

**Comparison of  
the NGA Relations  
with Data from Recent  
Earthquakes in California**

**California Geological Survey**

**September 25, 2006**

The following 4 strike-slip earthquakes were considered:

- Mw 7.1 Hector Mine of 10/16/99
- Mw 6.0 Parkfield of 9/28/04
- Mw 5.2 Big Bear City of 2/22/03
- Mw 5.2 Anza of 6/12/05

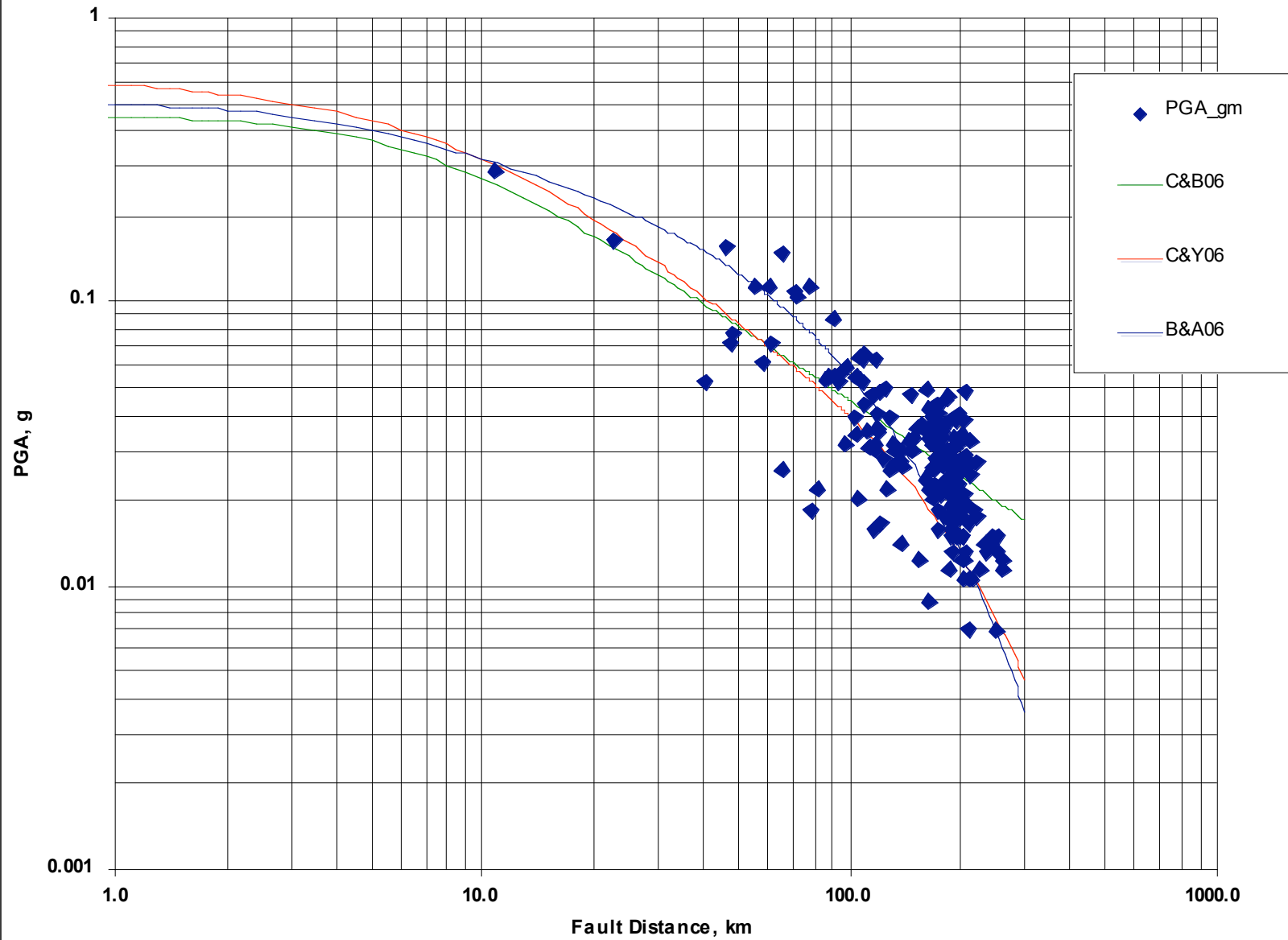
The following 3 dip-slip earthquakes were considered:

- Mw 6.7 Northridge of 1/17/94
- Mw 6.5 San Simeon of 12/22/03
- Mw 4.9 Yucaipa of 6/16/05

# Strike-Slip Earthquakes

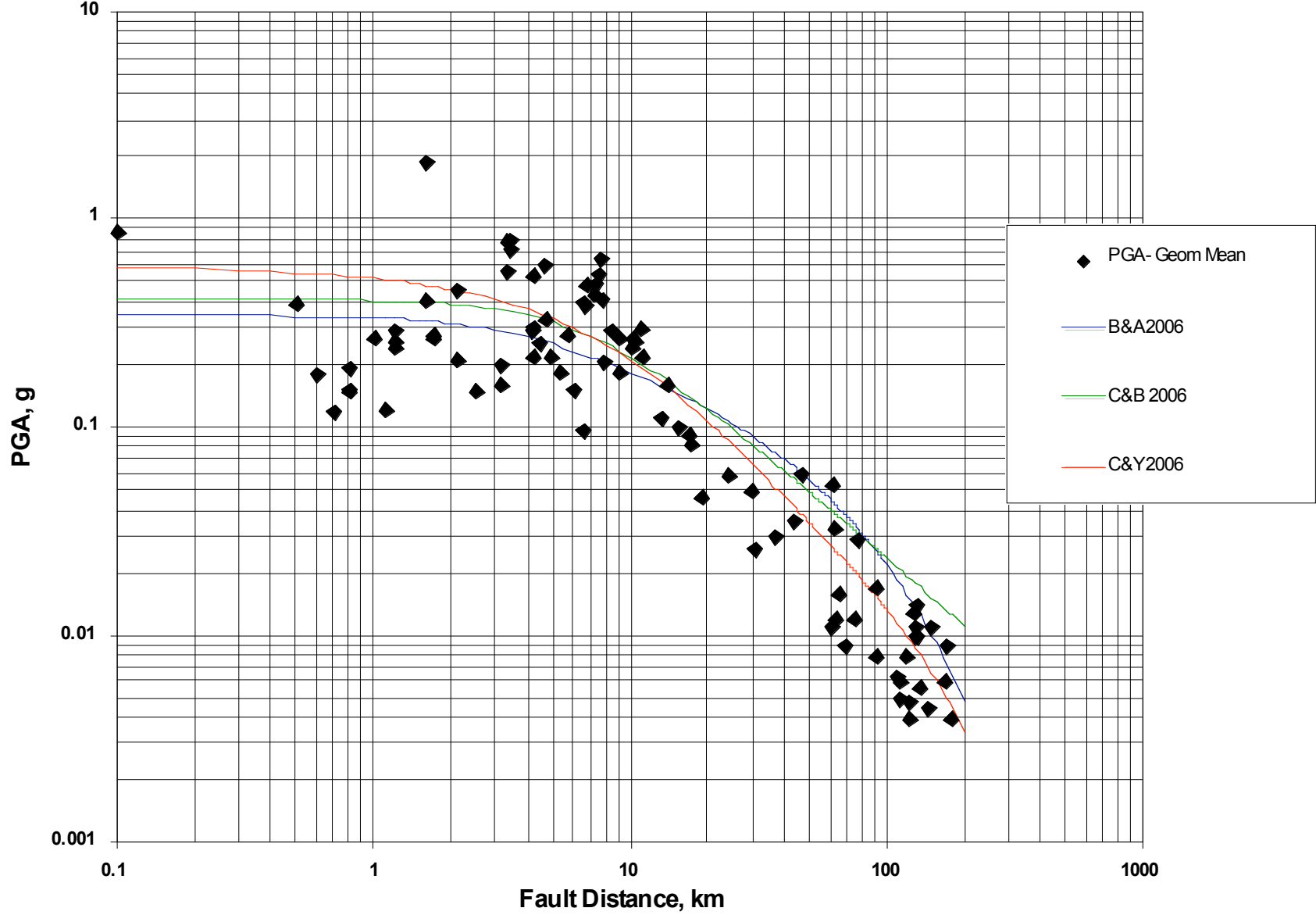
# Peak Ground Acceleration vs Distance

## Hector Mine Earthquake of 10/16/99, M7.1

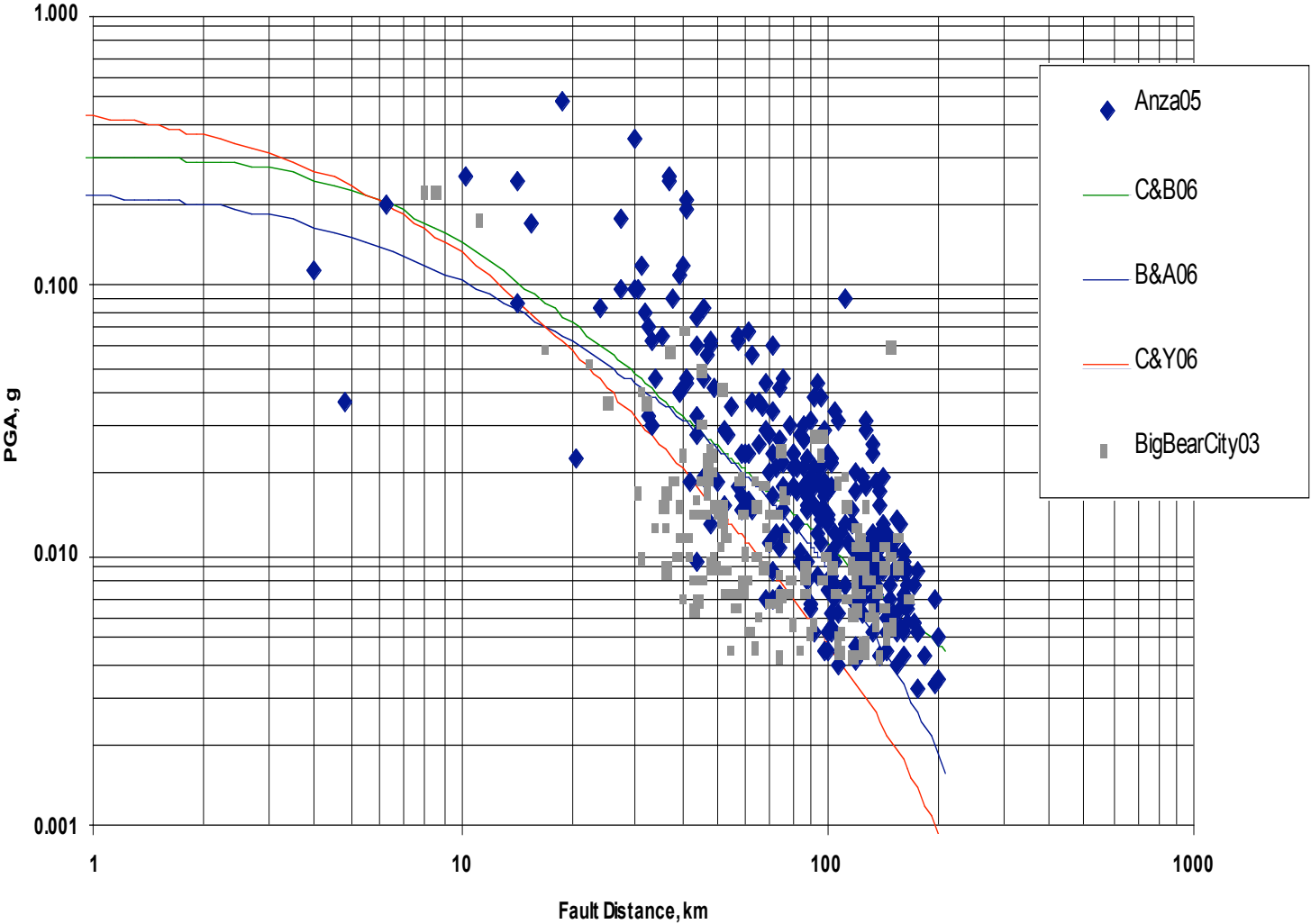


# Peak Ground Acceleration vs Distance

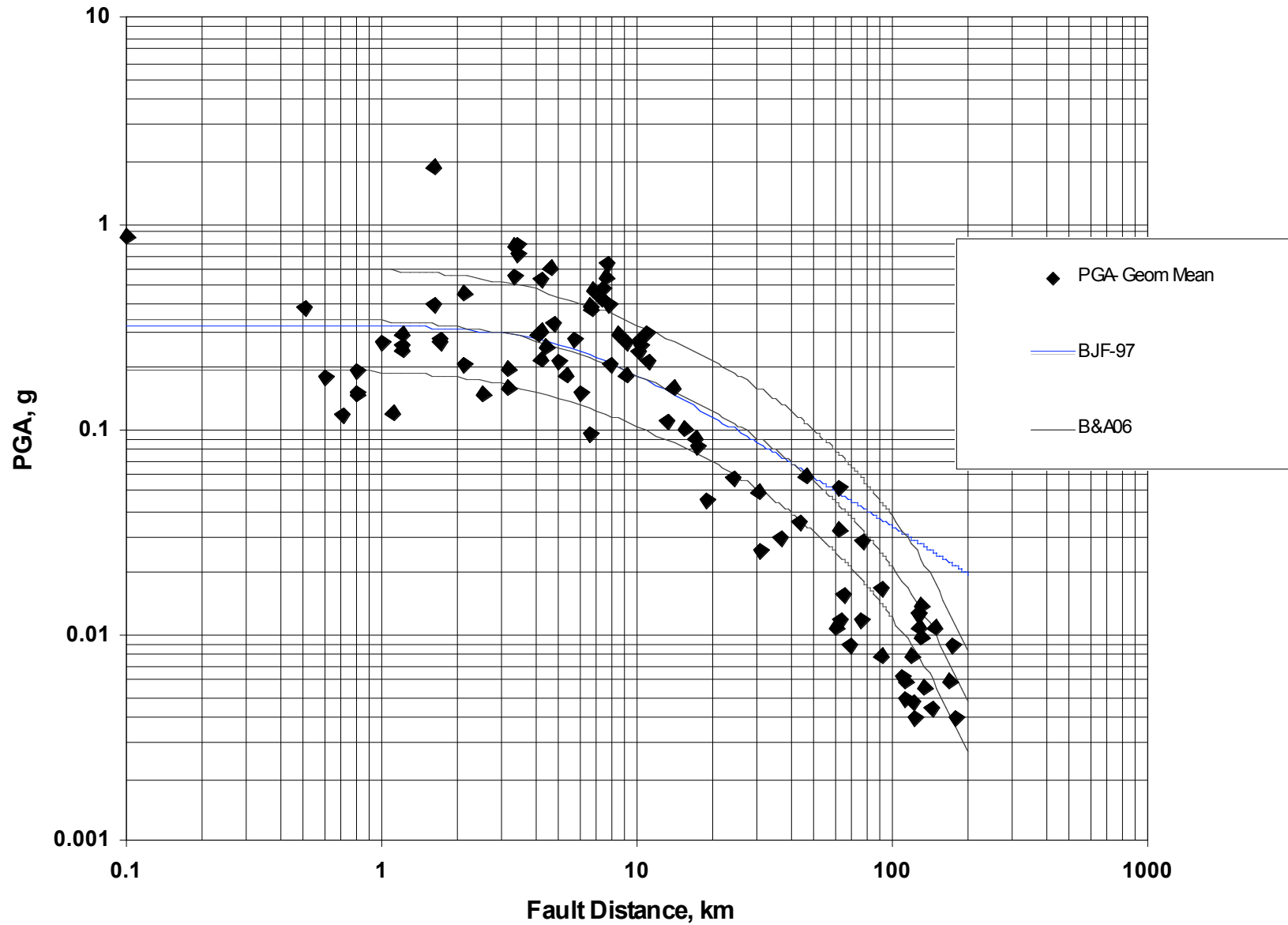
## Parkfield Earthquake of 9/28/04, Mw 6.0 (94 data points)



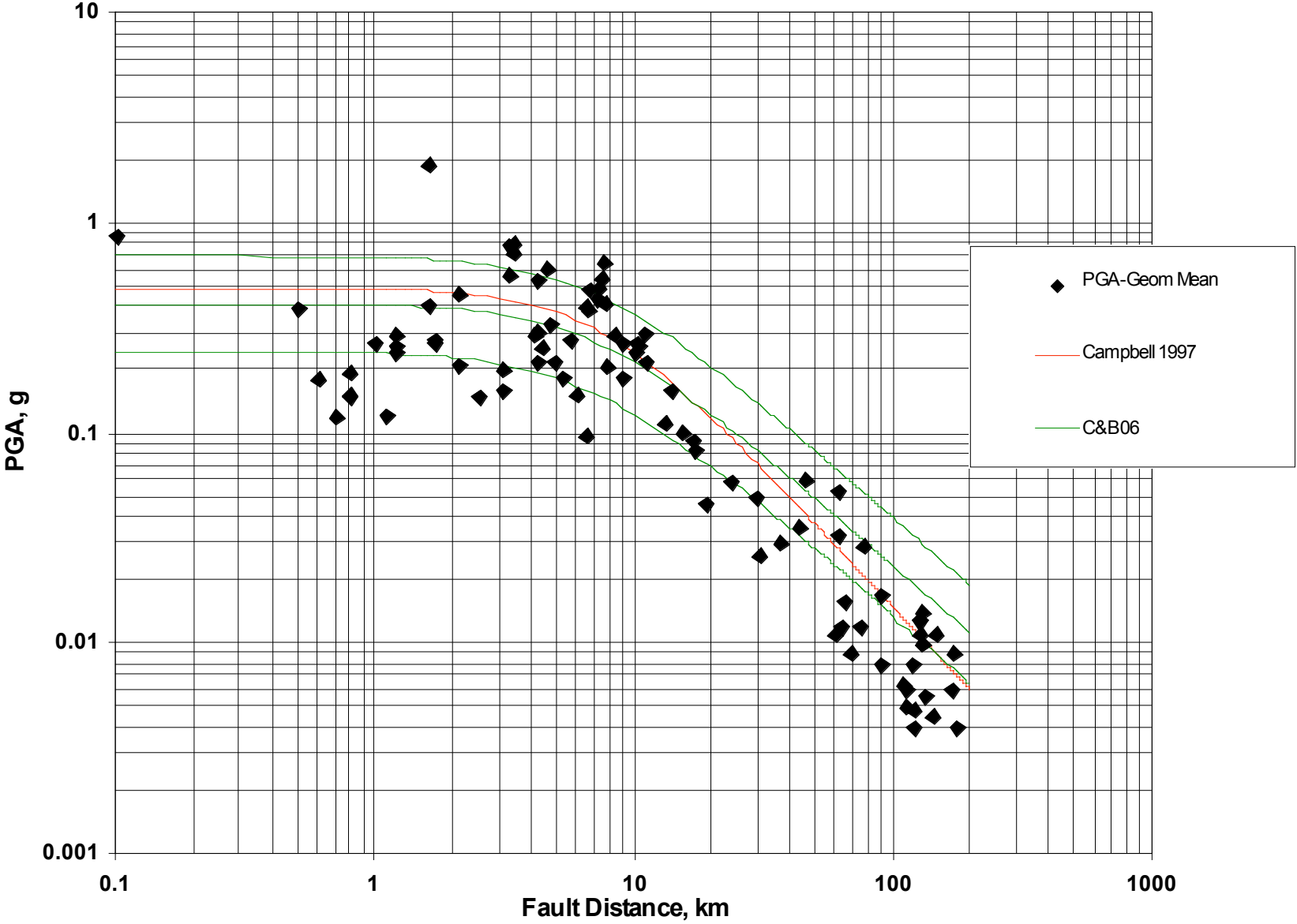
Peak Ground Acceleration vs Distance  
Anza 2005 and Big Bear City 2003 Mw 5.2



### Peak Ground Acceleration vs Distance Parkfield Earthquake of 9/28/04, Mw 6.0 (94 data points)



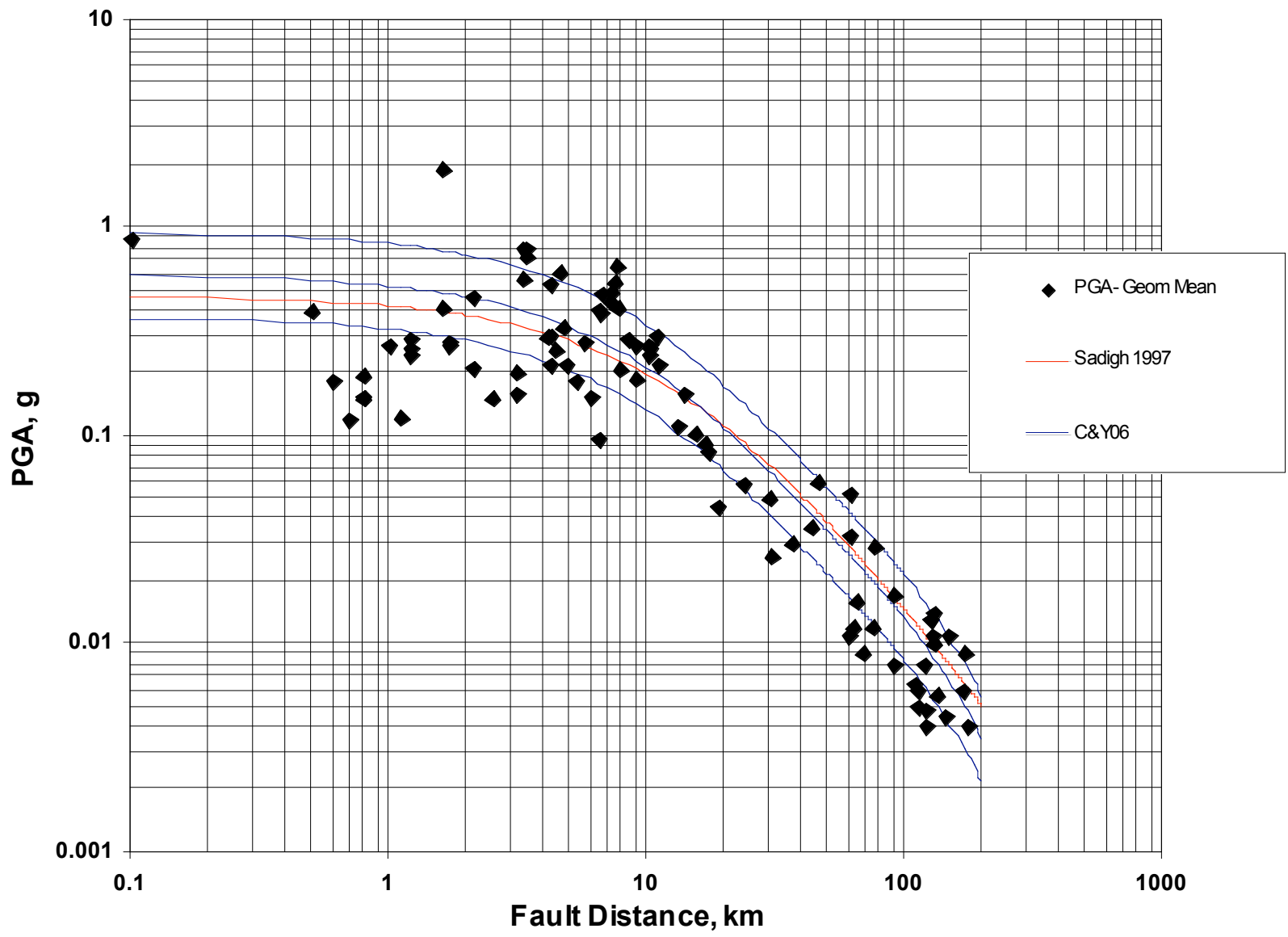
**Peak Ground Acceleration vs Distance**  
**Parkfield Earthquake of 9/28/04, Mw 6.0 (94 data points)**





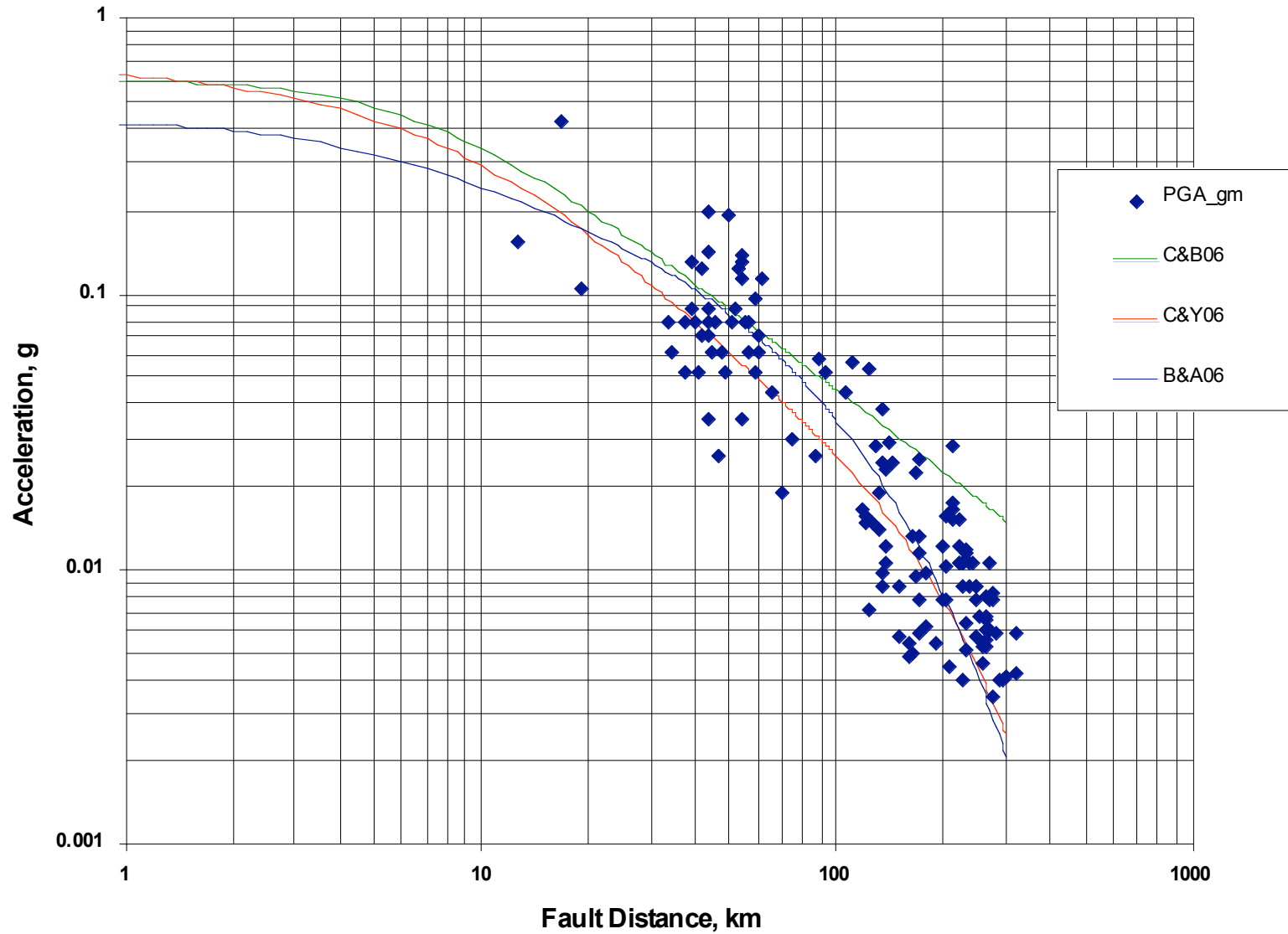
# Peak Ground Acceleration vs Distance

## Parkfield Earthquake of 9/28/04, Mw 6.0 (94 data points)



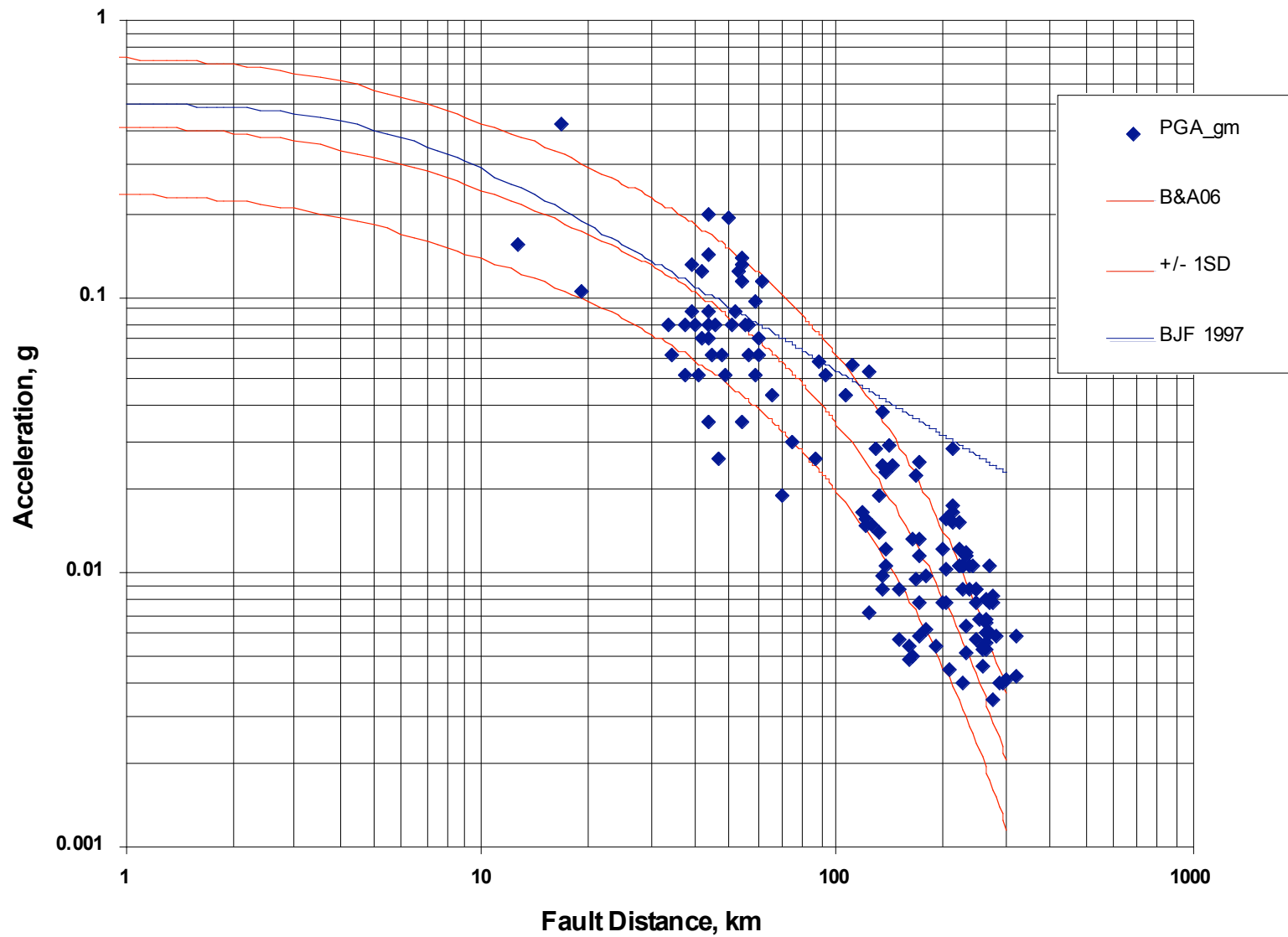
# Dip-Slip Earthquakes

# Peak Ground Acceleration vs Distance San Simeon Earthquake of 12/22/03, M6.5



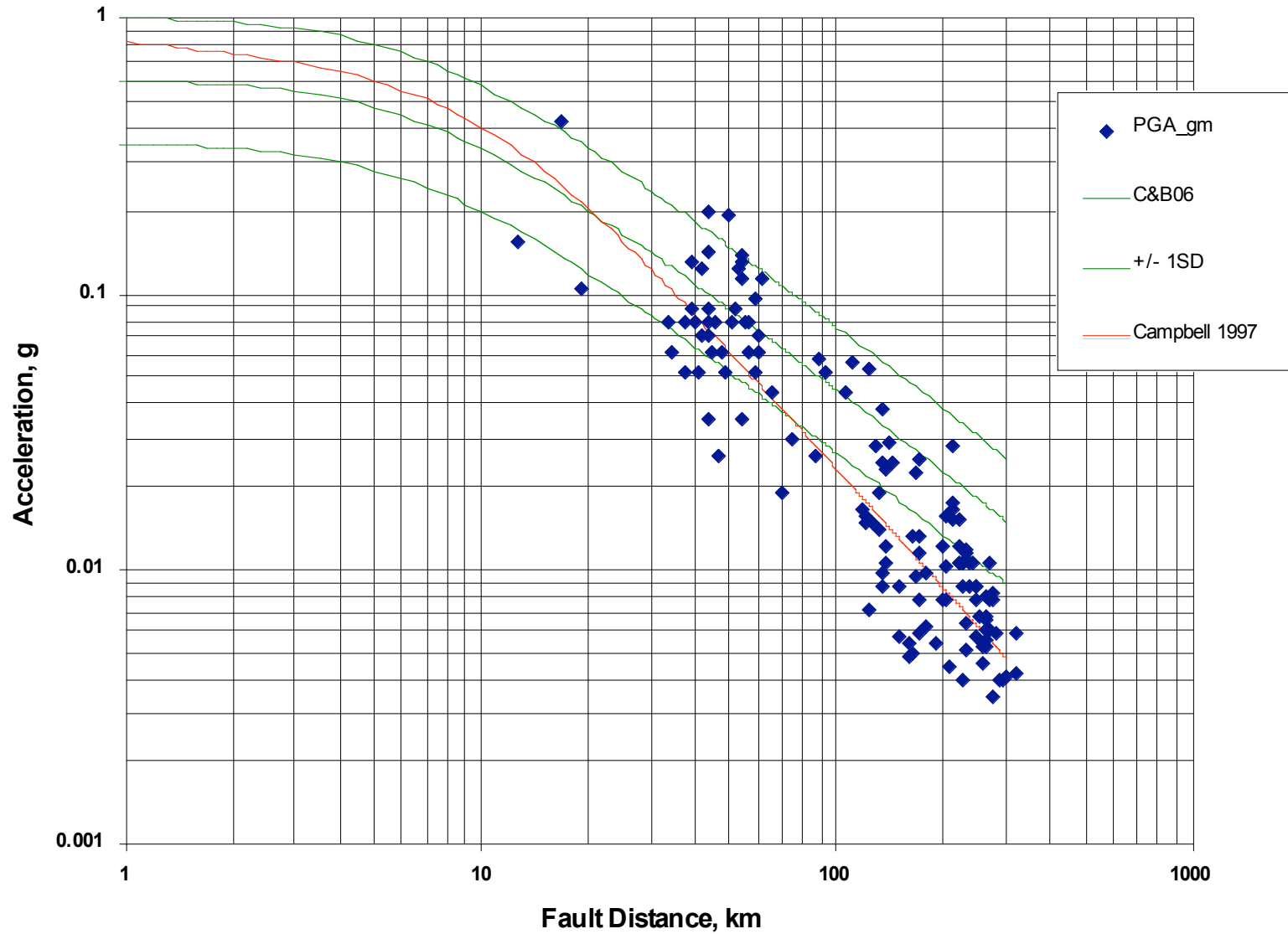
# Peak Ground Acceleration vs Distance

## San Simeon Earthquake of 12/22/03, M6.5



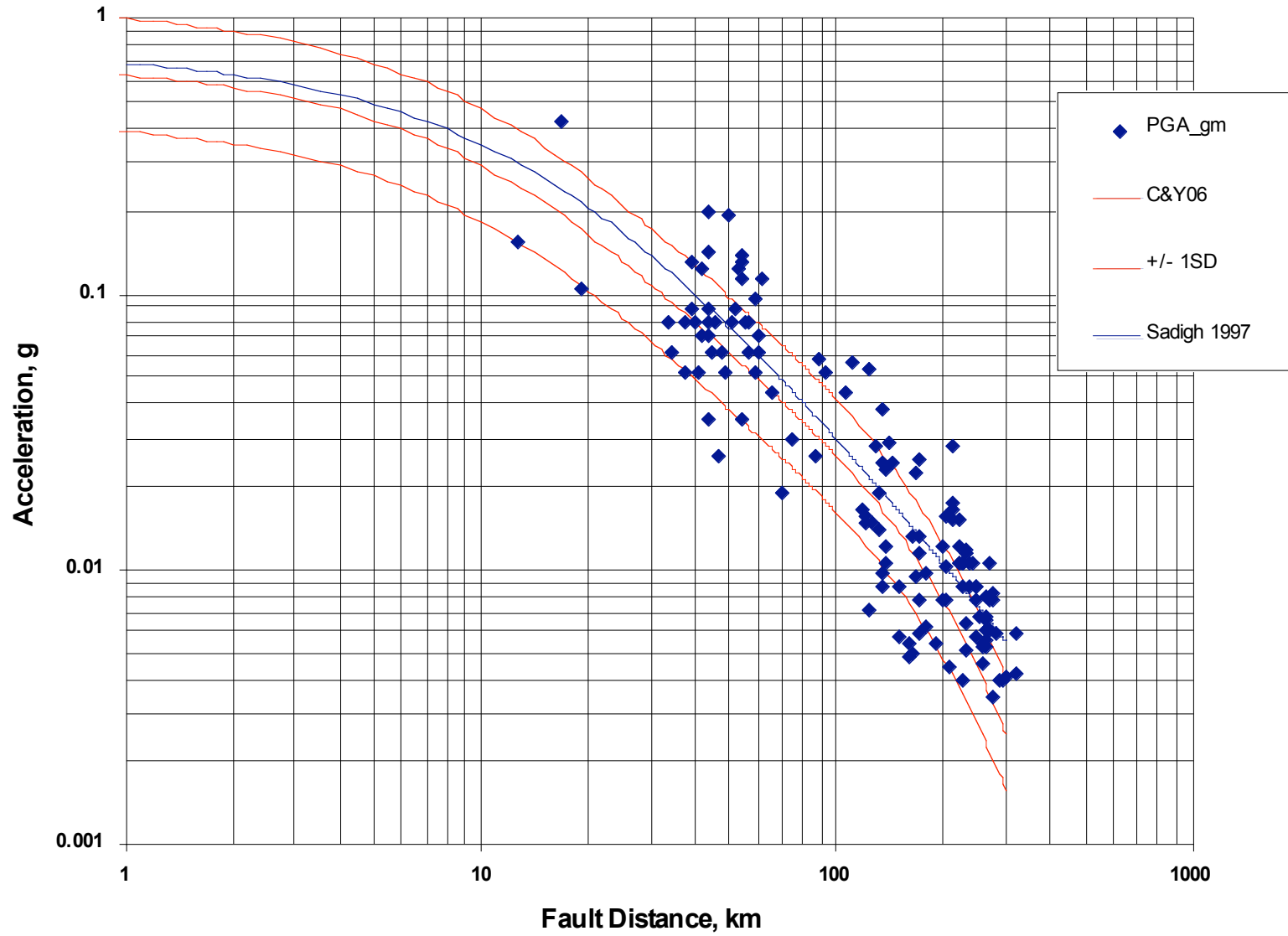
# Peak Ground Acceleration vs Distance

## San Simeon Earthquake of 12/22/03, M6.5

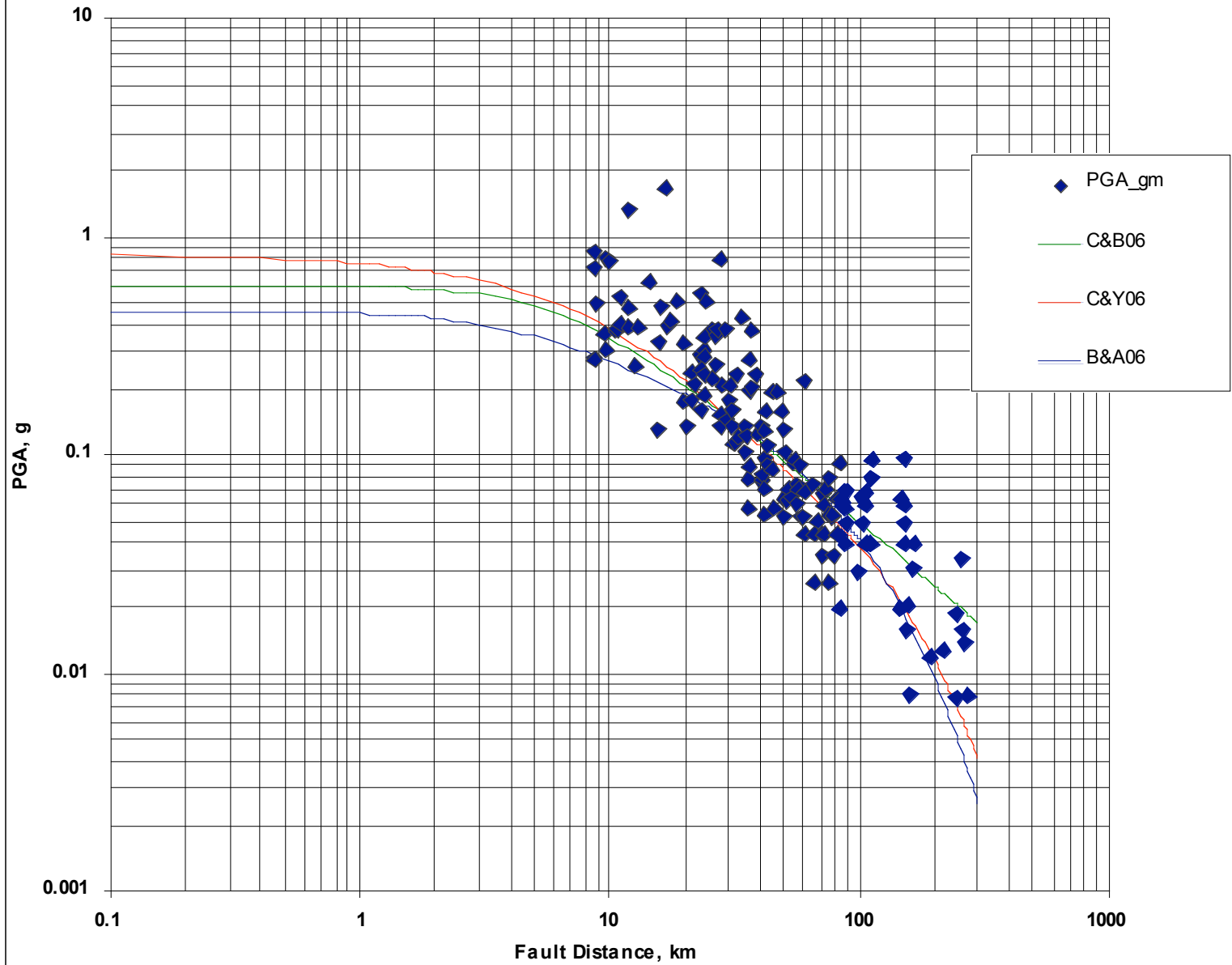


# Peak Ground Acceleration vs Distance

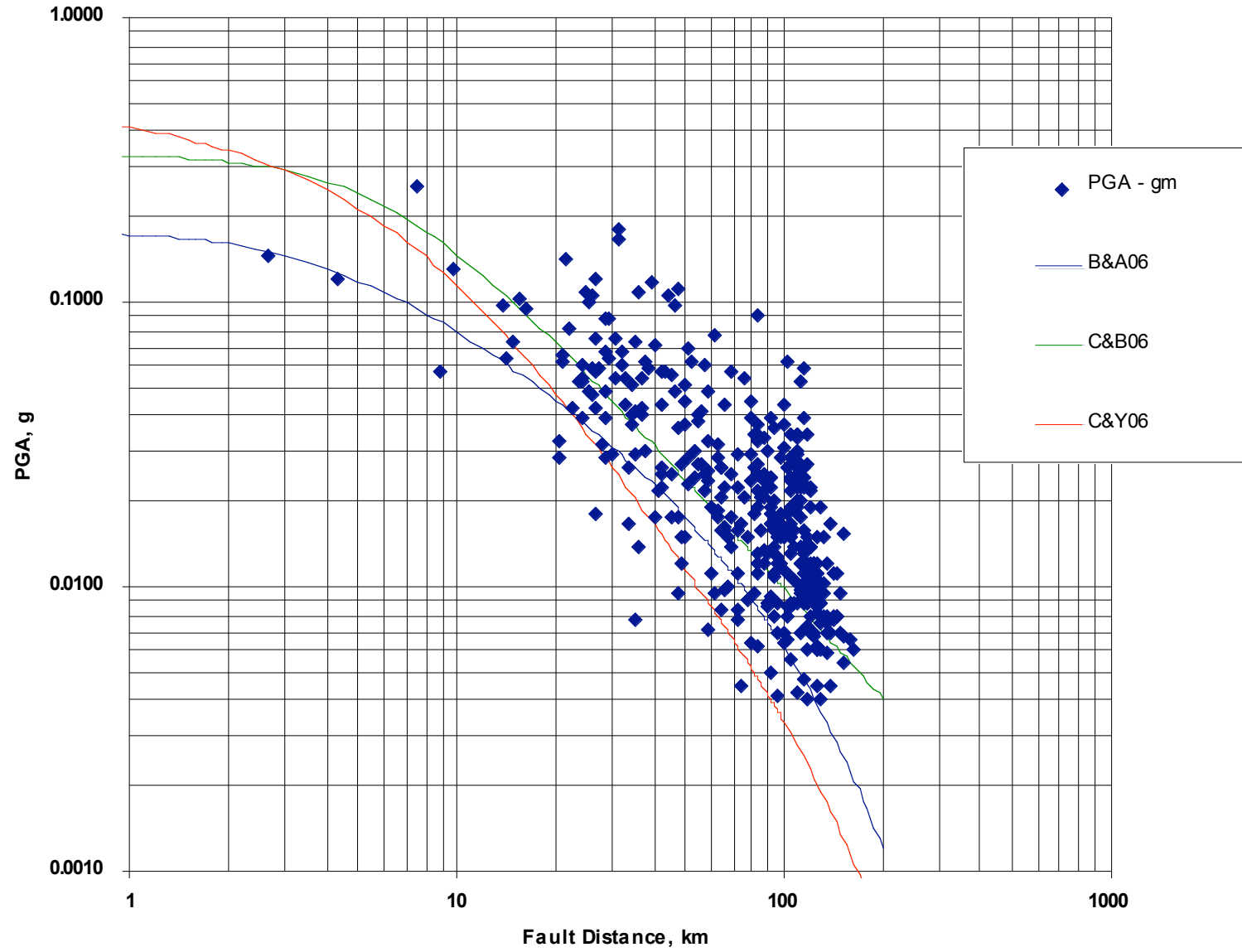
## San Simeon Earthquake of 12/22/03, M6.5



# Peak Ground Acceleration vs Distance Northridge Earthquake of 1/17/94, M6.7



**Peak Ground Acceleration vs Distance**  
**Yucaipa Earthquake of 6/16/05, Mw 4.9 (427 points)**





## Comparison of PGAs for M 4.9 Reverse

Model	PGA at 1 km	PGA at 10 km	PGA at 100 km	PGA at 200 km
B&A	0.174	0.079	0.0062	0.0012
C&B	0.328	0.148	0.0094	0.0041
C&Y	0.412	0.115	0.0034	0.0006

## Comparison of PGAs for M 6.0 Strike-slip

Model	PGA at 1 km	PGA at 10 km	PGA at 100 km	PGA at 200 km
B&A	0.335	0.183	0.0217	0.0048
C&B	0.405	0.217	0.0234	0.0110
C&Y	0.518	0.210	0.0132	0.0034

## Differences in accounting for the type of mechanism:

- ***B&A***

1% difference between reverse and strike,  
26% difference between strike and normal.

- ***C&B***

28% difference between reverse and strike  
12% between strike and normal

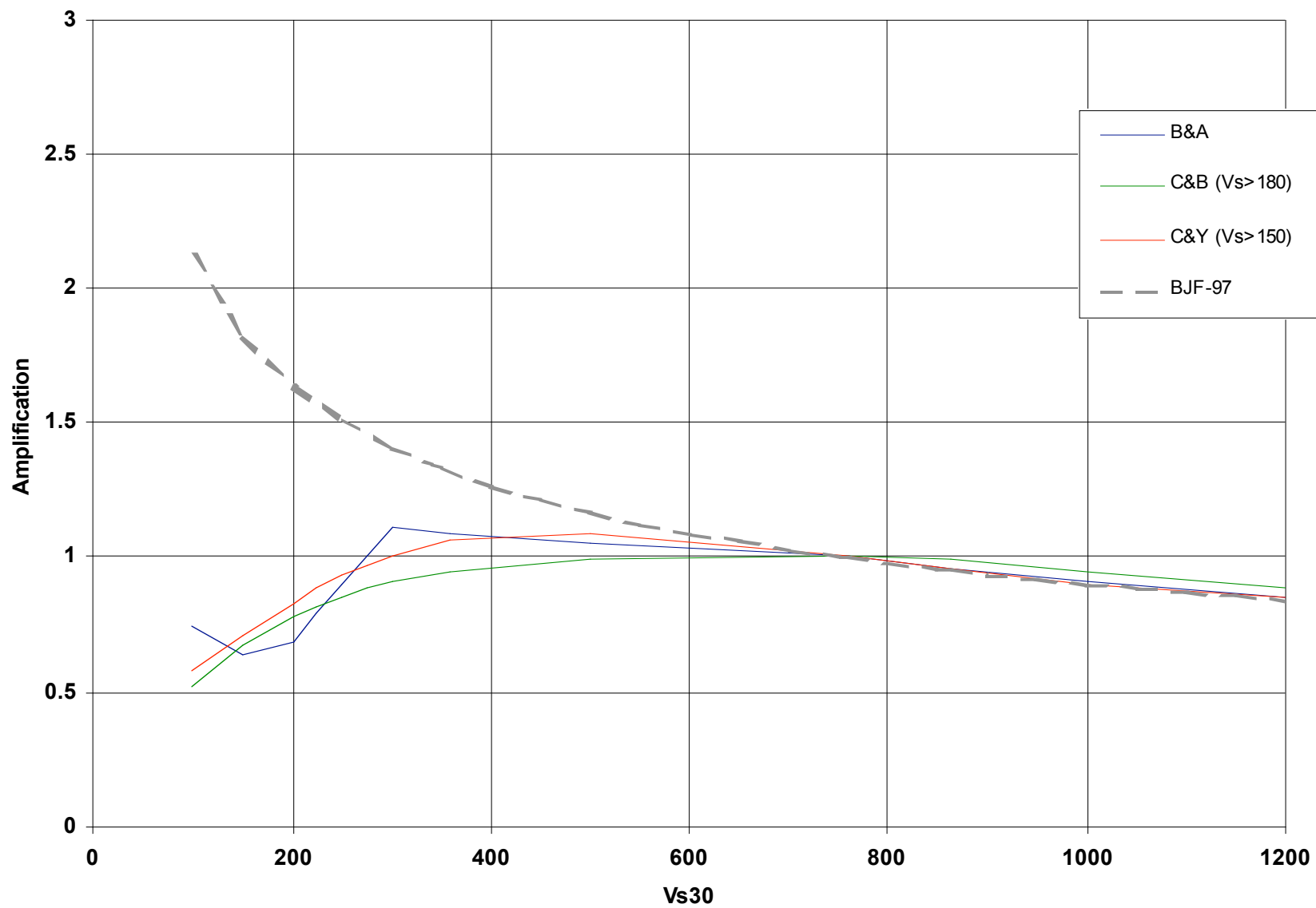
- ***C&Y***

10% between reverse and strike  
25% between strike and normal

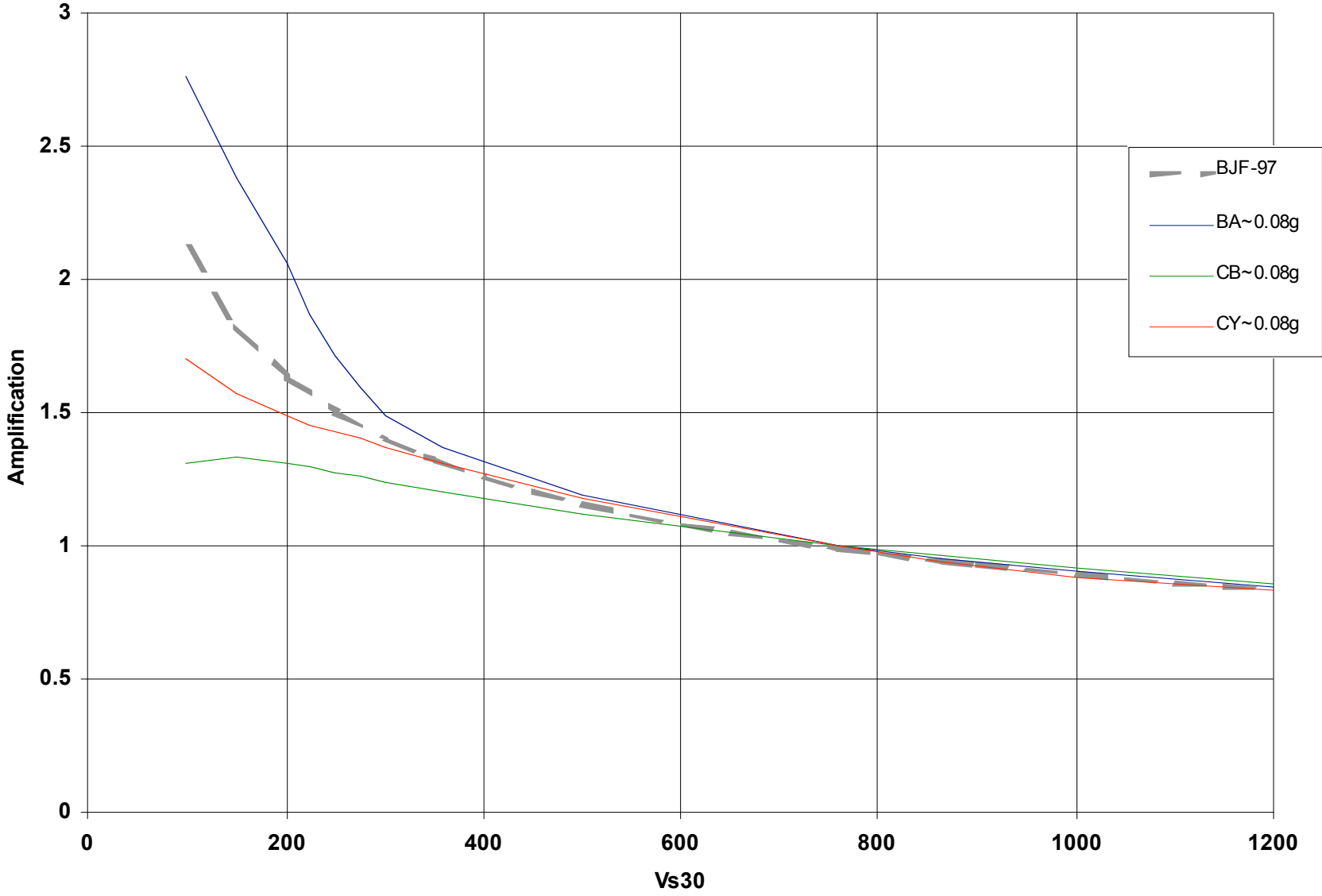
For reference, Sadigh et al. (1997) used 28% between strike and reverse.

**Site Amplification vs. Vs30 for  
a M 7.1 earthquake  
and PGA of 0.5, 0.08 and 0.01g**

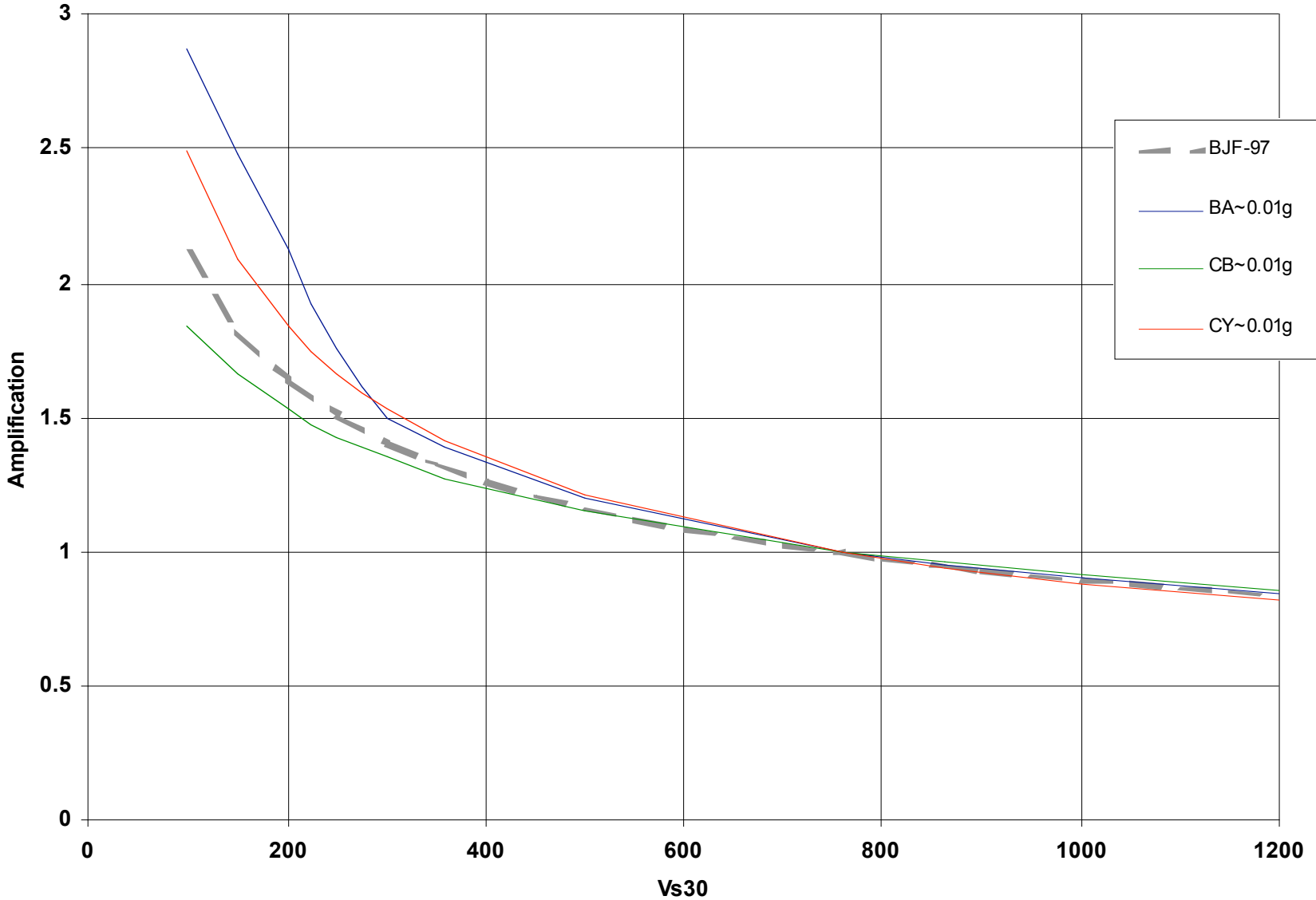
### Site Amplification vs Vs30 for PGA ~ 0.5 g

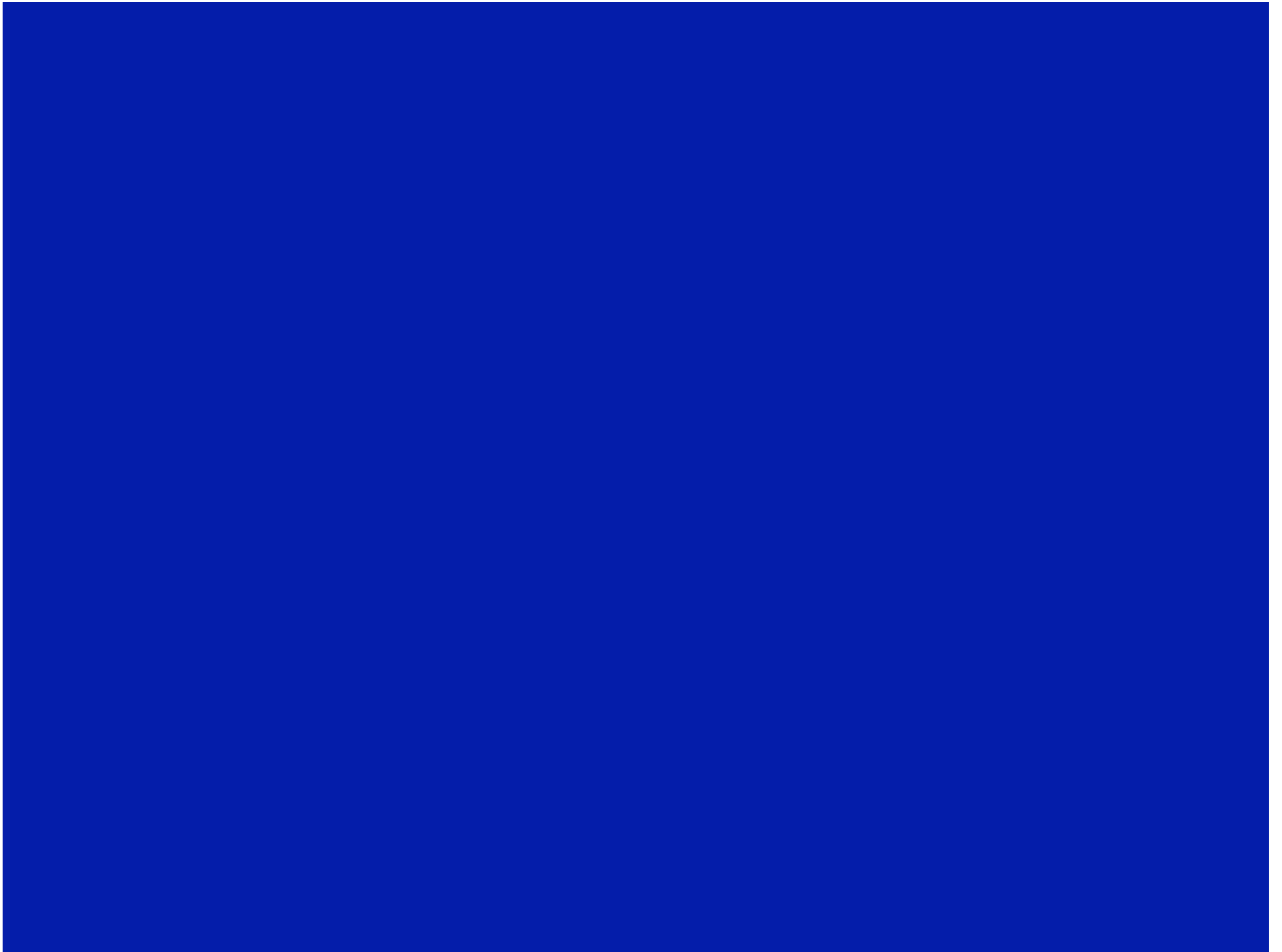


### Site Amplification vs Vs30 for PGA ~ 0.08g



### Site Amplification vs Vs30 for PGA ~ 0.01g



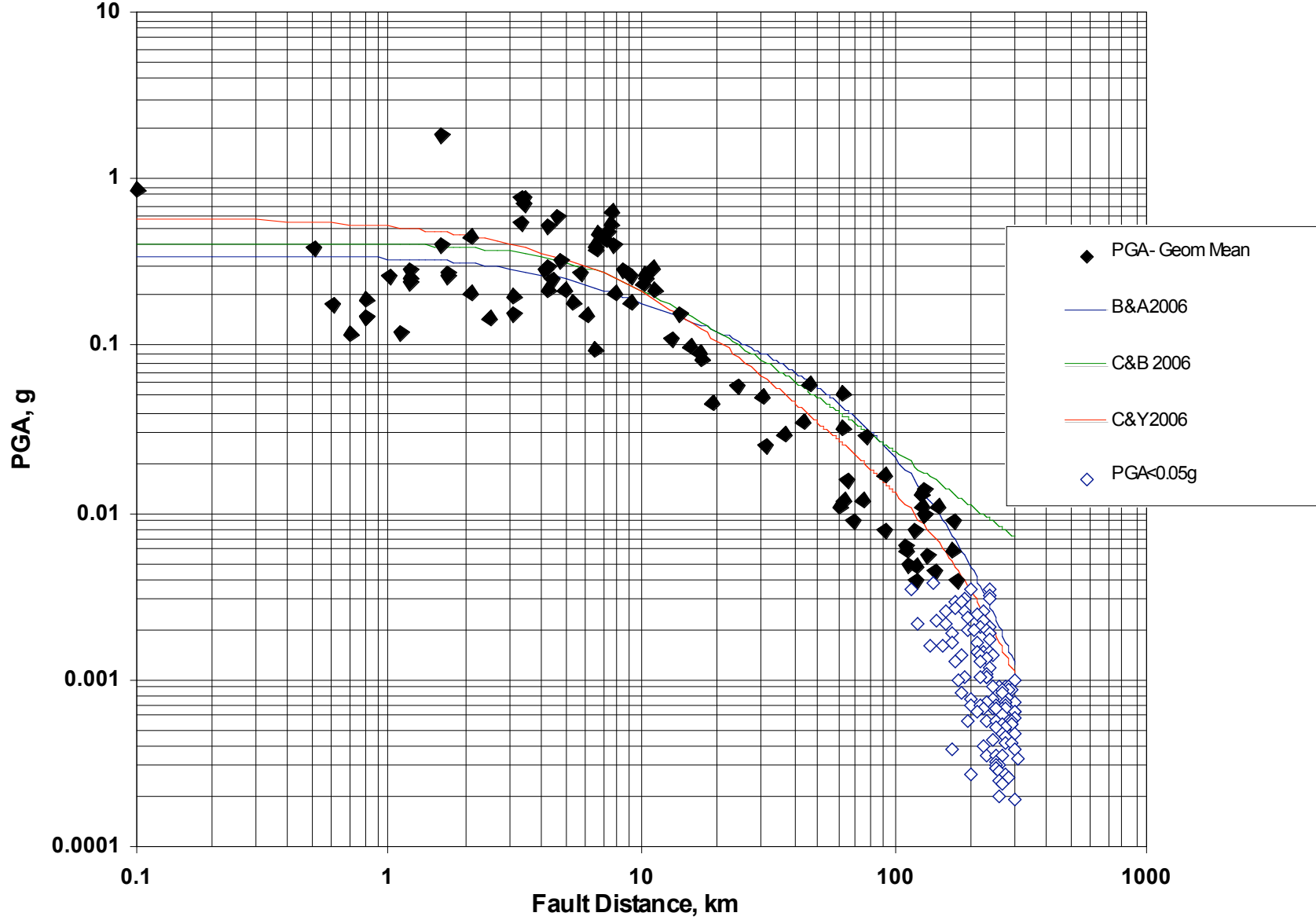


Combining large distance data  
with classical strong-motion

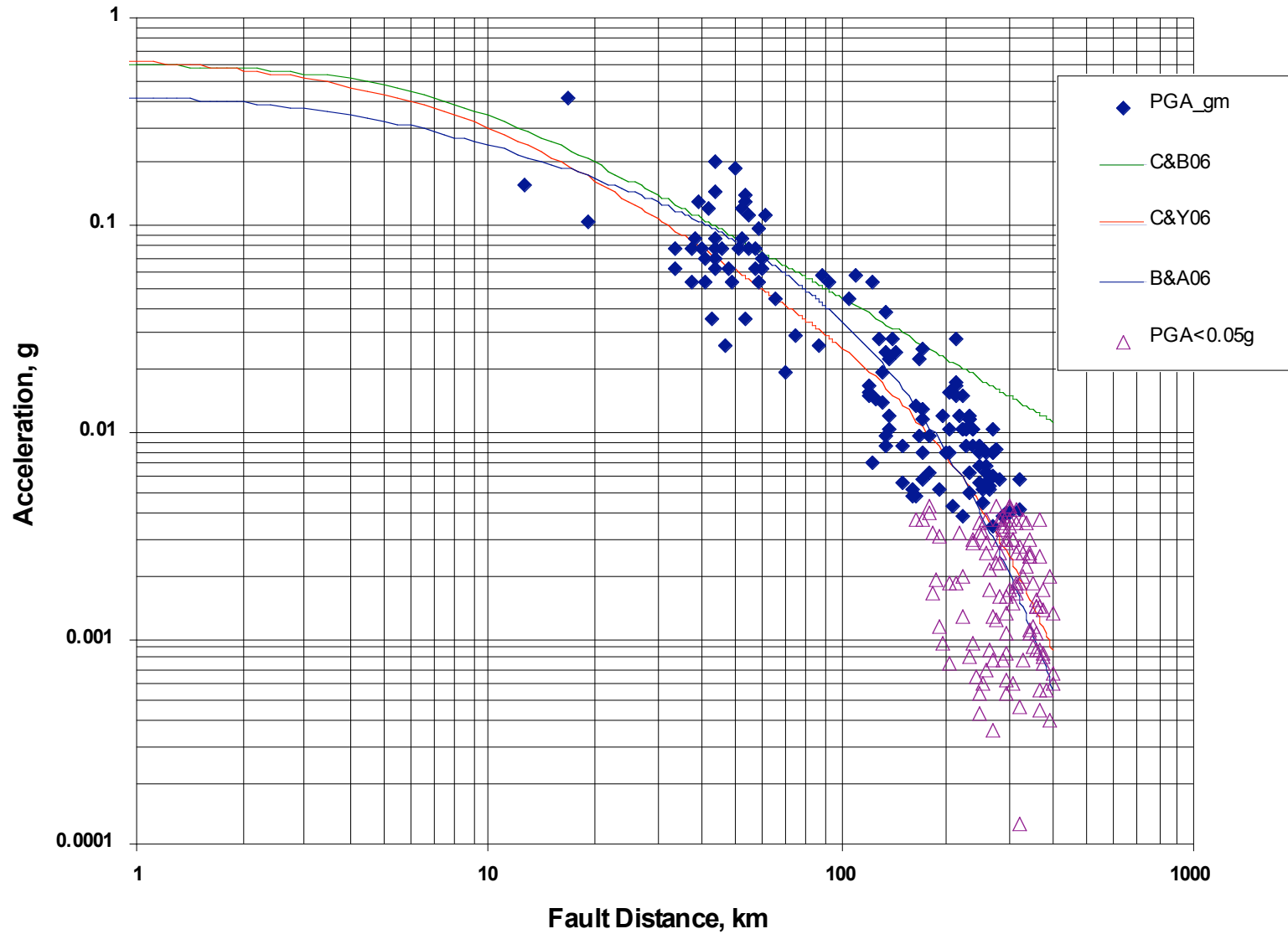


# Peak Ground Acceleration vs Distance

## Parkfield Earthquake of 9/28/04, Mw 6.0 (94 data points)



# Peak Ground Acceleration vs Distance San Simeon Earthquake of 12/22/03, M6.5



# Main Observations

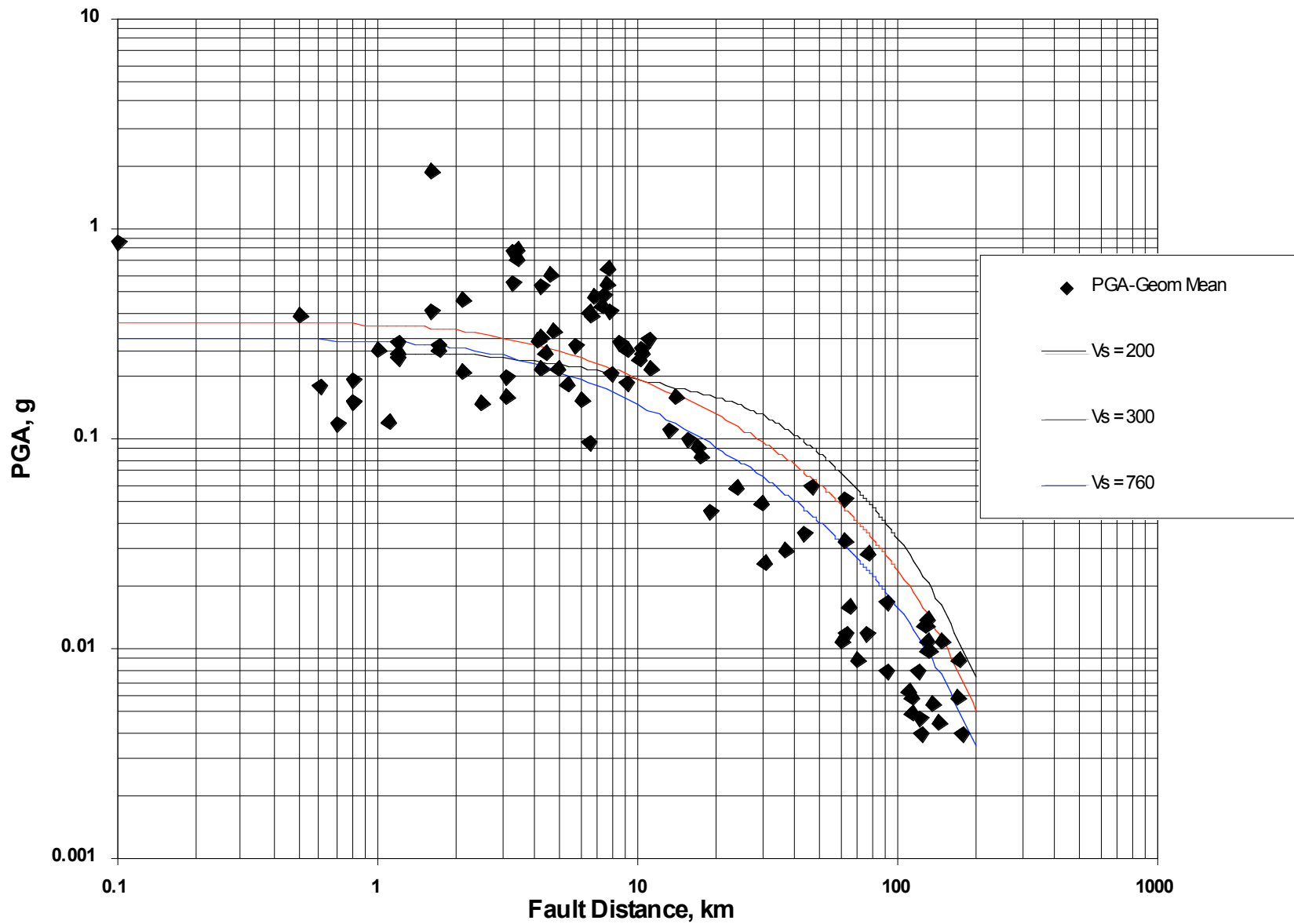
**Complexity of use of C&B and C&Y attenuations with a number of new parameters introduced in their formulas.**

**Large differences in basic assumptions in the attenuation formulas (non-linearity, inelastic term, effect of fault mechanism).**

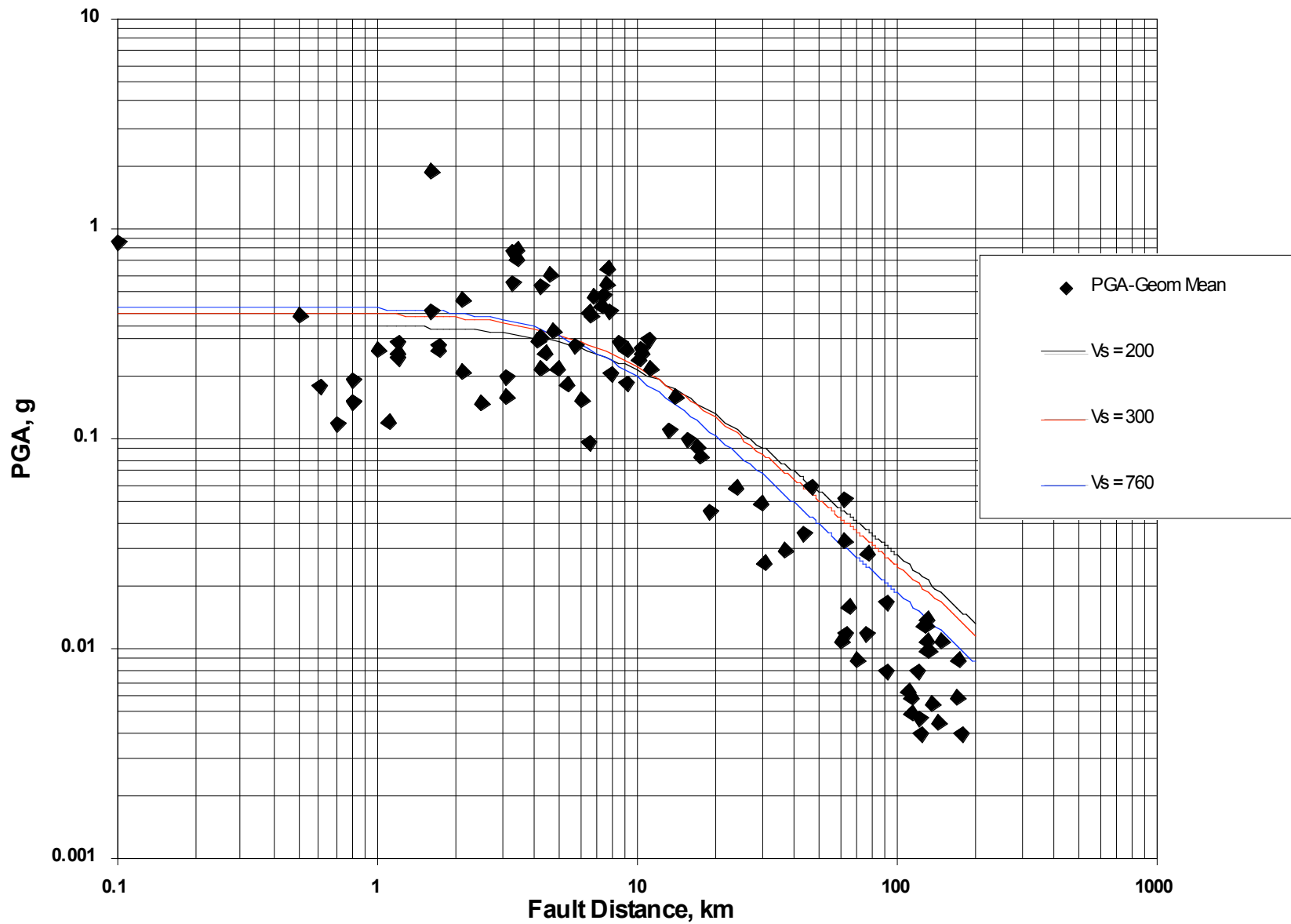
**Limiting dataset to about 70 km (C&Y) will most likely result in not accounting for basin effect.**

# Dependence of Attenuations on $V_{S30}$

# Boore & Atkinson 2006 Model Parkfield Earthquake 2004, Mw 6.0 (94 data points)



Campbell & Bozorgnia 2006 Model  
Parkfield Earthquake 2004, Mw 6.0 (94 data points)



Chiou & Youngs 2006 Model  
Parkfield Earthquake 2004, Mw 6.0 (94 data points)

