Frontiers of Science Handout #1
Earth Science Unit
Seminar I

Events at the K-T boundary layer in New Zealand: A case study
Part I: Designing the Study

In lecture and in your readings for this week, you learned about the extinction of the dinosaurs at the end of the Cretaceous geological epoch ca. 65 million years ago. Evidence suggests that this extinction event at the Cretaceous/Tertiary (K-T) boundary was precipitated by the impact of a large meteorite. Although the impact site was most likely in the Gulf of Mexico, evidence for the K-T event has been discovered in the rock record worldwide.

For this case study, your group is going to look for evidence of the K-T boundary in an outcrop of mudstone and coal in New Zealand. Of particular interest is a section approximately 20 cm in length, the deepest layers of which are thought to precede the K-T event. The rest of the section is thought to include sediments deposited during and after the K-T event.

1) Within your group, discuss what you might look for in the rock record to indicate the K-T event. Think back to examples from the assigned readings and lecture. Come up with a list of three types of evidence you would look for. What would each type of evidence suggest?

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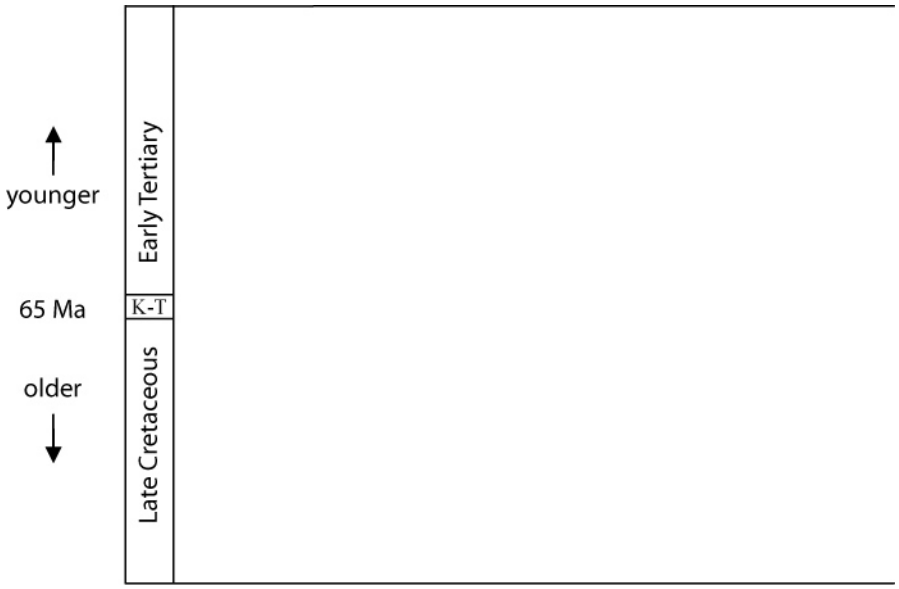
Handout #2

Events at the K-T boundary layer in New Zealand: A case study
Part II: Forming a hypothesis

1) On the chart below, sketch what you would expect to see as you look through the rock record. The y-axis represents the time both immediately before and after the K-T event.



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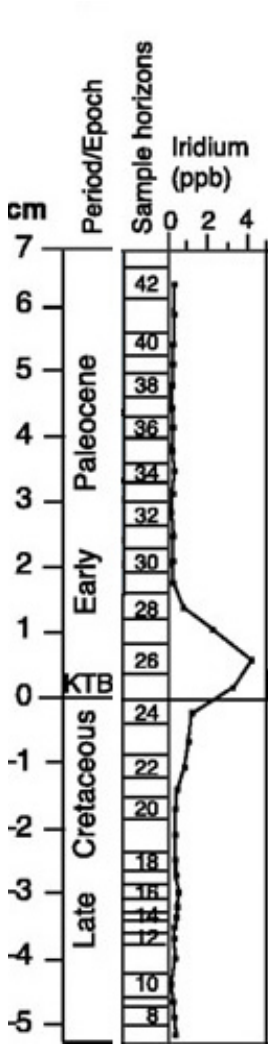
Handout #3

Events at the K-T boundary layer in New Zealand: A case study
Part III: Evaluating the Data (Iridium)

A similar study on the same rock unit was done by Vajda and McLoughlin in 2004. Their results were published in the journal *Science*[1]. Their iridium data and a portion of the main figure from their paper appears below:

	mm below (-) / above K-T boundary			Iridium (ppt)[a]		
	107	to	111.5	143	+ / -	13
	102	to	106.5	138	+ / -	17
	97	to	101.5	134	+ / -	12
	92	to	96.5	280	+ / -	19
	87	to	91.5	119	+ / -	13
	82	to	86.5	169	+ / -	12
	77	to	81.5	165	+ / -	12
	72	to	76.5	224	+ / -	12
	66.5	to	71.5	143	+ / -	12
	62	to	66	315	+ / -	16
	57.5	to	61.5	331	+ / -	15
	53	to	57	140	+ / -	10
	50.5	to	52.5	142	+ / -	11
	47	to	50	139	+ / -	21
	43.5	to	46.5	185	+ / -	13
	40	to	43	133	+ / -	11
	36.5	to	39.5	187	+ / -	14
	34	to	36	171	+ / -	9
	30.5	to	33.5	111	+ / -	11
	27	to	30	109	+ / -	11
	23.5	to	26.5	108	+ / -	25
	20	to	23	259	+ / -	14
	16.5	to	19.5	192	+ / -	18
	12	to	16	971	+ / -	102
	7	to	12	2116	+ / -	329
	4.5	to	8.5	4136	+ / -	69
K-T	0	to	4	3184	+ / -	452
	-1	to	-4	1365	+ / -	185
	-4.5	to	-8.5	1060	+ / -	174
	-9.5	to	-12	1039	+ / -	58
	-12	to	-15	547	+ / -	143
	-15	to	-18.4	376	+ / -	74
	-18.4	to	-23.4	477	+ / -	134
	-23.5	to	-26.5	266	+ / -	58
	-26.5	to	-28.5	292	+ / -	22
	-28.5	to	-30.5	347	+ / -	51
	-30.5	to	-32.5	279	+ / -	21
	-32.5	to	-34	270	+ / -	54
	-34	to	-35.5	260	+ / -	19
	-35.5	to	-37.5	381	+ / -	68
	-37.5	to	-40.5	275	+ / -	16
	-40.5	to	-44	312	+ / -	64
	-44	to	-47	211	+ / -	19
	-47	to	-50	211	+ / -	19
	-50.5	to	-54	178	+ / -	17
	-54	to	-59	138	+ / -	13
	-59	to	-64	122	+ / -	13
	-64	to	-67	87	+ / -	8
	-67	to	-70.5	66	+ / -	6
	-70.5	to	-74.5	70	+ / -	11
	-80.5	to	-74.5	51	+ / -	6

[a] Precision is noted as 1 sigma value in Gaussian statistics



[1] Science, Vol 303, Issue 5663, 1489 , 5 March 2004.

1) Are the results consistent with what you expected to find? If you can find differences, what are they, and why might they exist?

2) You've learned from lecture that iridium is a rare element on Earth. Can you use the table to guess at a quantitative value of the natural "background" concentration in terrestrial (Earth-formed) rocks? What would the value be?

3) Vajda and McLoughlin report 1 sigma errors on their iridium measurements. How confident are you that the peak in iridium concentrations at the K-T boundary are above terrestrial background?

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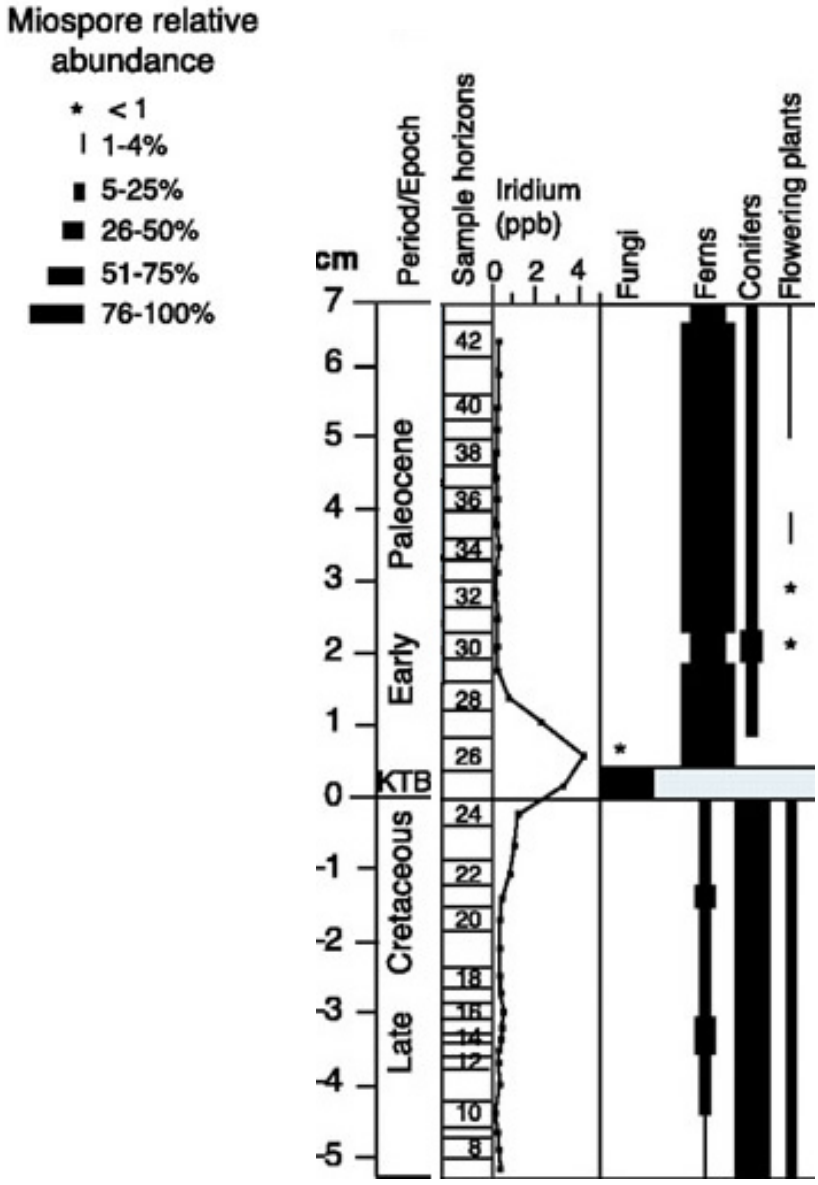
Part III: Evaluating the Data (Plants)

Vadja and McLoughlin[2] also considered plant data. Here is what they found:



1) Are these results consistent with what you expected? Why or why not?

[2] Science, Vol 303, Issue 5663, 1489 , 5 March 2004.