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Precise Calcium Abundance Determinations for 207 Flare Decays observed by the BCS Channel 1 aboard SMM

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The Bent Crystal Spectrometer (BCS) observed high resolution spectra of flares between 1980 and 1989. The instrument's channel 1 recorded the triplet of lines arising from He-like Ca (Ca XIX) together with several satellite lines formed from doubly excited states of the Ca XVIII ion. Portions of the continuum emitted by flares were also observed, free from instrumental effects (crystal fluorescence). A collimator in front of the BCS allowed only emission from particular active regions, so preventing overlapping of spectra from multiple active regions. The SMM BCS spectra are still the best ever recorded for flaring hot plasmas. Early analysis of these Ca spectra revealed changing abundances of Ca between flares for ~146 events observed early in the Mission. In the present study, we extended this study for the spectra obtained over the entire SMM Mission duration using updated instrument response data. We determined/redetermined the absolute (relative to hydrogen) abundances for 207 flares during their decay phases with a precision of 1 to 3 % for some flares, the best abundance determinations for any coronal sources. We describe the new data reduction process and compare derived flare abundances with other selected flare characteristics as well as average calcium abundances determined from other measurements.

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