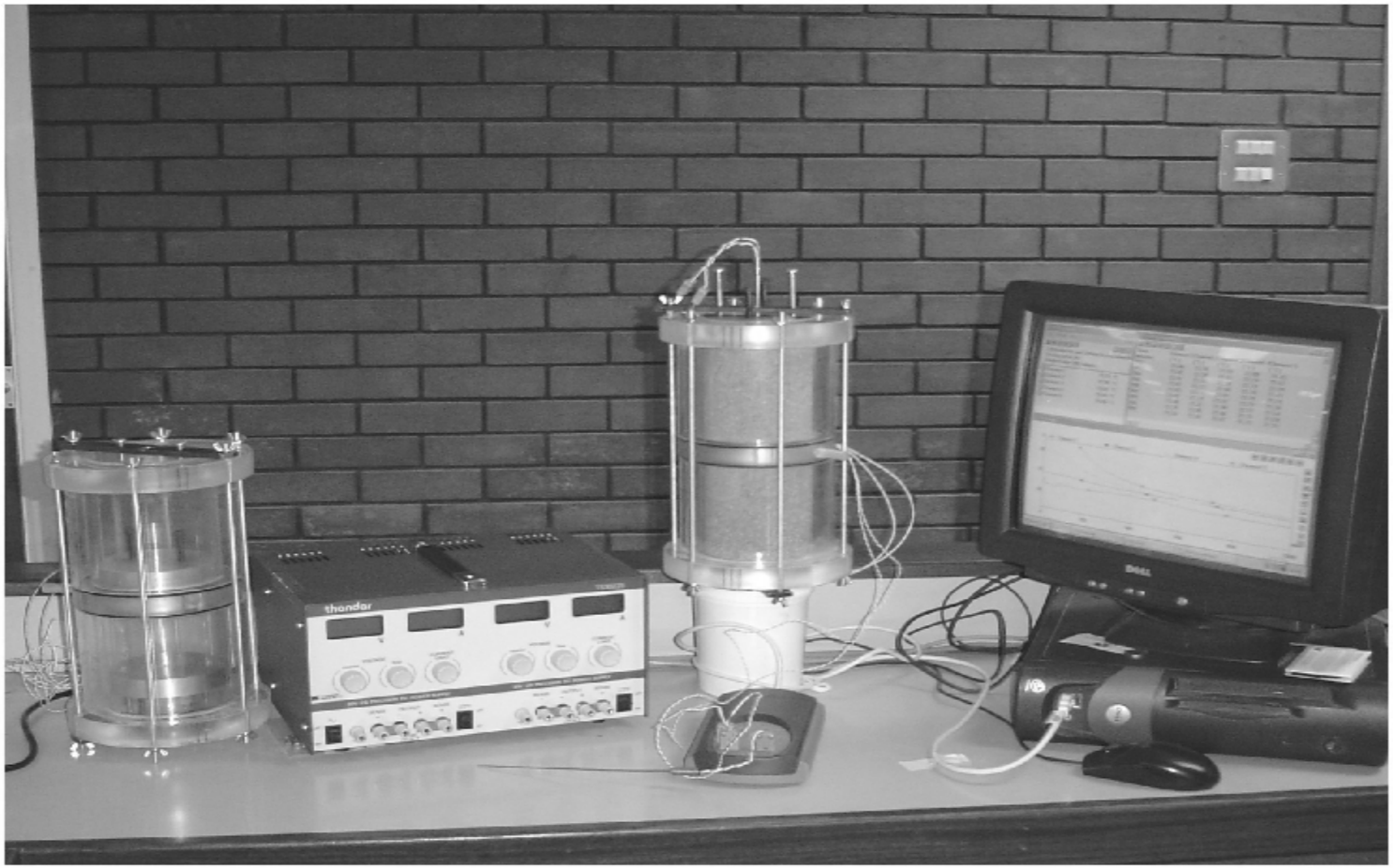
- **Thermal Needle probe, ASTM D5334 etc**
- **Divided Bar, Norwegian University of Science & Technology, 1974**
- **Guarded Hotplate, BGS, 1990's, extension of divided bar apparatus**

- **Thermal Conductivity Cell, 2007**
  - **Ø – based on research paper by Clarke, Agab and Nicholson, 2006, "A model specification to determine the thermal conductivity of soils"**

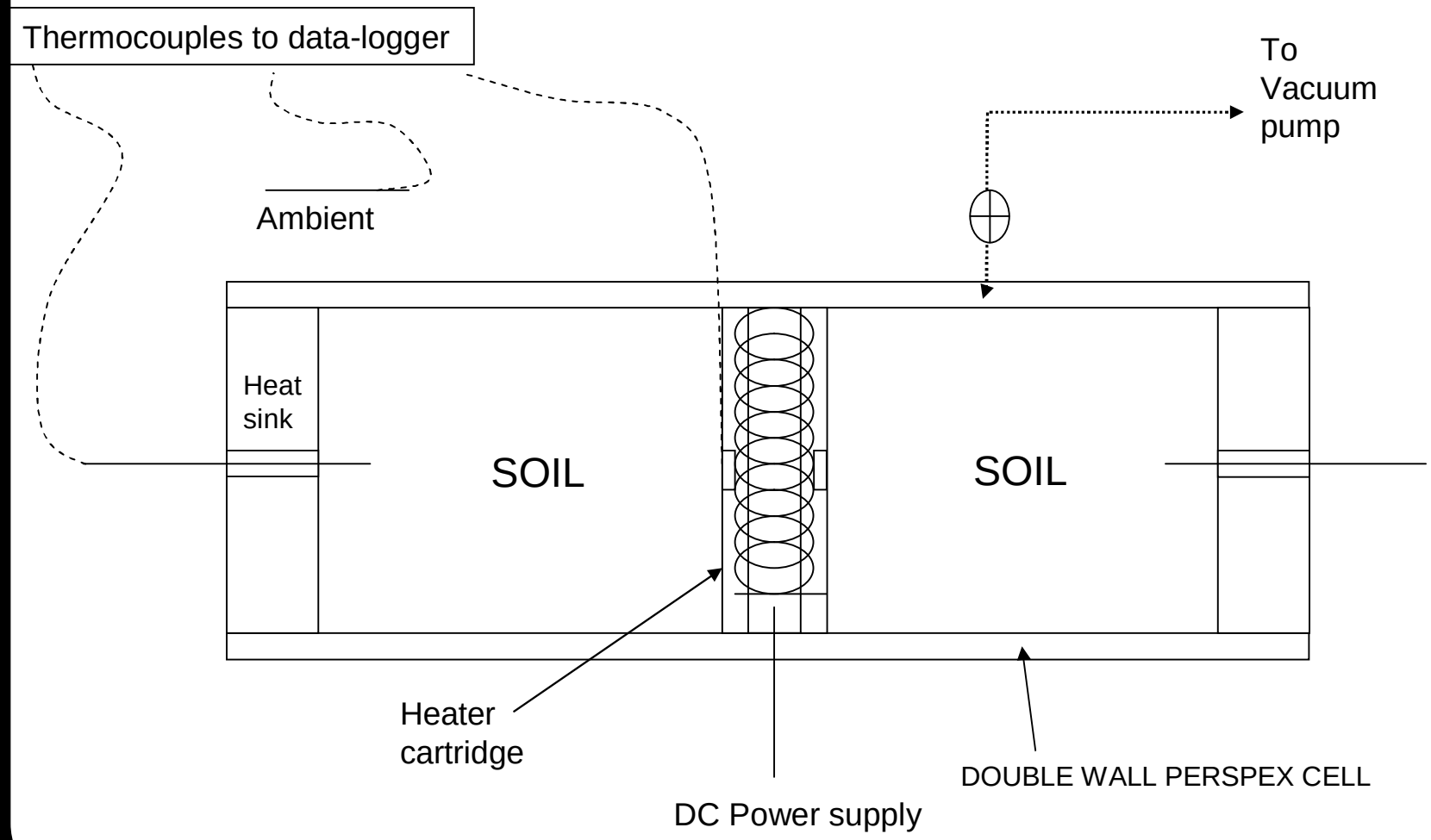
THERMAL CONDUCTIVITY CELL

- steady state technology
- can use routine samples from site investigation phase of project
- tests mass properties of soils and rocks
- other thermal and geotechnical properties can be derived for the same sample
- easily operated in laboratory with established environmental control

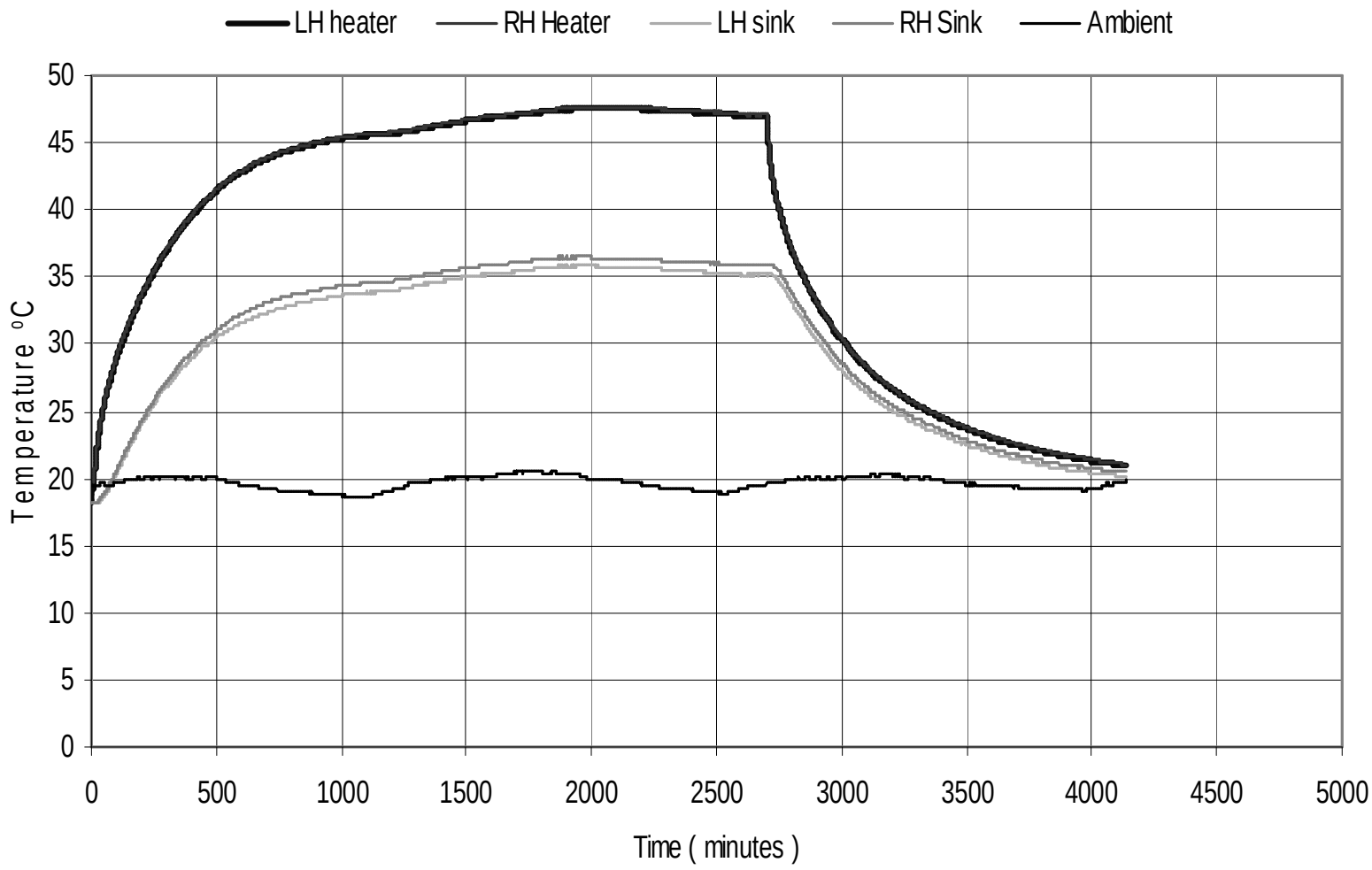
TC cell and system



Schematic of new cell



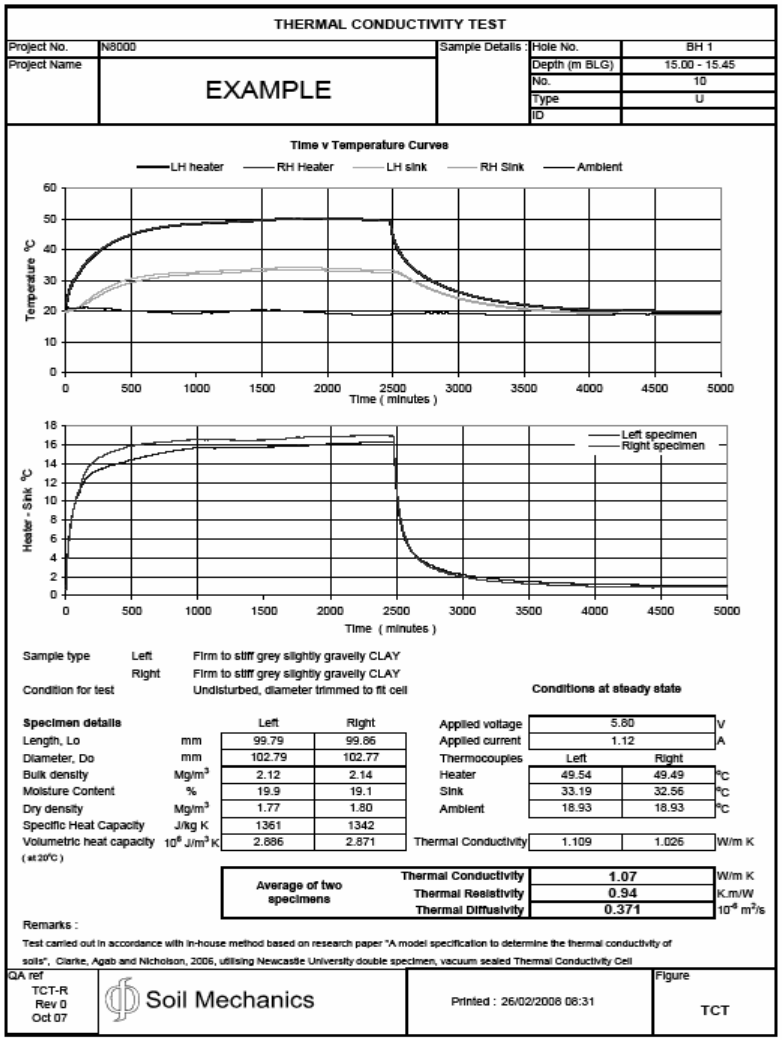
Temperatures v Time



Parameters Derived

- **Thermal Conductivity**
- **Thermal Resistivity**
- **Specific Heat Capacity**
  - **Ø from density/moisture parameters**
- **Thermal Diffusivity**

Typical Example of test report



THERMAL CONDUCTIVITY TEST

Project No.	N8000	Sample Details :	Hole No. BH 1
Project Name	EXAMPLE		Depth (m BLG) 15.00 - 15.45
			No. 10
			Type U
			ID

Time v Temperature Curves

LH heater — RH Heater — LH sink — RH Sink — Ambient

Temperature °C

Time (minutes)

Heater - Sink °C

Left specimen
Right specimen

Time (minutes)

Sample type	Left	Firm to stiff grey slightly gravelly CLAY
	Right	Firm to stiff grey slightly gravelly CLAY
Condition for test		Undisturbed, diameter trimmed to fit cell

Conditions at steady state

Specimen details		Left	Right
Length, Lo	mm	99.79	99.86
Diameter, Do	mm	102.79	102.77
Bulk density	Mg/m³	2.12	2.14
Moisture Content	%	19.9	19.1
Dry density	Mg/m³	1.77	1.80
Specific Heat Capacity	J/kg K	1361	1342
Volumetric heat capacity (at 20°C)	10^6 J/m³ K	2.886	2.871

Applied voltage	5.80		V
Applied current	1.12		A
Thermocouples	Left	Right	
Heater	49.54	49.49	°C
Sink	33.19	32.56	°C
Ambient	18.93	18.93	°C
Thermal Conductivity	1.109	1.026	W/m K

Average of two specimens	Thermal Conductivity	1.07	W/m K
	Thermal Resistivity	0.94	K.m/W
	Thermal Diffusivity	0.371	10^{-6} m²/s

Remarks :

Test carried out in accordance with in-house method based on research paper "A model specification to determine the thermal conductivity of soils", Clarke, Agab and Nicholson, 2006, utilising Newcastle University double specimen, vacuum sealed Thermal Conductivity Cell

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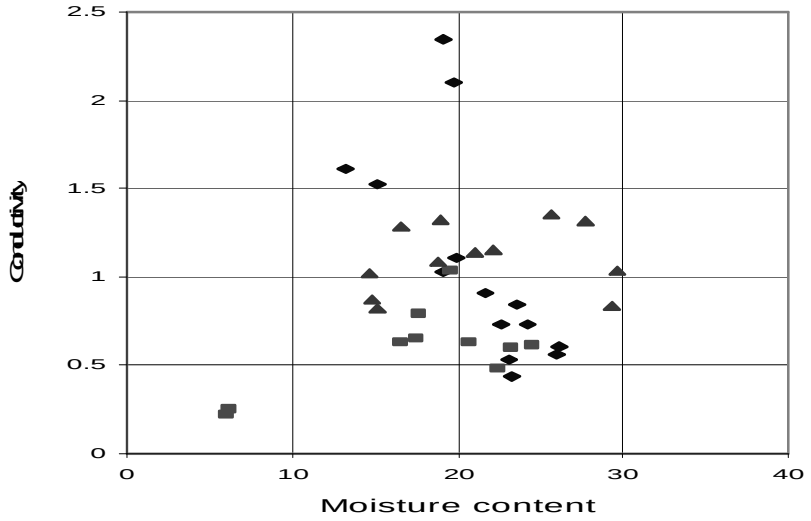

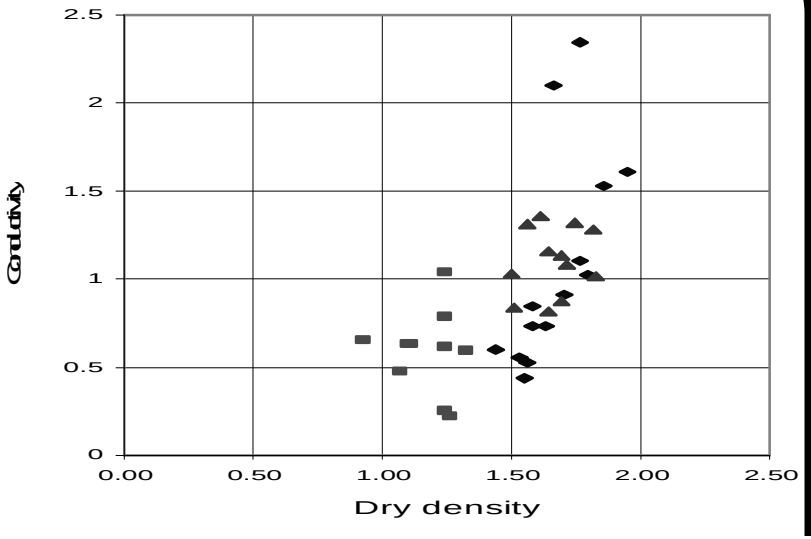

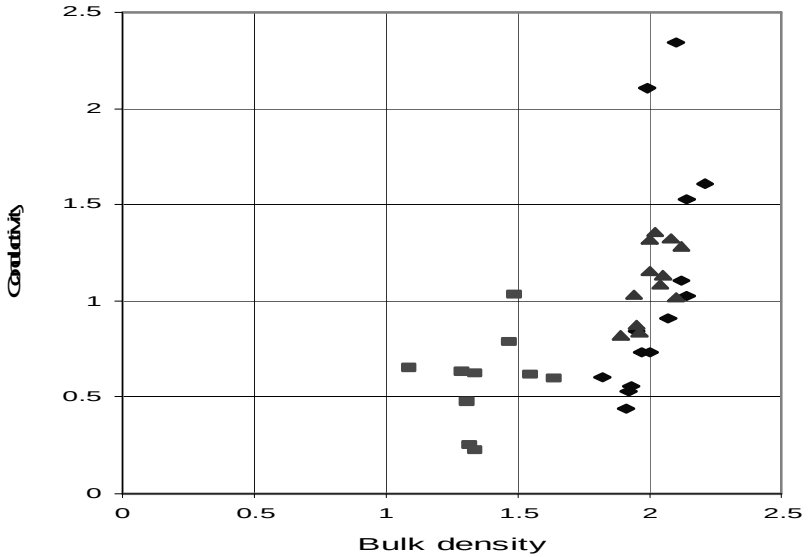

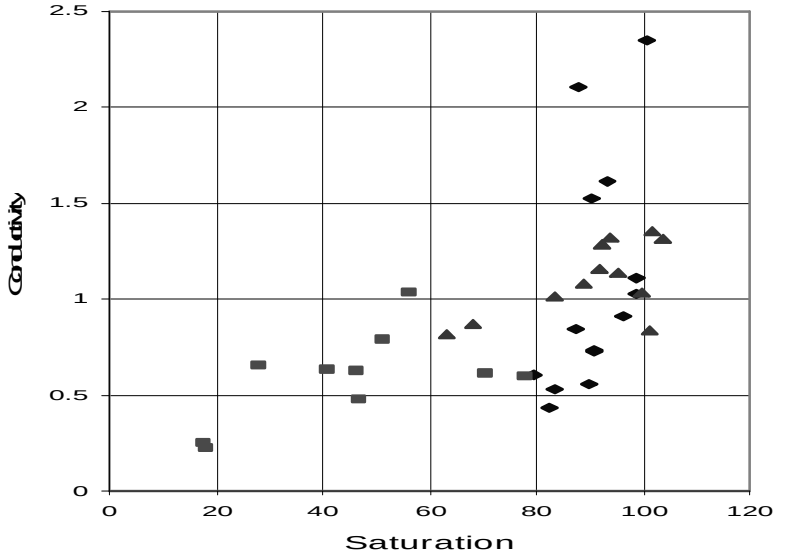

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Thank you