



Fusion of NIR and Raman spectra for the classification of Parmigiano Reggiano Mountain Product



Lorenzo Strani¹, Caterina Durante¹, Juan Antonio Fernandez Pierna², Sara Michelini³, Valentina Pizzamiglio³, Marina Cocchi¹

¹University Modena and Reggio Emilia, Department of Chemical and Geological Sciences, Via Campi 103, 41125 Modena, Italy

²Walloon Agricultural Research Centre (CRA-W), Quality of Agricultural Products Department, Chaussée de Namur 24, 5030 Gembloux, Belgium

³Consorzio del Formaggio Parmigiano Reggiano, Via Kennedy 18, 41214 Reggio Emilia, Italy

BACKGROUND

“**Mountain Product**” is a relatively new quality label defined in the European Community regulation reserved for food products produced and processed in **mountain areas**, aiming to support the economy in disadvantaged areas. However, the “Mountain Product” denomination is still not enough spread and not well known by consumers. Both dairy farmers and consortia want to **protect the authenticity** of their products from analogues and, at the same time, **promote** them.

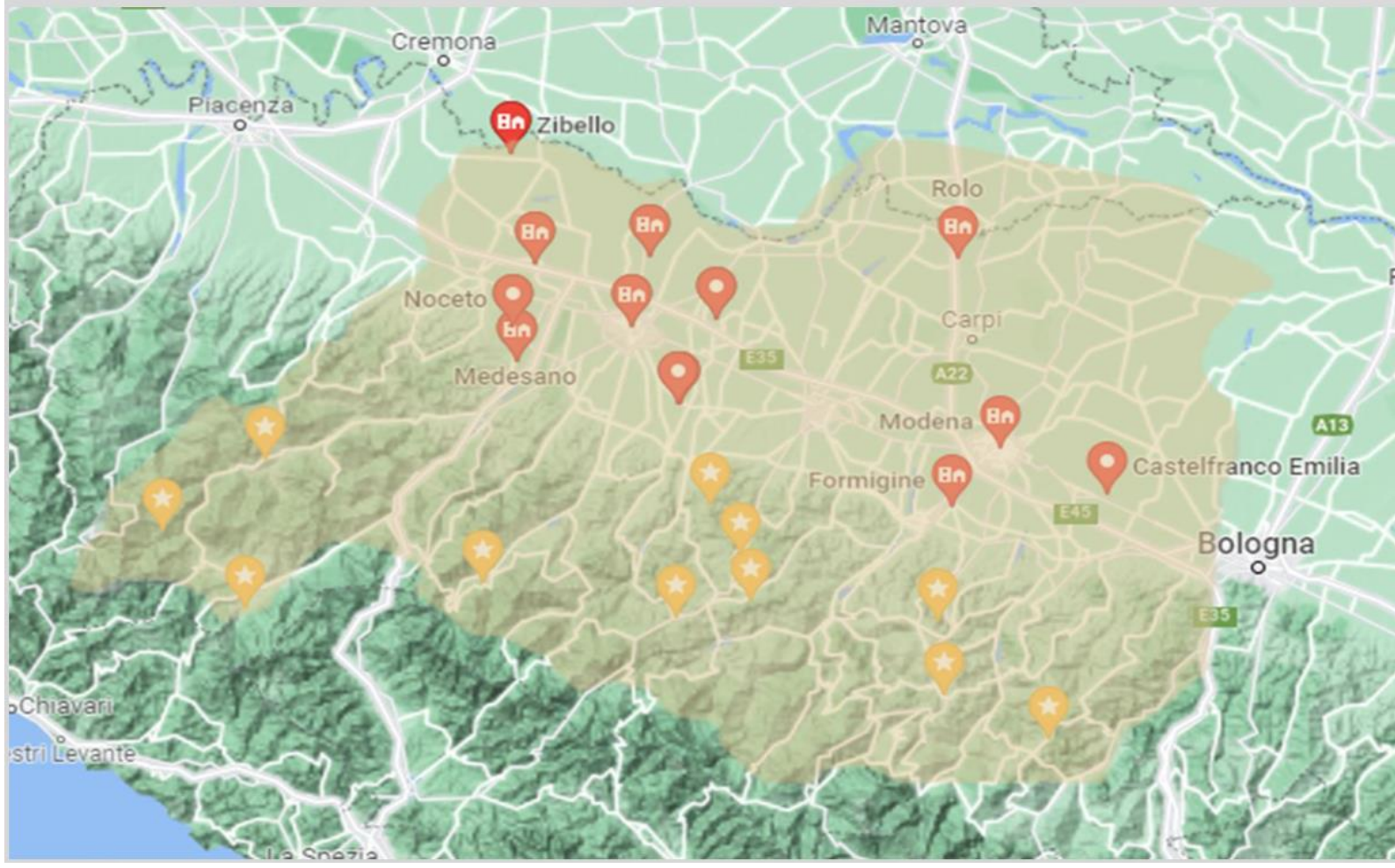


AIM

Assessing, among different samples of Parmigiano Reggiano (PR), the ones with the **mountain denomination**, through fast and non-destructive spectroscopic techniques

SAMPLING

- 80 PR samples:
- 60 from **Mountain** areas (40 cal/20 val)
 - 20 from **Plain** areas (15 cal/5 val)
- 40 different suppliers in 5 Provinces



SPECTROSCOPIC TECHNIQUES AND DATA TREATMENT

Vis-NIR (benchtop):

Foss NIRS DS3
400-2500 nm

Vis-NIR (Camera):

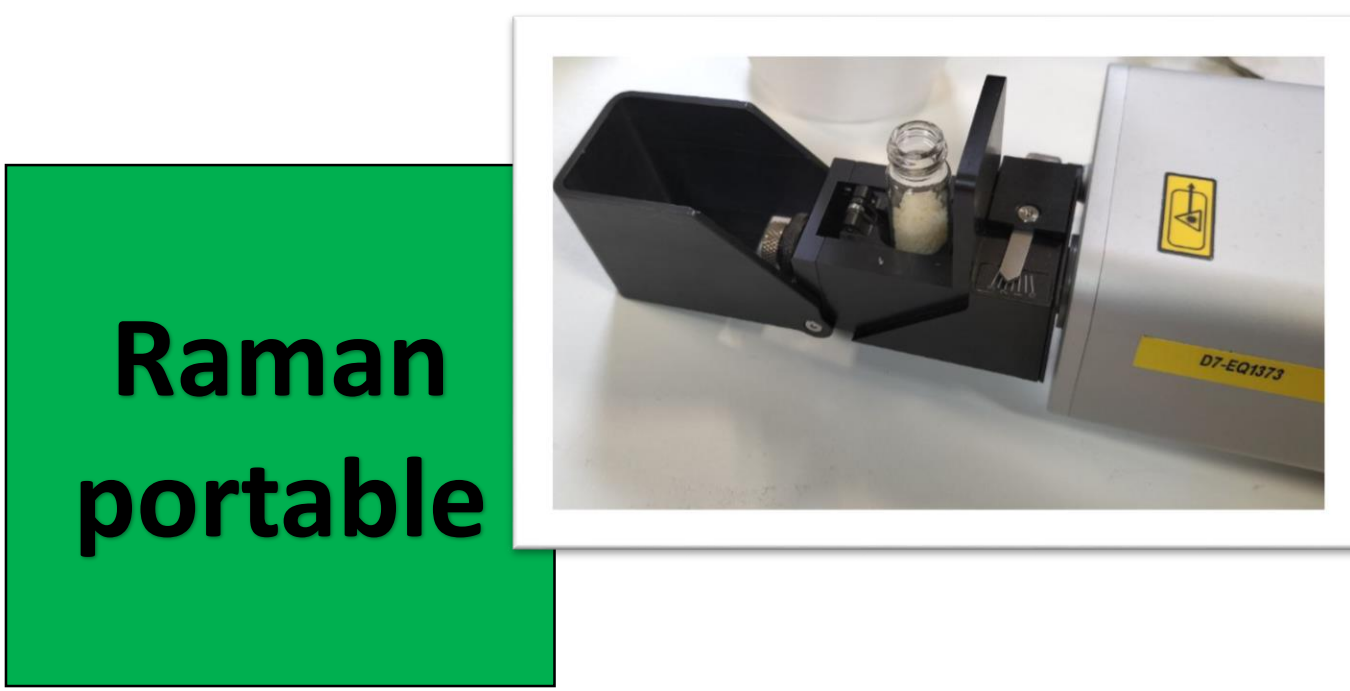
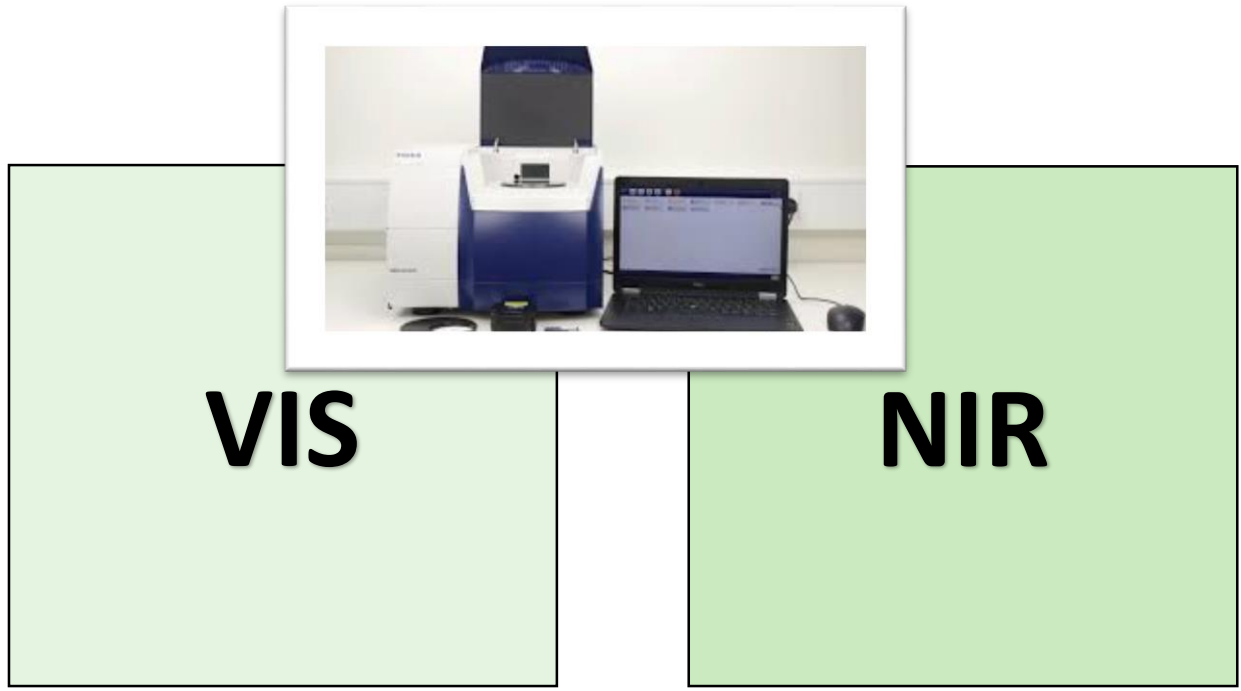
Camera Specim FX10
400-1000 nm

Raman (benchtop):

Bruker RAM II
3600-200 cm⁻¹

Raman (portable):

Rigaku Progeny
2500-150 cm⁻¹



SNV

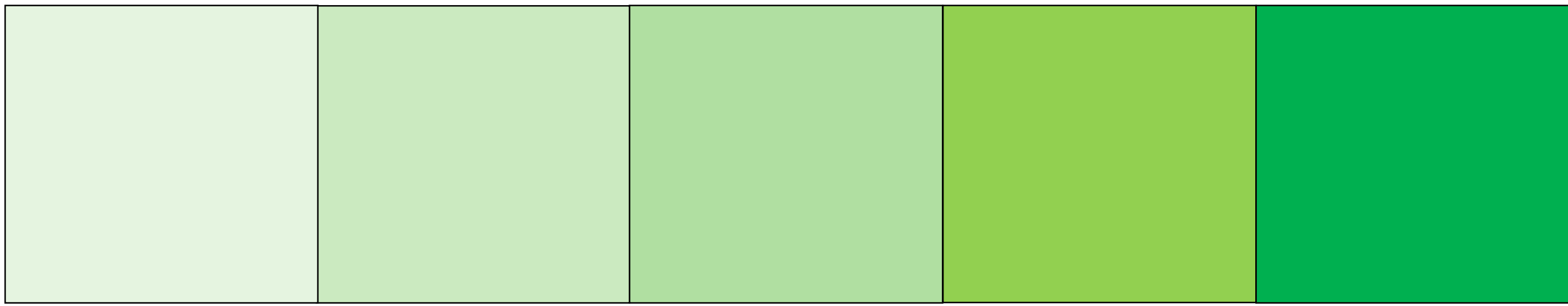
SNV

SNV

SG Smoothing
Normalization

Baseline correction (AWF)
Normalization

Low Level Data Fusion

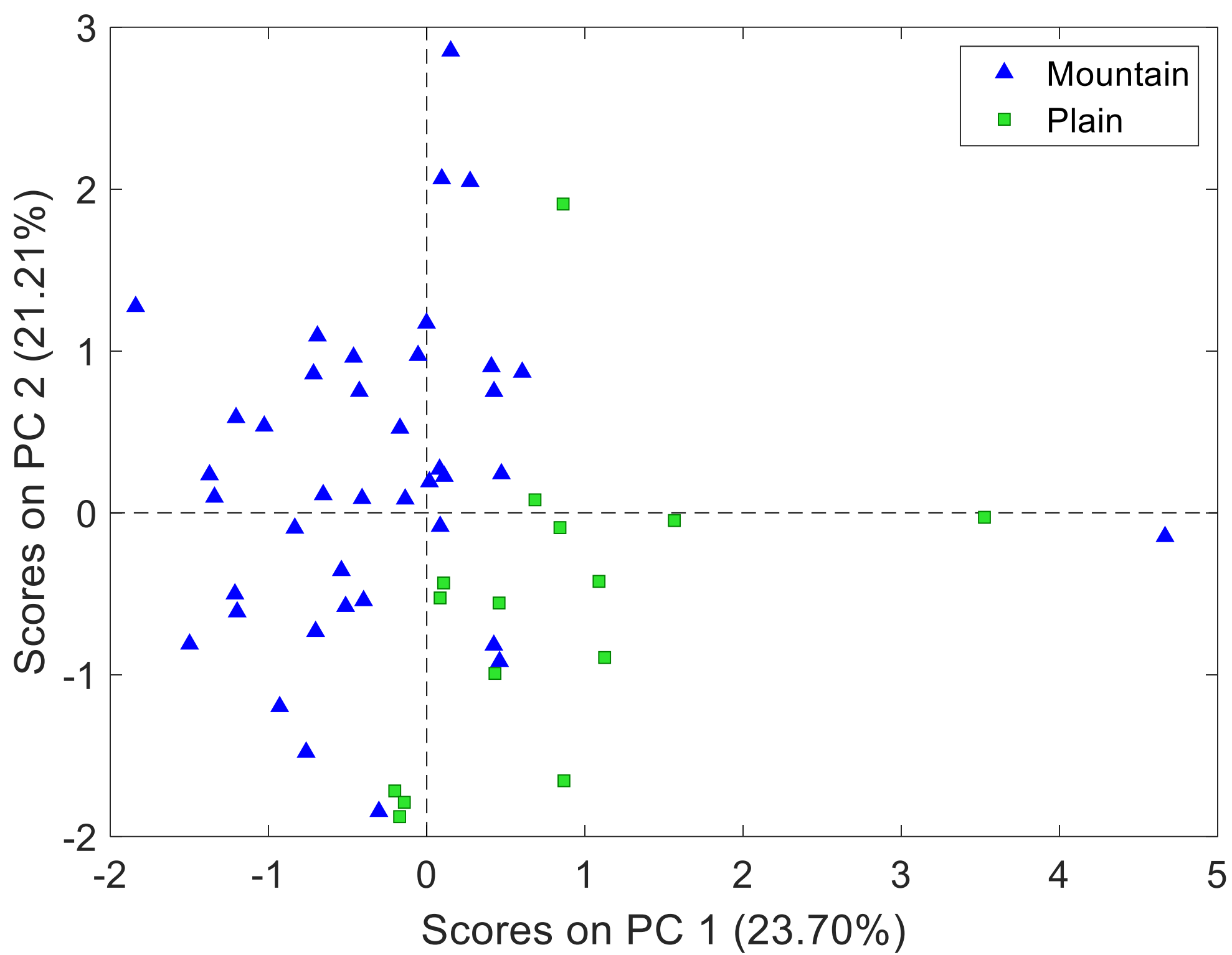


Block Variance
Scaling

Data analysis

RESULTS

PCA



Discrimination between mountain and plain PR samples

VIS-NIR (benchtop and camera) are important to explain this difference

— NIR
— Raman Benchtop
— Raman Portable
— VIS
— Camera VIS-NIR

SIMCA

Techniques	PC	Sensitivity (%) CV	Specificity (%) CV	Sensitivity (%) Pred	Specificity (%) Pred
All	7	100	73	90	60
VIS	6	100	46.6	90	40
NIR	6	90	33.3	80	20
VIS-NIR (camera)	5	97.5	66.6	80	60
Raman (bench)	6	100	33.3	65	20
Raman (portable)	5	97.5	33.3	60	0

CONCLUSIONS

Through PCA it was possible to observe **differences** between **mountain** and **plain** PR samples, highlighted by Visible and Raman spectroscopies. The **fusion** of different data blocks allowed to obtain **better results** in terms of classification performance.

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