MICROSTRUCTURAL CHARACTERIZATION OF SERRA CHEESE USING LOW-VACUUM SEM

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INTRODUCTION

SERRA CHEESE IS ECONOMICALLY AND ORGANOLEPTICALLY THE MOST IMPORTANT VARIETY OF TRADITIONAL CHEESE PRODUCED FOR CENTURIES ON FARMS IN THE INTERIOR MOUNTAINOUS REGIONS OF SERRA DA ESTRELA, PORTUGAL. IT IS MANUFACTURED FROM RAW EWES' MILK USING DRIED FLOWERS OF THE THISTLE (*CYNARA CARDUNCULUS* L.) AS COAGULANT, WITHOUT ADDITION OF ANY STARTER OR SECONDARY MICROFLORA. THE WIDE VARIATION OF THE FINAL QUALITY OF THIS "APPÉLATION D' ORIGINE PROTEGÉE" CHEESE HAS BEEN EXPLAINED BY THE INTRINSIC VARIABILITIES OF THE RAW MATERIALS, CHEESE-MAKING PRACTICES AND MATURATION CONDITIONS.

IN ORDER TO INVESTIGATE HOW MUCH DIFFERENT IS THE MICROSTRUCTURE BETWEEN SERRA CHEESES, SELECTED CERTIFIED DAIRIES THROUGHOUT THE AOP REGION WERE COMPARED FOR THEIR CHEESES BY LOW-VACUUM SCANNING ELECTRON MICROSCOPY.

MATERIALS AND METHODS

THE CHEESES WERE MANUFACTURED ACCORDING TO THE TRADITIONAL CHEESE-MAKING PRACTICE (MACEDO *et al.*, 1993) AT THREE SELECTED, CERTIFIED FARMHOUSES. AFTER 60, 90, 120, 150 AND 180 DAYS, CHEESE PARALLELIPIPEDS (1X1X2 cm) WERE FIXED IN FORMAL SALINE AS DESCRIBED BY DEAN *et al.* (1959) FOR AT LEAST ONE MONTH. THE PIECES OF FORMALINE-FIXED CHEESE WERE DEHYDRATED IN A GRADED ETHANOL SERIES, AND USED DIRECTLY FOR OBSERVATION AT 15 KV IN A JEOL 5600LV SCANNING ELECTRON MICROSCOPE (JEOL, TOKYO, JAPAN).

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RESULTS AND DISCUSSION

THE SEM MICROGRAPHS OF SERRA CHEESE SHOWED A PROTEIN MATRIX WITH OPEN SPACES AND INDIVIDUAL BACTERIA AND YEAST ENTRAPED IN THE PROTEIN NETWORK (FIG. 1-A, F). THESE VOID SPACES INDICATE THE LOCALIZATION OF FAT GLOBULES BEFORE THEY WERE EXTRACTED DURING THE CHEESE SAMPLE PREPARATION.

THE AVERAGE HOLE SIZE IN CHEESES RANGE OF ABOUT 5-10 μM AT 60 D TO 3-4 μM AT 180 DAYS OF RIPENING (FIG 2). CURD JUNCTIONS CAN BE SEEN IN FIG. 2-C, AS A RESULT OF PRESSING.

FRAGMENTS OF VEGETABLE MATERIAL (FIG. 1-B, C), INCLUDING POLLEN GRAINS WERE ALSO FOUND WITHIN THE CHEESE, PROBABLY ORIGINATING IN THE THISTLE-FLOWER EXTRACT ADDED AS COAGULANT.

THE MAGNIFIED ELECTRON MICROGRAPHS (FIG. 1-D, E) REVEALED POPULATIONS OF ELONGATED YEASTS, SPHERICAL YEASTS AND COCCI, UNEVENLY DISTRIBUTED THROUGHOUT THE CURD BUT IN WELL-DEFINED AREAS OR COLONIES, AS PREVIOUSLY REPORTED BY PARKER *et al.* (1998).

THE MICROGRAPHS OF CHEESES (FIG. 3, 90 DAYS OF RIPENING) SHOW THREE PROTEIN STRUCTURES FROM DIFFERENT DAIRIES. AT THIS TIME, CONSIDERABLE DIFFERENCES COULD BE OBSERVED; SOME CHEESES (FIG. 3-B) REVEALED A MORE CLOSED MICROSTRUCTURE WITH SHORTER OPEN SPACES, BUT THE CHEESE IN FIGURE 3-C SHOW CONVERSELY LARGER VOID SPACES WITHIN THE PROTEIN NETWORK.

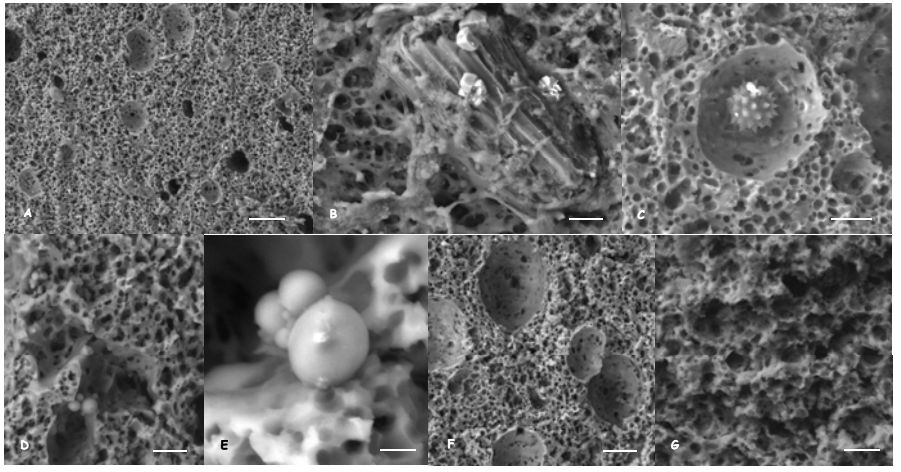

FIG. 1. LOW-VACUUM SCANNING ELECTRON MICROGRAPHS OF SECTIONS THROUGH THE INNER REGION OF SERRA CHEESE. (A) ELONGATED AND SPHERICAL YEAST CELLS WITHIN THE CASEIN CURD, SCALE BAR = 60 μm. (B) FRAGMENT OF VEGETABLE MATERIAL AND CRISTALLINE DEPOSITS IN THE PROTEIN MATRIX, SCALE BAR = 20 μm. (C) POLLEN GRAIN WITHIN THE VOID SPACE OF THE PROTEIN MATRIX, SCALE BAR = 15 μm. (D) COLONIES OF SPHERICAL YEAST CELLS, SCALE BAR = 20 μm. (E) PART OF COLONY OF YEAST CELLS, SCALE BAR = 5 μm. (F) PROTEIN NETWORK WITH VOID OPEN SPACES, SCALE BAR = 35 μm. (G) PROTEIN NETWORK AT 150 D, SCALE BAR = 15 μm.

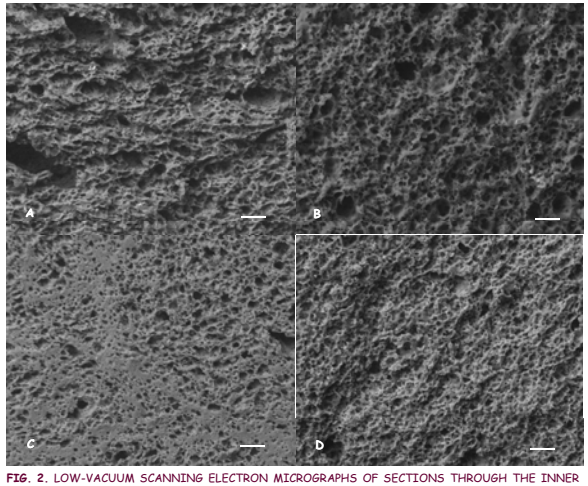

FIG. 2. LOW-VACUUM SCANNING ELECTRON MICROGRAPHS OF SECTIONS THROUGH THE INNER REGION OF SERRA CHEESE AT (A) 60, (B) 90, (C) 150, AND (D) 180 DAYS OF RIPENING. SCALE BAR = 25 μm.

THE MICROSCOPIC OBSERVATIONS OF THIS CHEESE REVEAL A VERY HETEROGENOUS MATRIX AS A RESULT OF THE SPECIFICITY OF THE CHEESE-MAKING PROCESS.

THE AFOREMENTIONED DIFFERENCES ARE PROBABLY A RESULT OF CHANCE RATHER THAN DUE TO DELIBERATELY FIXED FACTORS; NO SIGNIFICANT DIFERENCES WERE INDEED OBSERVED BETWEEN CHEESES MANUFACTURED IN DIFFERENT FARMHOUSES.

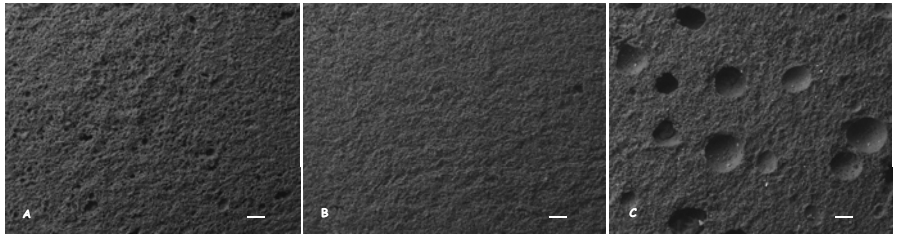

FIG. 3. LOW-VACUUM SCANNING ELECTRON MICROGRAPHS OF SECTIONS THROUGH THE INNER REGION OF SERRA CHEESE FROM DIFFERENT FARMHOUSES AT 90 DAYS OF RIPENING. SCALE BAR = 100 μm