Color systems in cartography. Pre-publishing process and publishing maps and cartographic products.

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INTRODUCTION

- COLORS – possibility for right choice in the process of map compiling
- COLORS - guarantee in design of cartographic products
- Successful reproduction of colors –

  it is possible when there are enough knowledge about them

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COLOR SYSTEMS

- Ancient, astronomy based
- consists 7 base colors corresponding of planets from Solar system
- System of fire, water, air and earth
- Aristotle – 4 base colors
- Signs of the zodiac – connection with colors

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Ancient, astronomy based

	Old color	New color
Sun	Yellow/ gold	Orange
Moon	White/ silver	Violet
Mars	Red	Red
Mercury	Neutral	Yellow
Jupiter	Blue	Indigo blue
Venus	Green	Blue
Saturn	Black	Green

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Signs of the zodiac

	Old color	New color
Aries	Red	Red
Taurus	Dark green	Red-orange
Gemini	Maroon	Orange
Cancer	Silver	Orange - yellow
Leo	Gold	Yellow
Virgo	Parti colored	Yellow - green
Libra	Green	Green
Scorpio	Scarlet red	Green-blue
Sagittarius	Sky blue	Blue
Capricorn	Black	Blue-violet
Aquarius	Grey	Violet
Fishes	Sea blue	Violet-red

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COLOR SYSTEMS

- **model CIE 1931**

(updated and changed in 1964 and 1976)

$$X=0,49R+0,31G+0,20B$$
$$Y=0,18R+0,81G+0,01B$$
$$Z=0,00R+0,01G+0,99B$$

Commission Internationale de l'Eclirage

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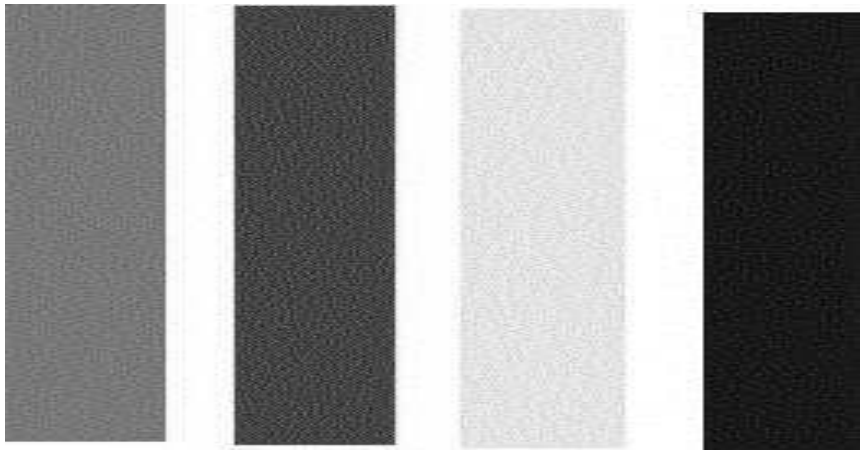
COLOR SYSTEMS

- ***SUBTRACTIVE COLOR SYSTEMS***

XIX c.



Cyan Magenta Yellow Key
(Black)

CMYK color system

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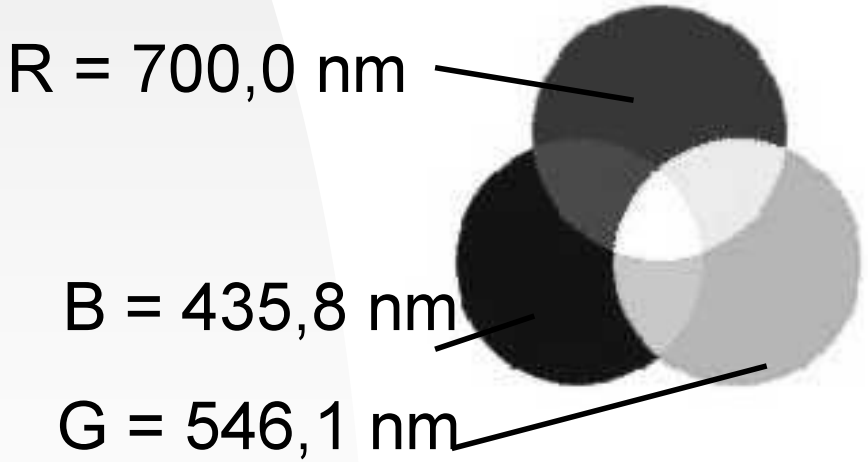
COLOR SYSTEMS

SUBTRACTIVE COLOR SYSTEMS

- ***RGB color system***

$$C \equiv r'R + g'G + b'B$$



r', g', b' -

Co-ordinates of color

r'R, g'G, b'B -

color components

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COLOR SYSTEMS

- **HVS color scheme (tonality)**

Hue, Value, Saturation

$$Hue = \frac{500}{\pi}\arctan\left[\sqrt[1/]{3}\left(Green - Blue\right)/\left(\mathrm{Re}\,d - \frac{1}{2}Green - \frac{1}{2}Blue\right)\right]$$

$$Saturation = \sqrt{\left(\mathrm{Re}\,d^2 + Green^2 + Blue^2 - \mathrm{Re}\,d.Green - \mathrm{Re}\,d.Blue - Green.Blue\right)}$$

$$Intensity = \frac{\mathrm{Re}\,d + Green = Blue}{3}$$

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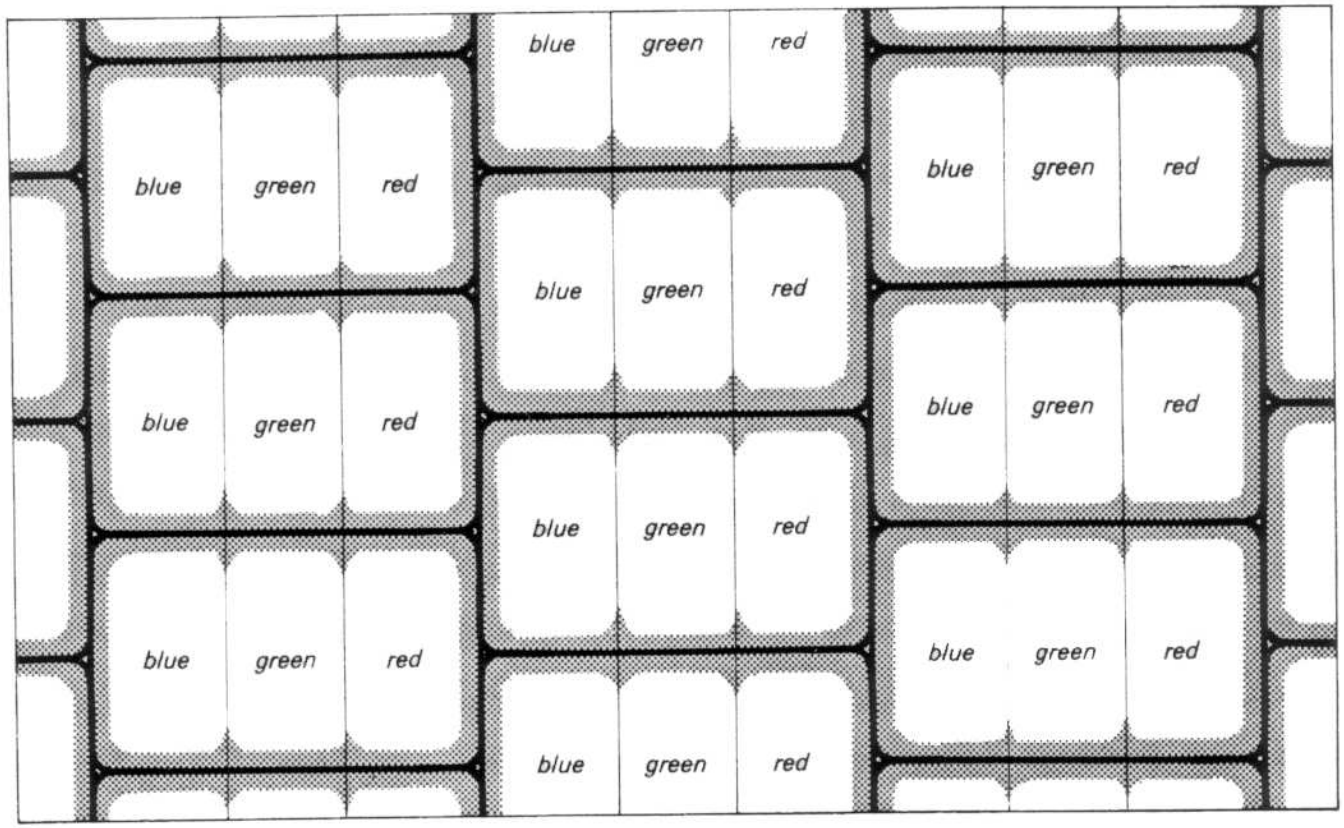
Multiple enlarge part of screen – RGB color system



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Possible colors in 3 bits color system

Active spotlights			***Perceiving colors***
R	**G**	**B**	
1	0	0	Red
0	1	0	Green
0	0	1	Blue
0	1	1	Cyan
1	0	1	Magenta
1	1	0	Yellow
1	1	1	White
0	0	0	Black

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Number of colors in different color systems

Color System	*Quantity of info.*	*Number of colors*
1. B/W B - black W - white	1 bit / dot	2^1 = 2 colors
2. B and W	8 bit / dot	2^8 = 256 colors
3. Indexed Colors		2^8 = 256 colors
4. RGB R - red G - green B - blue	8 bit / dot 8 bit / dot 8 bit / dot	24 bit / dot 2^{24} > 16,7 Millions colors
5. CMYK C - cyan M - magenta Y - yellow K - key black	8 bit / dot 8 bit / dot 8 bit / dot 8 bit / dot	32 bit / dot 2^{32} > 4 Milliards colors

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Number of colors necessary for map designing and screen visualizing

- 3 000 000 colors laid abreast
- 7 000 – for not abreast colors

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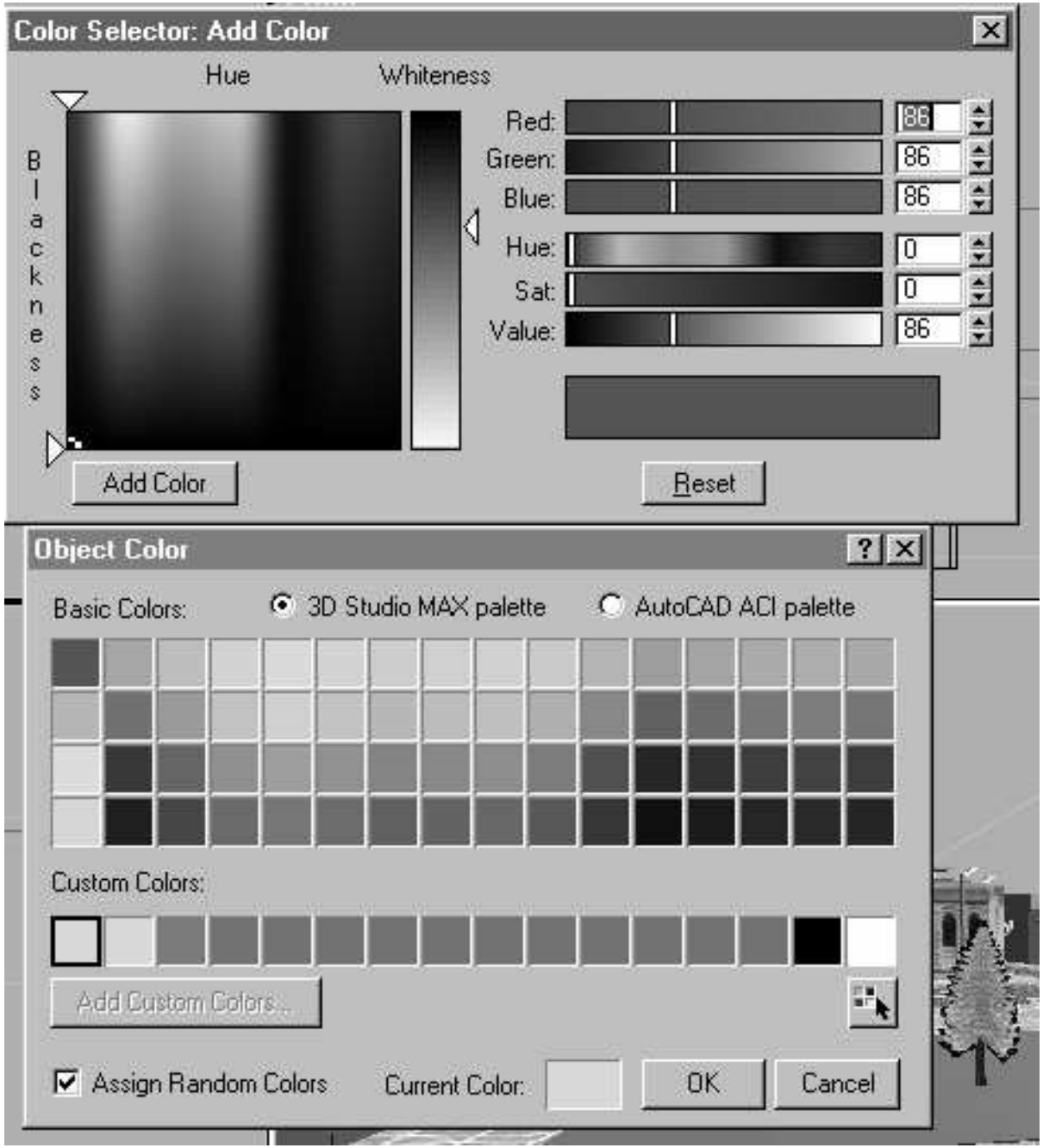

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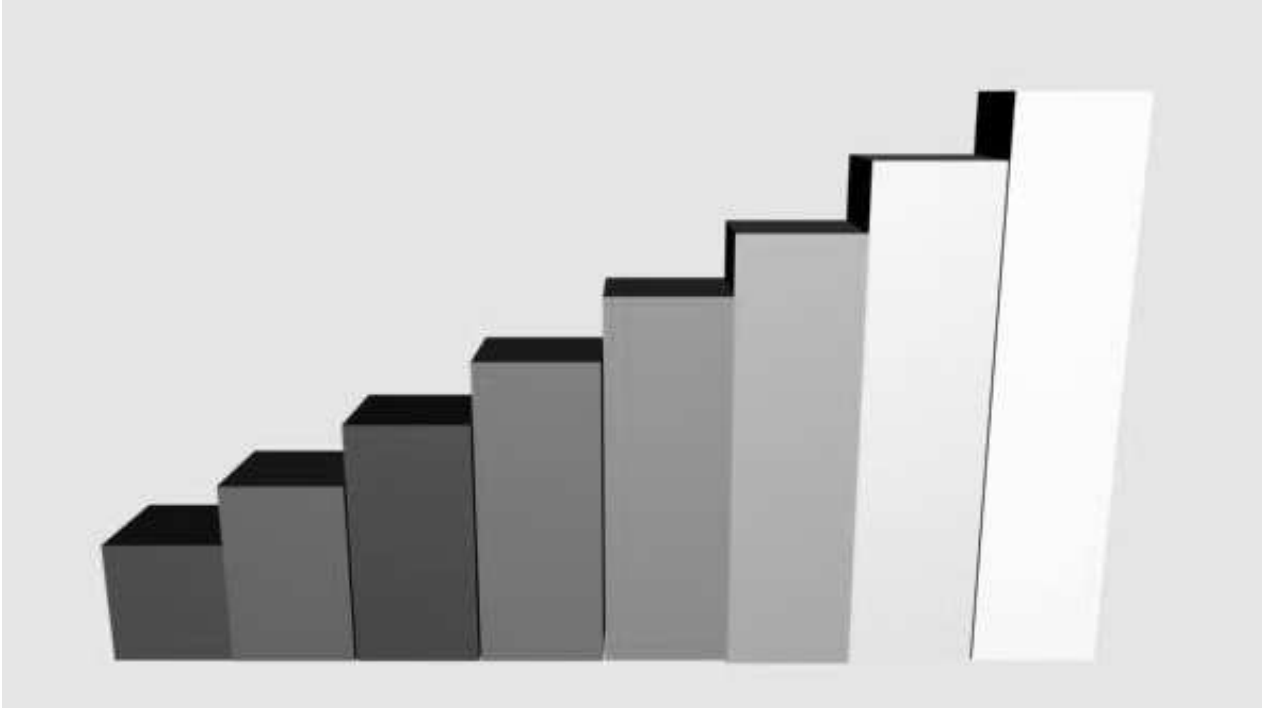
Buildings' floors in 3D map



1 2 3 4 5 6 7

above7

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Color definitions in 3D map

Bilding/ floor	color	dimensions - RGB и HSV
1	Dark brown	R =130 G =52 B =0 H =17 S =255 V =130
2	Brown	R =170 G =71 B =5 H =17 S =247 V = 170
3	Dark red	R =176 G =26 B =26 H =255 S = 217 V = 176
4	Red	R =220 G =67 B =67 H =255 S = 177 V = 220
5	Light red	R =226 G =96 B =96 H =255 S = 147 V = 226
6	Orange	R =224 G =143 B =87 H =17 S =156 V = 224
7	Yellow	R =233 G =222 B =104 H =39 S =141 V = 233
above 7	Light yellow	

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Colors in map designing and pre-publishing process

- 100% cyan for Hydrology
- 20, 30, 40% C – water areas – see and oceans
- 1,2,3 colors of CMYK – area color
- > 5% for every color
- Clean colors (without black - K)

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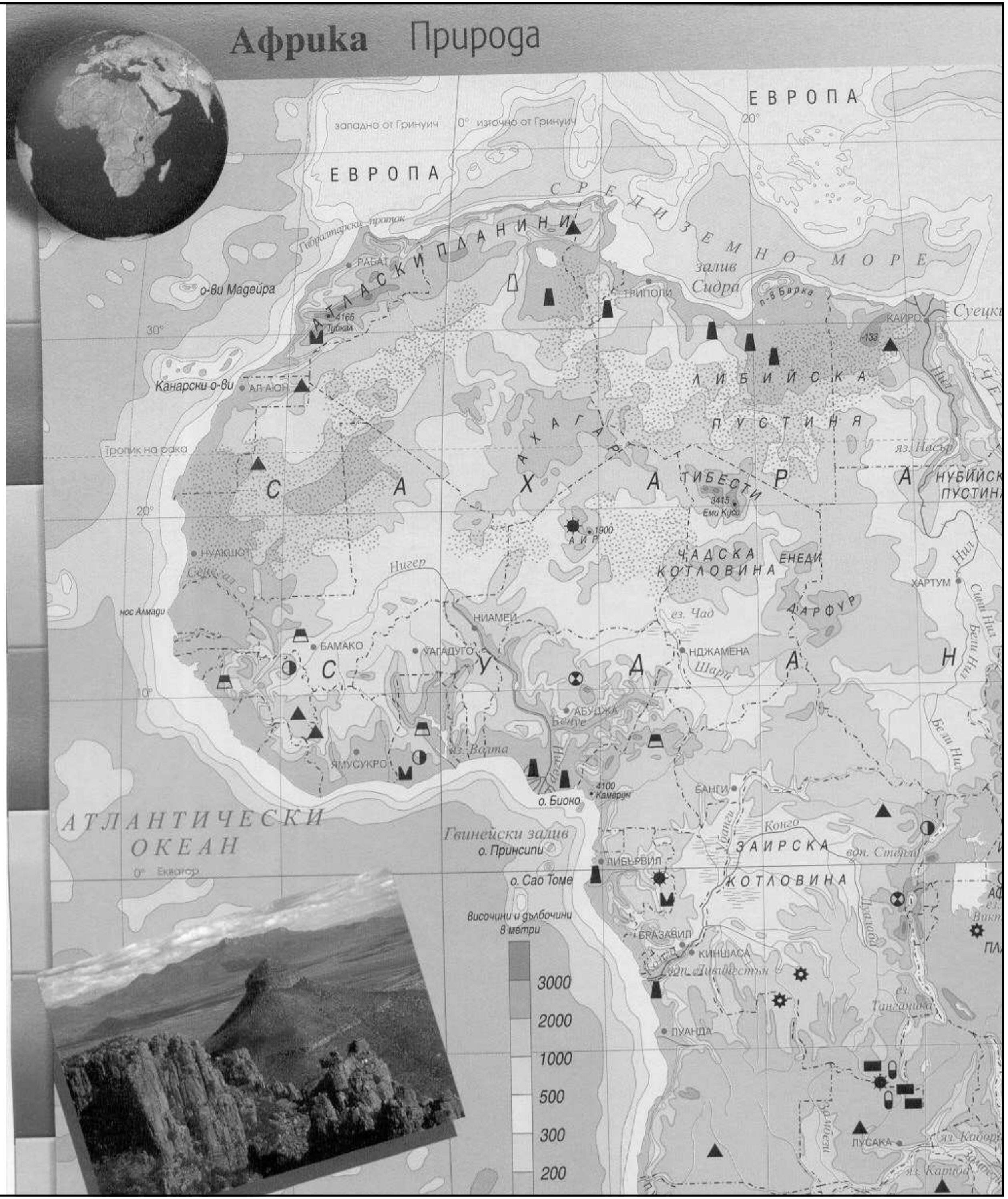
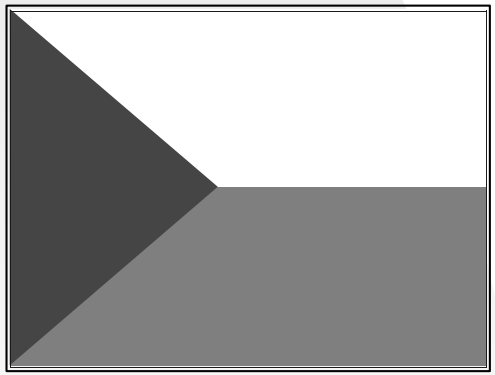
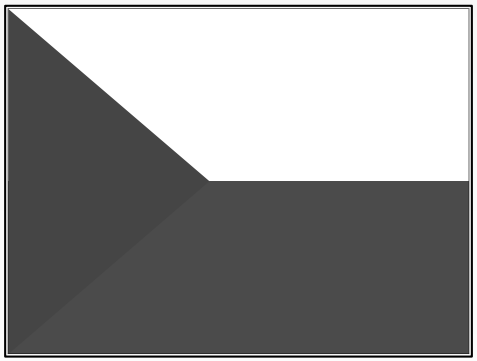


Африка Природа
ЕВРОПА
западно от Гринуич
0°
източно от Гринуич
20°
Гибралтарски проток
СРЕДИЗЕМНО МОРЕ
АТЛАСКИ ПЛАНИНИ
РАБАТ
о-ви Мадейра
4165 Тубкал
30°
ТРИПОЛИ
залив Сидра
п-в Барка
КАЙРО
-133
Суецк
Канарски о-ви
АЛ-АЮН
ЛИБИЙСКА ПУСТИНЯ
Тропик на рака
АХАГАР
С А Х А Р А
ТИБЕСТИ
3415 Еми Куси
яз. Насър
НУБИЙСК ПУСТИН
20°
1900 АИР
НУАКШОТ
Нигер
Сенегал
ЧАДСКА КОТЛОВИНА
ЕНЕДИ
ХАРТУМ
Нил
нос Алмади
НИАМЕЙ
ез. Чад
ДАРФУР
БАМАКО
УАГАДУГУ
НДЖАМЕНА
С У Д А Н
Шари
10°
АБУДЖА
Бенуе
яз. Волта
ЯМУСУКРО
4100 Камерун
о. Биоко
БАНГИ
Сини Нил
Бели Нил
АТЛАНТИЧЕСКИ ОКЕАН
Гвинейски залив
о. Принсипи
0° Екватор
Конго
ЗАИРСКА КОТЛОВИНА
вод. Стенли
ЛИБРЕВИЛ
о. Сао Томе
Височини и дълбочини в метри
3000
2000
1000
500
300
200
БРАЗАВИЛ
КИНШАСА
вод. Ливингстън
ез. Танганика
ЛУАНДА
ЛУСАКА
яз. Кабора
яз. Кариба
Замбези

CONCLUSIONS





- Dimensions for color defining – independent of color monitor and possibilities of print or publishing machines.
- Traditional rules for map coloring could be kept.
- Some limits in publishing process should be take into account in the first steps of map designing
- Unification of the colors could be lead to their standardizations.

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Thank you very much for your attention

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